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Editor in Chief

Dr. Swapnesh Taterh

FOREWORD

I am pleased to put into the hands of readers Volume-6; Issue-5: 2019 (May, 2019) of **"International Journal of Advanced Engineering Research and Science (IJAERS) (ISSN: 2349-6495(P) | 2456-1908(O)"**, an international journal which publishes peer reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers. Now journal has also been indexed in **Qualis (Interdisciplinary Area) (Brazilian system for the evaluation of periodicals, maintained by CAPES).**

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

Dr. Swapnesh Taterh
Editor-in-Chief
Date: June, 2019

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Sustainability Analysis of Porto Velho City Through a Basket of Indicators

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Abstract— *Sustainability is a theme that is on the agenda of cities when discussing municipal development. This research adopts the methodology developed by Cândido, Vasconcelos e Souza (2010) that builds the Participatory Municipal Sustainable Development Index (IDSMP) and in this research the IDSMP is calculated for the city of Porto Velho, state of Rondônia. It is an instrument already used in several places, citing as examples the municipalities of Cabaceiras and Guarabira, in the state of Paraíba. This index is important so that public and private managers can make decisions about the directions of local sustainability. This is a qualitative and explanatory study. In the data collection phase, the results of 38 sustainability indicators were extracted, 7 of which were cultural, 12 were social, 05 were demographic, 04 were institutional policies, 04 were environmental, and 06 of the economic dimension. As a result, it can be shown that the municipality obtained the result of 1 on the cultural dimension, 0.6860 for the social dimension, 0.5159 for the demographic dimension, 0.7392 for the institutional political dimension, 0.4237 for the environmental dimension and 0.7713 for the economic dimension, which eventually generated an IDSMP of 0.6893 for the municipality and, according to the method, the locality is in an acceptable level of sustainability. It is worth mentioning that the parameter of interpretation of the result of this index is comprised between the numbers 0 and 1, the lowest level of sustainability being in result 0 and the largest is in 1.*
Keywords— Sustainable Development. Sustainability Indicators. IDSMP.

I. INTRODUCTION

Sustainable development is a topic widely discussed by science and society in general. This is due to the importance that sustainability indicators present when we want to obtain a logical and rational picture of the impact of economic results. These indicators help pinpoint the paths to be pursued for sustainable development. And this is the way that this text inserts 38 indicators of sustainability and proposes a Participatory Sustainable Development Index of the Municipality (IDSMP) for the city of Porto Velho, state of Rondônia.

The main reference of the IDSMP comes from Martins and Cândido (2008), being a very used instrument, mentioning, as examples, the municipalities of Cabaceiras and Guarabira, in the state of Paraíba, but with little modification, since the authors used 48 indicators and in the case of Porto Velho, it was only possible to construct 38, but it should be noted that there were no negative impacts on the index.

The guiding question of the text is: What is the level of sustainable development of the city of Porto Velho when analyzed in the light of multiple indicators (basket of 38 indicators)?

The importance of the methodology focuses on the fact that in a basket of indicators, instead of analyzing them individually, the main benefit is the possibility of a relationship between the data, thus producing aggregate information for decision making in a more realistic way and compatible with local complexity.

II. THEORETICAL REFERENCE

2.1 Sustainable Development

Saeta (2012) informs us that the term sustainability is derived from Latin sustenance: "the word sustain comes from Latin to support, protect, maintain, care for, conserve. Therefore, sustainability is the characteristic or condition of maintaining and conserving a set of elements necessary for the maintenance of life. "The term"

sustainable development "began to be generated and debated on the international scene with the United Nations Conference on the Human Environment, which took place in 1972 and is known worldwide as the Stockholm Conference, which was organized by the United Nations - UN (LAGO, 2007). Rosa and Staffen (2012) mention that the main concern at the Stockholm Conference was the need to combine development with the preservation of natural resources. It is true, the authors claim, that, in the first principle of that convention, it was stated that man has the fundamental right to freedom, equality, enjoyment of adequate living conditions in such a dignity and enjoyment of the well-being, and it has a solemn obligation to protect and improve the environment for present and future generations.

In this perspective, the study or research on the sustainable development of a specific region or locality requires a set of actions that must be observed by local government in partnership with organized civil society, since "there is no way to think of sustainability without the contribution (RANAURO, 2004), "the effectiveness of sustainability is to involve all actors involved in the same process" (RANAURO, 2004). As well as Cruz and Bodnar (2011), who define sustainability as an integrating and unifying concept capable of establishing the relationship between man and the environment at the same level, without any hierarchy, they reinforce that sustainability, as well as implying social transformation is also an integrating and unifying concept that suggests the celebration of the man / nature unity, in the origin and in the common destiny, which presupposes a new paradigm, therefore. While the content of the principle of sustainability is historically directed to the basis of production in liberal capitalist models, this notion must be broadened so that the beneficiaries of development are all those biotic and abiotic components that will ensure life to the fullest, even for future generations.

Buarque (2008, p.15), discussing the best planning for the promotion of sustainable regional development, based on the following strategies:

> (...) organization of society, contributing to the formation of local social capital (understood as capacity for organization and cooperation of local society) combined with the formation of institutional spaces for negotiation and management, value added in the productive chain, with the articulation

and increase of the competitiveness of the economic activities with local advantages, and restructuring and modernization of the local public sector, as a form of decentralization of the decisions and elevation of efficiency and effectiveness of the local public management.

Quiroga (2001) argues that "technically, an indicator can be defined as the function of one or more variables, which together measure a characteristic or attribute of individuals in a study." In turn, Bellen (2005) states that the main functions of indicators are "to assess the conditions and trends of a phenomenon observed in relation to the goals and objectives intended to be able to warn in advance and anticipate future conditions."

Emery (2016) understands that the viable development of human societies is only one that does not ignore the notion of sustainability in its multiple dimensions. For him, sustainability is a profound, complex, multivectoral concept that reaches a myriad of multidisciplinary interests that encompass countless areas of knowledge that bequeath to it a connotation of balance, maintenance of a situation, perpetuity. It involves actions that reflect on various fields of human activity that have to be coherent with each other, and although different activities imply a greater emphasis on one or another aspect, there is a common substrate that allows the formulation of a single concept to support the sustainable development.

III. RESEARCH PROCEDURES

3.1 Methodological Framework

The following are the processes implemented for the production of the indicator divided into phases: in phase 1 the importance of each indicator, weighted by means of weights, are determined in surveys with experts from the postgraduate programs of the Federal University of Rondônia Foundation with adherence to the theme.

The tools used were: questionnaires with closed answers and transformed into value from the Likert scale.

In this case, we multiply each value by its "weight", that is, by its relative importance. Thus, the p-weighted arithmetic mean of a set of numbers x_1, x_2, x_3, ..., x_n where its weight is respectively p_1, p_2, p_3, ..., p_n is calculated by through Equation 1, as follows:

Equation 1:

$$x_p = \frac{\sum\limits_{m=1}^{n} p_m * x_m}{\sum\limits_{m=1}^{n} p_m}$$

In Phase 2, according to the positive and negative relation of the indicators, this previously defined in the method, so that equations 2 and 3 can be applied, depending on the case.

Equation 2 (Positive Relationship)

$$I_+ = \frac{x - m}{M - m}$$

Equation 3 (Negative Relationship)

$$I_- = \frac{M - x}{M - m}$$

At where:

I - calculated index for the municipality analyzed;

x - value of each variable for the municipality;

m - minimum value of the variable identified in the State;

M - maximum value of the variable identified in the State.

The calculations for each dimension are defined according to equations 2 or 3, depending on whether the relationship is positive or negative in each Sustainability Indicator, and then equation 1 is used for the result in each dimension.

Eq.   04

$$IDSMP = \frac{IDC + IDS + IDD + IDP + IDA + IDE}{n}$$

It is worth noting that each of these dimensions are calculated by means of Equations 1 and 2.

At where:

IDSMP-Participatory Municipal Sustainable Development Index

IDC-index of the cultural dimension

IDS-index of the social dimension

IDD-index of the demographic dimension

IDP-index of the political-institutional dimension

IDA-index of the environmental dimension

IDE-index of the economic dimension

n-number of dimensions

The development index has four levels represented by table 01 below, the closer and the better the level of sustainability.

Table.1: Classification of sustainability levels.

INDEX (0 - 1)	LEVEL OF SUSTAINABILITY
0.0000 - 0.2500	Critical
0.2501 - 0.5000	Alert
0,5001 - 0,7500	Acceptable
0.7501 - 1.0000	Ideal

Source: Martins and Cândido (2008).

Considering the difficulty of obtaining some data for the construction of some indicators, 2 different calculations were made: in the first one, all the indicators were considered absent with the result 0, thus having a minimum value to be reached by the dimension; in the second moment, calculations were made considering the value of 1 for the missing data, thus simulating a maximum value to be achieved as a result.

3.2 Characterization of the Municipality

The present study was the municipality of Porto Velho, state of Rondônia, which was created by virtue of the Petropolis treaty in 1903, but it was made by pioneers around 1907, during the period when the Madeira Mamoré Railroad, in view of the need to surpass the stretch of the Rio Madeira, in order to enable the transportation of rubber production in Bolivia and the Guajará Mirim region.

On the other hand, in economic terms, the municipality has the fourth largest GDP of the North region, which in 2010 was estimated around R $ 7.5 billion.

The municipality also had a Municipal Human Development Index (HDI) in 2010 of 0.736, according to SEBRAE (2010).

3.3 Secondary Data Collection

It is worth noting, however, that in view of the extreme difficulty of accessing data, especially about the municipalities of the interior, due to the fact that they were not available by the IBGE during the study period, and also due to the lack of information filed at each location, used in the method adopted in this research, only 38 information were found, which is why in the calculation of the dimensions the obligation to calculate the minimum and maximum probable results was calculated to calculate the influence of this absence of indicators on the final result of the IDSMP . The table

below describes the data collected in official bodies, used to calculate the Participatory Sustainable Development Indices of each Dimension, and, afterwards, the general IDSMP of the Municipality.

IV. DATA PRESENTATION AND ANALYSIS

From this part of the research, the results of each constructed indicator and thecalculation of the IDSMP in their respective dimensions will be presented, and, finally, the level of sustainability of the municipality.

4.1 Construction of the Participative Municipal Sustainable Development Index

For the effective Construction of the Participative Municipal Sustainable Development Index for the city of Porto Velho, it is necessary to calculate the Indices in each dimension. In Table 02, the results are presented with the minimum and maximum values, comparing them with the results achieved when considering the data collected:

It should be noted that for the minimum result the number 0 was considered and for the maximum the number 1 was considered.

Table.2: Dimensional Results

Dimensions	Indicators	Minimum Results	Maximum Results	Results obtained
Cultural	Bibliotecas	_	_	1
	Museus	_	_	1
	Centro Cultural	_	_	1
	Unidade de Ensino Superior	_	_	1
	Ginásio de Esportes e Estádios	_	_	1
	Cinema	_	_	1
	Teatros ou Sala de Espetáculos	_	_	1
	IDC	_	_	1
Social	Índice de Gini da dist. do rendimento	0,4167	0,4167	0,4167
	Rend. familiar per capita (% até 1/2 SM)	0,8165	0,8165	0,8165
	Famílias Atendidas por transf. Benef. Socais	0,8061	0,8061	_
	Razão de rendapopulação masculina e feminina	0,8562	0,8562	0,8562
	Esperança de vida ao nascer	0,9111	0,9111	0,9111
	Oferta de Serviços de Saúde****	0	1	-
	Taxa de mortalidade infantil	0,8957	0,8957	0,8957
	Prevalência de Desnutrição Total****	0	1	_
	Imunização contra doenças infec. Infantis****	0	1	_
	Taxa de escolarização	0,6959	0,6959	0,6959
	Taxa de alfabetização	1	1	1,0000
	Analfabetismo funcional	0,4625	0,4625	0,4625
	Morte por acidente de transporte	0,682	0,682	0,6820
	Morte por homicídios	0,586	0,586	0,586
	Adequação de moradias	0,2205	0,2205	0,2205
	IDS	0,5566	0,7566	0,6820

Demográfico	Densidade demográfica hab/km2	_	_	0,6472
	Razão entre a população masculina e feminina	_	_	0,7905
	Distribuição da população por faixa etária	_	_	1
	Taxa de crescimento da população	_	_	0,6904
	Razão entre população Urbana/Rural	_	_	0,0482
	IDD	_	_	0,5159
Político - Institucional	Acesso Público a Internet****	0	1	
	Acesso a serviços de telefonia	0,4974	0,4974	0,4974
	Acesso a Justiça****	0	1	
	Comparecimento nas eleições	0,3654	0,3654	0,3654
	Despesa por função	1	1	1
	Transferências intergovernamentais da união	0,9637	0,9637	0,9637
	Número de Conselhos Municipais****	0	1	
	IDPI	0,4158	0,8533	0,7392
Ambiental	Acesso a esgotamento sanitário	0,2514	0,2514	0,2514
	Acesso a serviço de coleta de lixo doméstico	0,8292	0,8292	0,8292
	Acesso a sistema de abastecimento de água	0,3529	0,3529	0,3529
	Consumo médio per capita de água	0,18	0,18	0,18
	Volume da Água Tratada (%)****	0	1	
	Qualidade das Águas (rios e igarapés)****	0	1	
	Pastagens e Lavouras (Percentual)****	0	1	
	Matas e Florestas (Percentual)****	0	1	
	IDA	0,2118	0,7118	0,4237
Econômico	PIB	_	_	1
	Participação da Agropecuária no PIB	_	_	0
	Participação da Administração Pública no PIB	_	_	1
	Participação de Comércio/Serviços no PIB	_	_	
	PIB per capita (R$ 1,0)	_	_	0,7537
	%Renda proveniente do trabalho	_	_	1
	IDE	_	_	0,7713

Source: Elaborated by the author from data collected in the research (2018)

Subtitle:

* Result when the number 0 is assigned to the missing indicators.

** Result when the number 1 is assigned to the missing indicators.

*** Result when calculated with the data collected.

Color scheme: Critical Acceptable Alert Ideal

After calculating the Development Index of each dimension, by means of equations 1 and 2, we calculate the IDSMP of the municipality, simulating also their respective minimum and maximum values, according to Table 04:

Table.4: Dimensional Results

Dimensões	Resultados Mínimos*	Resultados Máximos**	Resultados Obtidos***
IDC	–	–	
IDS	0,5566	0,7566	1
IDD	–	–	0,5159
IDPI	0,4158	0,8533	0,7392
IDA	0,2118	0,7118	0,4237
IDE	–	–	0,7713
IDSMP	0,5658	0,7606	0,6893

Source: Elaborated by the author from data collected in the research (2018)

Subtitle:

* Result when the number 0 is assigned to the missing indicators.

** Result when the number 1 is assigned to the missing indicators.

*** Result when calculated with the data collected.

Color scheme: Critical Acceptable Alert Ideal

It is observed, therefore, that the maximum and minimum values of the IDSMP ranged from 0.7606 to 0.5658, respectively.

Therefore, when compared to the result calculated with the existing indicators that was 0.6893, the IDSMP Maximum, at the level of 0.7606, is very close to the result found for the municipality, presenting only 0.07 of difference, demonstrating, therefore, that the results of the sustainability of the municipality of Porto Velho are very close to the calculated maximum.

V. CONCLUSION

The sustainability of the municipality of Porto Velho was at an acceptable level, considering that the Participatory Municipal Sustainable Development Index - IDSMP reached the result of 0.6893, once again remembering that the reference value varies between the number 0, as minor and 1, as higher level.

The method adopted proved to be effective for the search of the results of the research, enabling the numerical analysis, in this way, a rational level of sustainability of the municipality, which, through a mathematical equation, added several indicators in their respective dimension, corresponding, in last analysis, to the arithmetic mean of the six areas studied, which is described below:

Regarding the Cultural Dimension, all of its indicators had a maximum level of sustainability, perhaps due to the fact that it is a capital and, as a result, it has increased investments by the State, which has considerably increased the final result of the municipality's IDSMP.

Concerning the Social Dimension, six indicators were presented in an Ideal state, among them, the literacy rate with maximum result (1), while three were constructed in an Acceptable state, in addition to the Gini Index (0.4167), Functional Illiteracy (0.4625) and Household Adequacy (0.2205), with the first two being on the alert and the last in the Critical state, respectively, which resulted in a result for the Social Development Index of 0, 6860.

The Demographic Dimension, in turn, presented two indicators in the Ideal state. The distribution of the population by age group, with a result (1), and two were still at Acceptable level and the ratio between urban / rural population, which was 0.0482, and therefore a critical level, which represents a great concern in the result of the present research, the great concentration of inhabitants in urban area of the municipality, and that ended up contributing to the Demographic Development Index reaching the level of 0.5159, therefore, in Acceptable State.

The Political-Institutional Dimension presented two indicators in an Alert state and two in an Ideal state, which resulted in the result of the Political-Institutional Development Index of 0.7392, thus, in an Acceptable State of Sustainability.

Regarding the Environmental Dimension, three indicators were highlighted: Access to sanitary sewage, Access to water supply system and Average per capita consumption of water, with 0.2514, 0.3529 and 0.1800 respectively, while o Access to domestic waste collection showed a result of 0.8292, resulting in an Environmental Development Index of 0.4237, therefore, in a degree of sustainability alert.

Finally, the Economic Development Index was determined at the level of 0.7713, thus, in an Ideal degree of Sustainability, caused by three excellent results, according to the adopted methodology: GDP, Public Administration Participation in the GDP and GDP per capita, with a result of 1, therefore, in maximum state.

Regarding the general and specific objectives, as well as the research problem, all are considered and answered, considering that the Participative Municipal Sustainable Development Index was determined for the municipality of Porto Velho, with a result of 0.6893, in this way, in an Acceptable State of Sustainability.

Based on this information, it is possible to clearly, mathematically, and therefore rationally, not only the Sustainability Index of the municipality, but also the possibility of verifying in which indicators the public power and society in general should devote themselves to to seek the necessary improvements to the well-being of the citizens.

Within this context, chapter 5 was dedicated to simulating the results needed to make all the indicators that were in a critical and alert state in an acceptable level of sustainability.

In this way, it intends to foster the reflection of the need, in practice, through integrated public-private actions to improve the results, to meet some of the municipality's wishes, thus promoting the sustainable development of the municipality, understood as the improvement in six dimensions analyzed by the adopted method, taking into account the last specific objective adopted in the present research.

Confirmed the hypothesis adopted in the survey that indicated the sustainability of the municipality of Porto Velho as an acceptable level, according to the method adopted, due to the fact that some results of indicators are better than the rest of the municipalities of the State, decade important ventures, however, encountering the other variables with their not so good results.

As a limitation of the research, it can be presented that there are no important data for the construction of 10 indicators, which generated the need to exclude these variables from the general calculation of the Index. Therefore, of the 48 variables adopted in the method, a basket with 38 was used, a limitation that was solved through the creation of maximum and minimum parameters for each indicator.

This limitation, in turn, eventually contributed to future research, considering that the criterion was adopted to simulate the maximum and minimum possible values for the results, thus creating a parameter of evaluation of possibilities, which will allow other authors to solve any problems of lack of data in their research.

The non-existent variables were thus simulated with maximum value (1) and minimum value (0), to obtain the result better or worse than each indicator, each dimension and, consequently, the municipality index could reach if the data existed.

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Proposal for the Implantation of Forestry System in a Small Rural Property Located in the Municipality of Nanuque-Mg

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Abstract— *Deforestation and the irregular use of the soil in Brazil has produced several areas degraded and without utility for the breeding of animals, the recovery of degraded areas with the beans can be an excellent alternative for the improvement of the quality of small producers, the property will not render it unproductive and it is still possible to use the beans as food. The aim of this study was to diagnose a farm as their chemical, physical and climate and develop a silvopastoral system deployment proposal in order to ensure balanced environmental management area. The study area is situated between the towns of Nanuque and Carlos Chagas in the state of Minas Gerais. The area is in an advanced process of degradation. The same was diagnosed through technical visits, conducting photographic survey and satellite imagery, and soil samples were taken for analysis, to environmental assessments of the local situation. With the completion of all analyzes and evaluations, was obtained as a result, the possibility of deploying a silvopastoral system within that area, so it will be proposed the planting of trees in the area of the spring.*

Keywords— *silvopastoral systems. Recovery of degraded areas.*

I. INTRODUCTION

One of the sectors that stand out in the Brazilian agribusiness is dairy farming, whose important feature is the fact that most of their herd raised on pasture, which constitutes the most economical and practical way to produce and provide food for cattle. This crop is extremely appreciated by the Brazilian population and an important source of protein (Domingues, 2018)

Despite the reduction of costs, this type of management generates very negative impacts on the environment. The degradation of pastures in Brazil because many environmental and economic damage. As Almeida et al (2011) degraded pasture forage cause lower productivity and decreased soil organic matter, and consequently, lower animal productivity.

The recovery of productivity of these areas should be increasingly a priority. In agricultural production systems, sustainability can be considered as the continuation of production over time, though without the degradation of natural resources on which production is dependent (Graças; 2018).

In the search for alternatives to the multiple use of the land, different modes of production are necessary in view of the ecological consequences of inadequate practices in the use of natural resources. Against this background the implementation of silvopastoral systems is seen as one of the options for the recovery of degraded pastures. The system is silvipastoral an embodiment of agroforestry, which relates to production techniques in which integrate animals, forage crops and trees, in the same area.

The silvopastoral systems represent a form of land use where forestry and livestock activities are combined to generate production so complement the interaction of its components. These systems bring many benefits to the environment, some of these advantages are listed by Ibrahim et al. (2001) and PAGIOLA et al. (2004) are soil conservation, conservation of water resources, the promotion of carbon sequestration and increased biodiversity.

The aim of this study is to diagnose a farm as their chemical, physical and climatic characteristics; draft a silvopastoral system deployment, assessing the advantages and disadvantages, and verify the feasibility of the system implementation, in order to ensure the balanced environmental management area and proposed action plans aimed at sustainability of rural properties analyzed.

II. LITERATURE REVIEW

Dairy farming history

According to Almeida et al (2011), until the mid-twentieth century, the Brazilian cattle industry was

composed of natural pastures, mainly in areas of cerrado and country. From the 60's, there was an increase in areas with cultivated pastures mainly in the Cerrado and Amazon forest biomes, reflecting a significant increase in productivity, to meet the demands, which were becoming more frequent, for products of animal origin, especially meat and milk.

The dairy farming is considered a traditional activity in the country and is present in almost all the national territory. Besides its importance in the economic area, it is presented as one of the most complex sectors of Brazilian agribusiness, as Martins (2004) and Carvalho (2010). To produce milk, demand a series of inputs for agriculture and other sectors, such as those from the chemical, machinery and equipment, for example.

According to the Brazilian Institute of Geography and Statistics (IBGE, 2014), Minas Gerais has become, over the years, the largest milk producer in Brazil, with 24.5% of its cattle herd toward this activity. In 2014, the 100 largest dairy farms, 44 were located in Ontario (MILKPOINT, 2015).

The process of establishing the first cultivated grassland, however, started with the felling of native vegetation through the use of fire. This process led to the development of extensive livestock production systems, based on the natural fertility by high levels of soil organic matter and the ash from the burning of natural vegetation. These production systems, purely extractive, characterized by minimal use of materials and technologies, introducing, over time, low performance indexes and contributing to the degradation of natural resources (Almeida et al, 2011; hamawaki; 2018).

Pasture degradation

The concept of grassland degradation, according to Macedo & Zimmer (1993), refers to the evolutionary process of losing vigor, productivity, natural recovery capacity to sustain production levels, and quality required by the animals, and the ability to overcome the harmful effects of pests, diseases and invasive, culminating in the advanced degradation of natural resources, due to inadequate management.

However, according to kichel et al. (2011), degraded pasture is one that is producing below 50% of their productive potential, in relation to the soil and weather conditions of the place where it was located. It may be noted that not only is the improper management

itself that has increased the degradation of pastures, but also the lack of proper planning, even before its establishment, which is enhancing the factors involved in the degradation process (Almeida et al., 2011). Due to the strength of the degradation of pastures process sometimes it can be difficult to predict the time of the need to intervene in the process and choose the alternative recovery or renewal to be implemented. Either way, the degradation process must be controlled in the early stages, or in agricultural degradation stage, in order that, over time, the process tends to be more dramatic, reaching soil degradation, or biological degradation (Dias-Filho, 2007).

In this case, the difficulty and cost of recovery / renewal of pasture are much larger and, as a final result, the recovered pasture can not reach previous levels of productivity, the first cycle (Dias-Filho, 2007).

In this context, tropical forage breeding programs and edafoclimático zoning fodder, aiming at diversification and intensification of the use of pastures, are important tools to minimize the problem of pasture degradation in Brazil. However, the adoption of appropriate formation technology, management, and retrieval is another pasture renovation neck that needs to be solved for effective development of Brazilian cattle. (Almeida et al., 2011, p. 387).

The causes of degradation vary according to the situation of each pasture. According to the above author, the main causes of degradation are:

- Inadequate grazing practices;
- Inadequate pasture management practices;
- Failures in establishing the pasture;
- Pests, diseases and physiological problems;
- Abiotic factors.

Pasture recovery

The recovery of a pasture is characterized by restoring the fodder production, maintaining the same species or another cultivating (Macedo et al., 2000). The degraded pasture recovery strategies should be planned based on knowledge of the main causes of degradation. According to Dias-Filho (2007), the pastures recovery strategies (Figure 1) could be classified as:

- Renewal (reform) of pasture;
- Implementation of agricultural and agroforestry systems; and
- grazing fallow.
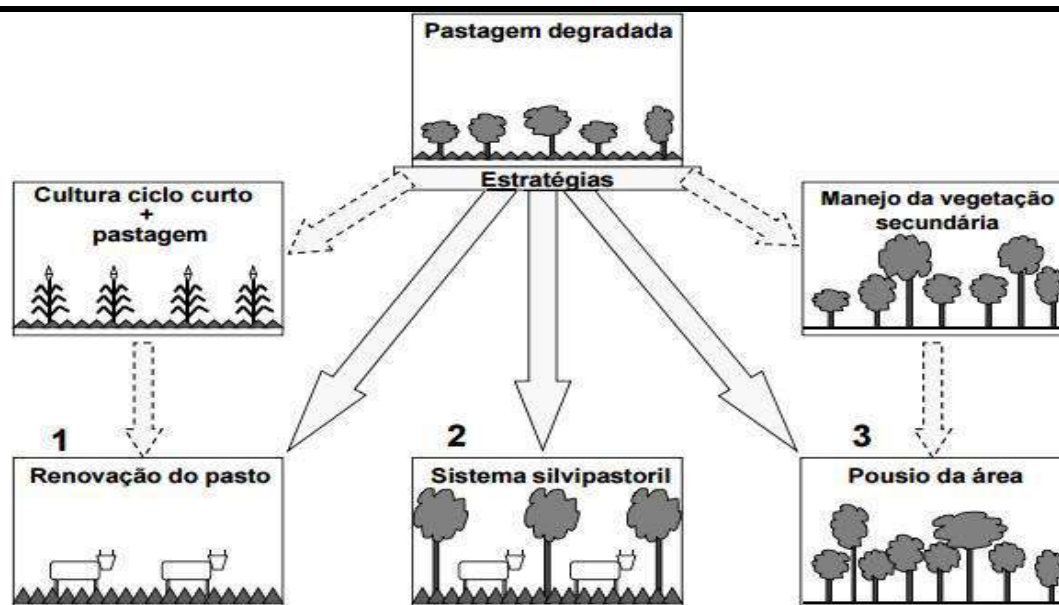
Fig.1: Strategies for the recovery of productivity of degraded pastures

Source: Dias-Filho (2007)

The integration and interaction of trees, pastures and livestock are of vital importance for sustainable development. All in order to include appropriate inquiries to mitigate their environmental impacts and providing the maximum possible biodiversity, moderate land use, production and conservation of water resources (Dias-Filho, 2007).

Silvopastoral systems

According to Silva (2004), Silvopastoral System is the purposeful combination of forestry, agricultural and livestock components in the same area at the same time and practiced so integrated, in order to enhance productivity per unit area. These systems have great capacity for financial and environmental benefits to producers and to society. They are multivalent, where there is the opportunity to increase the production by the joint management of natural resources, preventing their degradation, as well as to recover their productive efficiency.

As the aforementioned author, the integration and interaction of trees, pastures and livestock is of vital importance for sustainable development. All in order to include appropriate inquiries to mitigate their environmental impacts and providing the maximum possible biodiversity, moderate land use, production and conservation of water resources. The insertion of the forest component in production systems should give an approach that no longer accept the dismemberment of agricultural and forest, but all of these components in the countryside, in favor of quality of life, sustainability and yield stability.

One of the main barriers to adoption of silvopastoral systems would be its low initial profitability. The establishment of these systems needs essential investments of time and money that it decreases the speed at which profits would be obtained (Dias-Filho, 2007).

According PAGIOLA et al. (2004) in the early years after the implementation of a silvopastoral system, the income of rural property can be much smaller that the traditional system. This would happen because of the higher initial investment in time and capital required by the system and the time needed for the tree component grow enough to generate financial benefits. According to yet PAGIOLA et al. (2004), a study conducted in Nicaragua, only after the fifth year of investment with the system implementation, the income of the property began to exceed the income of the conventional system of pasture. The result of that there is the low economic rate of return that commonly characterize silvopastoral systems in the first years after establishment.

On the other hand, cultural aspects also hinder the adoption of the systems because they require the adoption of knowledge and, consequently, management practices that could be quite different from those conventionally used in traditional grazing systems (DIAS-FILHO, 2006). The implementation of silvopastoral systems is highlighted as one of the key strategies recommended for the recovery of productivity of degraded pastures. According days- Son (2005), the choice of a particular recovery strategy would be conditioned to local agro-ecological conditions, the purpose of the project and the availability of capital and labor-intensive. In this case, both pastures have suffered agricultural degradation, and biological, could have recovered productivity through the implementation of this system.

The recovery of degraded pasture through silvipastoral system implementation, i.e. where the planting of trees or shrubs to be incorporated into the pasture recovery process, or where she was encouraged natural regeneration of native species (handling the secondary vegetation) , could be a viable alternative to increase the economic and agronomic efficiency, enhance biodiversity and promote conservation of nutrients and water in these unproductive areas, the agronomic or biological point of view (SON days-, 2006).

The likelihood of success of a silvipastoral system can be increased with the use of better adapted species. Thus, both the tree component as the feed would have to be relatively tolerant to stress linked to this system. The

theoretically ideal tree for the system would have to have relatively rapid initial growth, to facilitate the establishment, reduced or sparse canopy and long shaft, to decrease the shading in the pasture, and the ability to rapid regeneration, when partially damaged. Economically, it would be desirable that the tree offered products (wood, oil, coal or fruit etc.) with high potential for commercialization.

Many silvopastoral systems are recommended for implementation in degraded pastures. Some of these models adequariam the degraded pasture recovery process are described below (Figure 2) (Oliveira et al. 2003; days-SON, 2005; DIAS-FILHO, 2006)
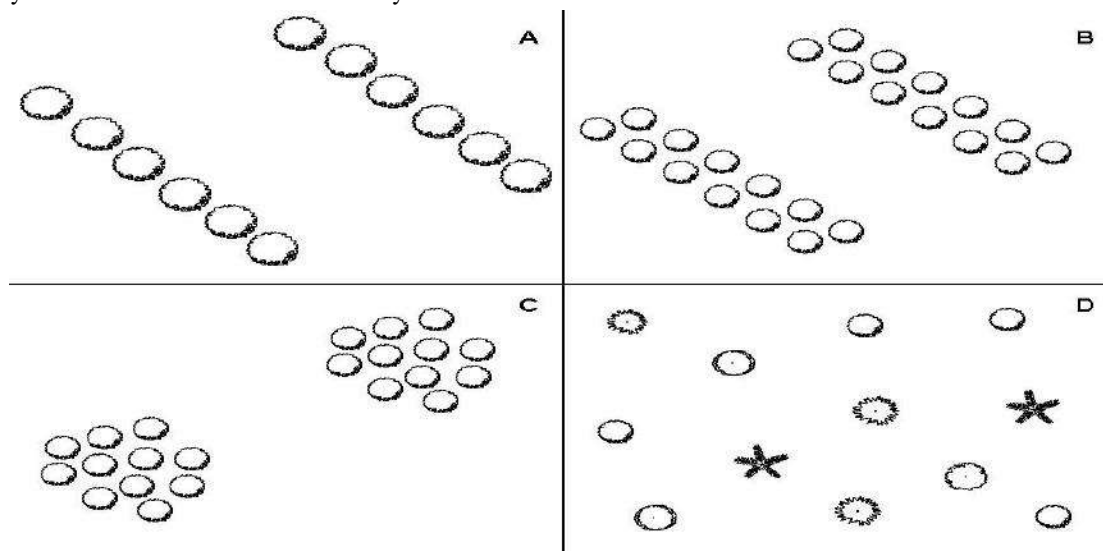
Fig.2: Schematic view of air SSP four models potentially useful in recovery of degraded pastures: simple lines (A), double lines (B) groves (C) and random planting (D)

Source: Dias Filho, 2006

Advantages and disadvantages of the implementation of silvopastoral systems

Theoretically, silvopastoral systems can bring many benefits to the environment when compared to traditional grazing without the planned integration of trees or shrubs in the livestock system. Some of these benefits, shown by Ibrahim et al. (2001) and PAGIOLA et al. (2004), are soil conservation, conservation of water resources, the promotion of carbon sequestration and increased biodiversity.

The benefits to the ground due to the implantation of silvipastoral systems result from the improvement in the medium and long term, the nutrient cycle, caused by the absorption of these elements by the roots of trees, of deeper layers of soil and the subsequent deposition of topsoil these nutrients (Dias-Filho, 2006).

silvopastoral systems have also the ability to use water from the deeper layers of the soil, which would normally be lost in traditional grazing systems (GYENGE et al. 2002) .Another benefit is the improvement in

biological activity of the soil, caused by microclimate changes due to shadowing from trees or for improving fertility, especially if the tree is able to be associated to microorganisms that fix nitrogen from the air, as occurs with certain leguminosas.O shading can still interfere with improved quality nutritional some forage plants. When planted in strategic locations, such as contour in hilly terrain, trees can also help control erosion (Carvalho et al. 2002). In economic terms, the silvopastoral systems have the potential to diversify the income of rural property by the marketability of the products generated by the trees as timber, fruits, oils, resins etc., as well as add value to the area. In some cases, silvopastoral systems can also be directed to supplementation of livestock diet, during periods of low pasture productivity through the use of foliage and fruit (green pods of legumes) produced by the trees (HOLGUÍN et al., 2003). According to Dias-Filho (2006), despite the direct and indirect benefits attributed to silvopastoral systems, it is important to point out that this system does not represent a solution to the

various problems linked tropical pastures. For example, the presence of trees and shrubs in the pasture may also hinder the development of the pasture. This would occur, mainly due to shading and, in some cases, competition for water and nutrients to the tree and shrub species exert on herbaceous forage pasture. In the case of tree and shrub species with abundant falling leaves, whose decomposition is slow, the accumulation of this litter can harm or regrowth germination and grass growth. In some situations, excessive shade or the constant assembly and movement of animals under the canopy of trees may cause thinning or total soil cover loss. These areas are more susceptible to compaction and consequent erosion and loss of nutrients, which have been identified as one of the main problems related to silvopastoral systems (BAGGIO, 1983; Daniel and Couto, 1999). On the other hand, frequent congregation of animals can still result in the trend towards greater accumulation of feces and urine in the soil under the trees, increasing the uniformity problem in the distribution of waste in the area of pasture. This fact contribute to reduced soil fertility, since the constant and excessive deposition of nutrients (such as found in areas affected by urine and feces) into restricted areas of pasture would hinder the absorption efficiency

and the use of these nutrients by plants, making them more susceptible to losses. The competition exerted by grazing animals and interference can also impair the development and survival of trees. Finally, the presence of trees inpasture could in some situations hinder its mechanization (Traffic machines). This would happen, especially when there was no proper planning of the spatial distribution of trees in the pasture (DIAS-FILHO, 2006).

III. METHODOLOGICAL APPROACH

General description of the study area

The work of this study area is located between the municipalities of Nanuque and Carlos Chagas in the state of Minas Gerais. Located in the Stream Thirty-Seven (Figure 3 and 4), is distant about 55 km from the city of Nanuque, and about 5 km from the District of Vila Gabriel Passos, also in Nanuque. Os its north and south ends are, respectively, the -17º35'29 coordinates, 81332 "and -17º35'44,88443"; and its extreme east and west are respectively -40º32'11,36908 coordinates "and -40º32'29,94372". Occupying a total area of 12.3812 ha. With a perimeter of 1.677 km.
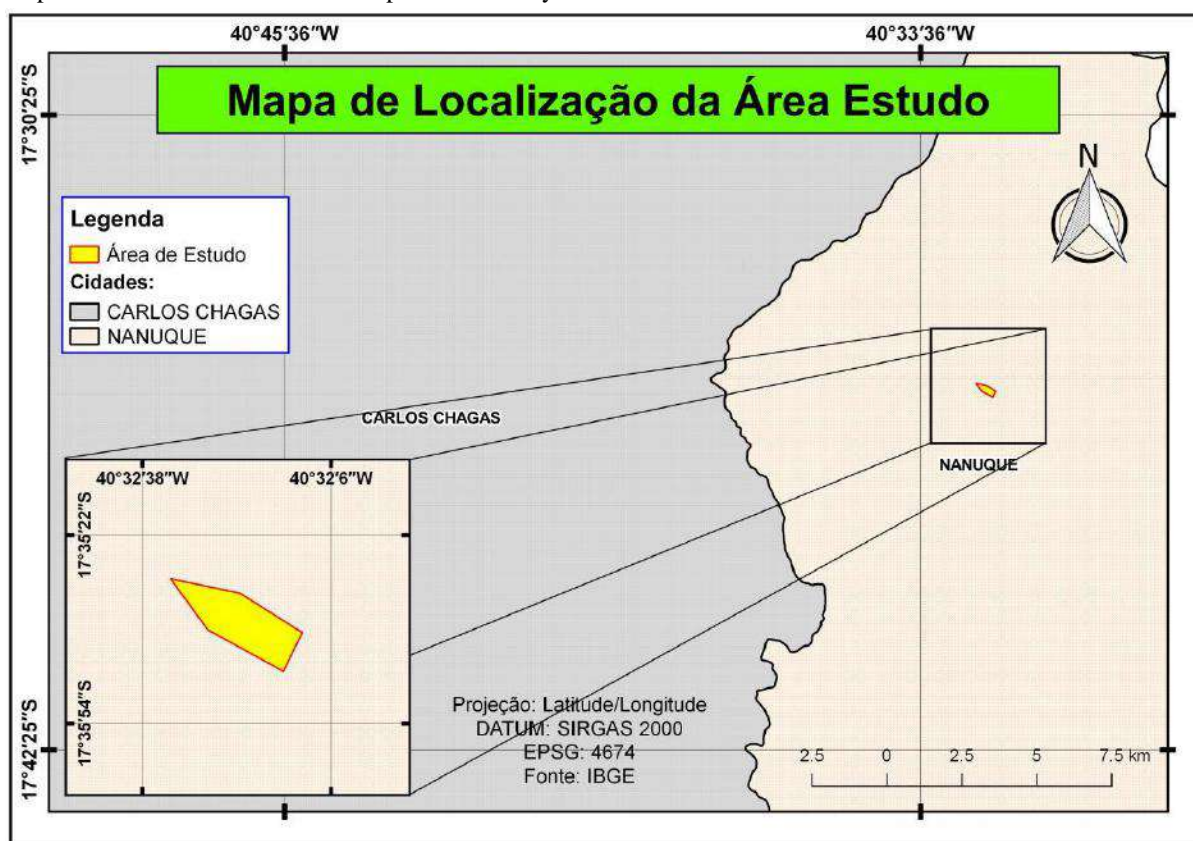
Fig.3: Location of the study area

Source: MENDES, 2017
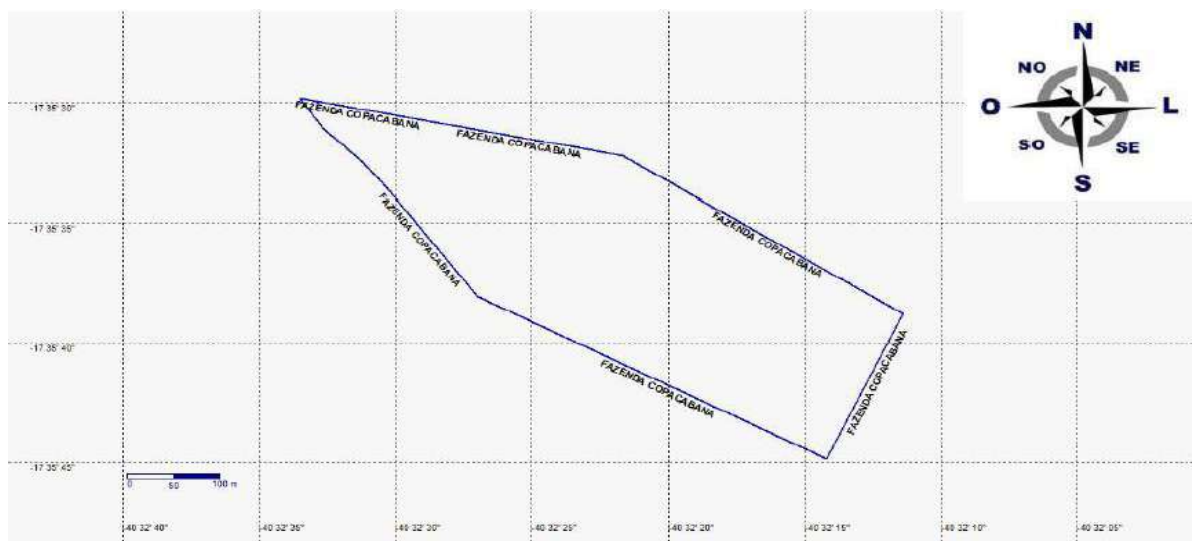
Fig.4: Polygon property (study area)

Source: L & N ENTERPRISES SERVICES, 2017

On the property, the predominant activity is dairy farming, keeping also small areas of agriculture, for livestock keep in times of drought. The area includes the degradation of historical deforestation caused by farming, cultivation of forage monocultures and soil compaction caused by animal trampling, and the traffic machines for whiffs purposes in the area.

General diagnosis area

The area was diagnosed through technical visits for the evaluation of the study area, it was also carried out a photographic survey with the use of GPS to obtain coordinates. Chemical analysis of soil were carried out in some parts of the study area, to assess the needs of acidity corrective and possible fertilizers. It conducted surveys through visits for assessment of the situation of tree species present in the area where will be the proposed implementation of silvopastoral system. Using satellite images, a survey was conducted of the Permanent Preservation Areas (PPAs) and the demarcation of waterways. Was calculated runoff coefficient of the area, runoff coefficient definition is the ratio of the total volume of runoff in the event and the total volume precipitate (Tucci, 2000) (Equation 1) and using Table 1, which presents the values of the flow coefficient (C), depending on the soil type, slope and vegetation.

$$C = \frac{\text{total volume drained}}{\text{total volume precipitate}}$$

Table.1: Values of the flow coefficient (C).

Slope (%)	Sandy soil	Solo frank	Soil argillaceous
forests			
0 - 5,	0.10	0.30	0.40
A 5 - 10	0.25	0.35	0.50
10 - 30	0.30	0.50	0.60
pastures			
0 - 5,	0.10	0.30	0.40
A 5 - 10	0.15	0.35	0.55
10 - 30	0.20	0.40	0.60
cultivated land			
0 - 5,	0.30	0.50	0.60
A 5 - 10	0.40	0.60	0.70
10 - 30	0.50	0.70	0.80

Source: CARVALHO E SILVA, 2006.

IV.   RESULTS AND DISCUSSIONS

Diagnosis of Property

The pasture area has degraded, because according to Kichel et al. (2011), degraded pasture is one that is producing below 50% of their productive potential, in relation to the soil and weather conditions of the place where it was deployed, and the same is with these conditions. In assessing the tree situation of the property can be identified that the area has only about 5% of its area with some tree species (Figure 5), an important fact for the proposition of the system implementation. The area has a spring at one of its ends, and this has little amount of components for its preservation tree as shown in Figure 6.

Fig.5: Overview of the property

Source: Mendes, 2017.

Fig.6: Rising

Source: Mendes, 2017.

Was calculated from the runoff coefficient, the area has a loam soil a 5-10 slope (%) and the pasture is predominant in this field, there was thus obtained the result that 35% of the volume precitado location is disposed on the surface as surface runoff values of the author table Carvalho and Silva (2006). After the results of soil analysis (Table 2) performed by the agronomic laboratory LABOMINAS it was found that the soil of the area is with its median nutritional levels, based on data from the Fertility of Soil Commission of the State of Minas Gerais.

Table.2: Result of soil analysis

Parameters	Unity	Average of samples
MO Mat. Organic (Oxi-Red.)	dag / dm3	1.7
pH (Water - Ratio 1: 2.5)	Items.	5.3
P (Mehlich 1)	mg / dm3	5.8
K (Mehlich 1)	mg / dm3	117
Here (KCl, 1 mol / L)	cmol / dm3	1.87
mg (KCl, 1 mol / L)	cmol / dm3	0.9
al (KCl, 1 mol / L)	cmol / dm3	0.10
H + Al (Calcium Acetate)	cmol / dm3	4.24
SB (Sum bases)	cmol / dm3	3.07
CTC (CTC)	cmol / dm3	7.3
% V (Saturation bases)	%	42
CTC% K (% K CTC)	%	4
% Ca CTC (CTC% Ca)	%	25.7
% Mg CTC (% Mg CTC)	%	12
CTC% Al (% Al CTC)	%	1.4
% H CTC + Al (M + Al% CTC)	%	58

Action plans

Given the Law 12,651 / 2012, of May 25, 2012, which says that the owner of rural areas is required to hold 20% (twenty percent) of its area to the Permanent Preservation Areas (APP) and / or legal reserve (RL) will be proposed to implement preservation in the areas of springs, these are surrounded, so there is no entry of animals within these areas, even with the lack of mandatory property, its total area, this property is exempt from RL, but will be chosen for preservation, for the recovery of this area will be targeted. The total area to be preserved is 2, 47624 ha. With the completion of all analyzes and assessments, the result was obtained, it is possible the implementation of a silvopastoral system within that area will be proposed planting trees in the area of the spring, causing it to be preserved, and so may favor the system mentioned above. Thus, the proposal will be the recovery of the spring by planting species such as banana (Musaceae), Inga (Inga sp.), Soursop (Annonamuricata) and ipe (Tabebuia), totaling 200 seedlings, species those that will be purchased and / or local nursery was purchased would cost on average $ 1,840.00 also be performed in the same enclosure, so that no cattle treading area and consequently soil compaction and difficulty in retention of stormwater in the enclosure cost average R $ 560.00.

Will be proposed the planting of native and pioneer tree species, as they are more resistant to sun exposure and the nutritional conditions found in the soil, and are species that have fruits and products that may be marketed, species such as Inga (Inga sp.), Aroeira- do-field (Astroniumfraxinifolium Schott) and annatto (Bixaorelana L.) was chosen for the simple line method for planting, with a spacing of 5 x 10m, preferably arranged in the east-west direction in order to reduce the shading on pasture, these trees have an average of three years to achieve growth and fruit start, will be planted around 500 saplings, they will be obtained through purchase and / or supply of municipal nursery, it bought the species would cost on average $ 3,250.00 . The grass species to be used is *Bhachiaria humidicola* because when shaded has relatively more efficient photosynthetic behavior within the system (DIAS-FILHO, 2002). They would be used on average 20 grass seed bags, costing on average $ 2,200.00. For matter of implementation should also take into consideration the costs of land preparation, conducting pits, seedling planting, monitoring and follow them. Calculating the hand labor to perform all activities, considering the work done by the owner, it is estimated that will be spent on average $ 4,000.00. It is anticipated that will be spent a time of 90 days for the deployment process, after this process will be periodic monitoring every 15 days, to combat possible pests and insects, and for observing the development of the species.

Advantages and disadvantages

The implementation proposal of a silvopastoral system will target the use of the farm in a sustainable manner, so that the property get their profits also recovering degraded areas. The implementation will have an estimated cost of approximately R$ 12,000.00. Given that is a small property will be a large investment for the producer, but with a positive return. The property could face problems with the return to profitability of the traditional system of time that was previously used in the area because the silvopastoral system get a higher profitability this system after medium and long term, the cost of deployment will be relatively high, because according PAGIOLA et al. (2004), only after the fifth year of investment with the system implementation, the income of the property began to exceed the income of the conventional system of pasture. Given that is a small property, and their activities are to support themselves, they may experience some adversity in relation to the complexity of the union of the tree, forage and feed components, such as problems related to excessive shading, the litter of some types of trees, it may take a long time to decompose, and this will generate low productivity in these areas, and also the competition for water and nutrients from grasses and bushes, but all these problems will not come to pass, because the proposal will be made by a rigorous planning, analyzing all the criteria for its implementation.

In contrast to these adversities, the property will possibly after a period of medium to long term, greater profitability than the traditional system, the soils are more fertile and have a site erosion control, water resources are more abundant and moreover It has a possible diversification of income and if necessary, you can use the trees as a form of bovine dietary supplementation, favoring thus indirectly to the economic value of the property.

V. CONCLUSIONS

The silvopastoral systems represent a land-use technology that ensures greater biodiversity and sustainable ecosystems compared to any monocultures. Interest in such systems has increased significantly across the country, but it is necessary to carry out public policies for the implementation of silvopastoral systems because this deployment has a high cost, yet the advantages are evident in relation to the disadvantages. the need to drive systems in soil favor, the environment in which we live and of present and future human generations is recognized.

The results of this work suggest that it is possible to recover degraded areas by applying this methodology, it can be an alternative of recovery with low cost, without use of synthetic products.

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Territorial Formation of the Nordestine Semiarid and Public Safety Policies

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Abstract— This research aims to integrate the theoretical and academic debate into the landscape of the territorial formation of the northeastern semi-arid as well as discuss how it interferes in the public safety agenda for the sustainability of the traditional peoples and communities residing in the semi-arid region of Bahia. As a methodological proposal, a bibliographical review on the theme was used, which allowed the identification of the concepts necessary for the analysis under the Human Ecology of information and the construction of articulation links.

Keywords— Community Policin, Human Ecology, Human right, Social Participation, Traditional People.

I. INTRODUCTION

The semi-arid region of Brazil is characterized by rainfall irregularities, high average temperatures and low humidity throughout most of the year, being a landscape where the vegetation of the caatinga predominates, presenting specimens of this very diverse environment (REIS, 2004). complements the Brazilian semiarid scenario with its traditional characterization as an area of economic backwardness, poverty and rural exodus (OLIVEIRA; SANTOS; SILVA, 2017).

Fortunately, with an increase in research in this region, carried out by institutions, public, private and third sector organizations, at least in the academic field, this characteristic has been deconstructed. We know that the Brazilian semiarid region has great potential for the implementation of sustainable activities, such as agroecological actions, sustainable tourism, agrosilvopastoris, sustainable solar energy, collection and processing of extractive products, potentialization of commercial and cultural activities, fairs free from this region, among many other synergies that can expand the repertoire of economic-sustainable coexistence in (e) with the semi-arid. As shown by Azevedo, (2008) when referring to the region of Paulo Afonso, a regional enclave of expressive prominence in the northeastern semi-arid region.

In this perspective, the present article discusses the territorial formation of the northeastern semi-arid region, emphasizing the discussion about how the federal, state and municipal public authorities see the needs of this region; it is proposed to make a historical appraisal of the investment models adopted over the years, mostly actions to combat drought, and its influence on the formation of regional identity (DINIZ, LIMA, 2017); the objective is to contribute to the discussion about the consequences of the public policies adopted by the political managers on the current formation of the northeastern semi-arid territory.

In order to elaborate the theoretical-conceptual framework, a brief discussion of topics related to the understanding of the semi-arid region, the concept of public policies in Brazil, public security policies in the semi-arid state of Bahia and the social participation of traditional peoples and communities in elaboration, concepts that will be approached from the perspective of Human Ecology defended by Bomfim (2016, 2017).

As a geographic cut, the research focuses on the reality of the communities located in the semi-arid Bahia of Northeast Brazil. As a methodological proposal, the qualitative research was adopted, orienting the analyzes primarily to the historiographic interpretation (MALERBA, 2002), in a context in which the main methodology is articulated with the use of ethnographic and historical-dialectical methods. These methods, especially, will be used when analyzing and interpreting the data collected in the course of the research.To base the understanding of this research at this point will be the discussion under the Human Ecology of topics related to the understanding of the reality experienced in the northeastern semi-arid.

II.   HUMAN ECOLOGY

More than a century man has demonstrated sufficient knowledge to significantly influence terrestrial ecosystems, modifying existing ecological standards and transforming the biosphere and earth's crust. In this scenario, natural events and processes such as erosion and extinction of species were accelerated, compromising the very survival of ecological systems (Ávila-Pires, 1983).

Complementing this thinking Begossi (1993) states that for some to study the relation of man to the environment includes several factors; which complements Harari's (2017) by claiming that for many years Homo Sapies was not conceived as part of the ecosystem and that reality does not confirm the constraints imposed by this thought.

In this point, we emphasize that in order to achieve the objective of this article, we must resort to the interdisciplinary view on the human-environment interrelationships, a condition for which studies carried out by Human Ecology (MACHADO, 1984) are proposed; confirming that the methodologies adopted in research on human ecology will be used, without generalization, because they are presented as a more specific resource to understand the human behavior against the different environmental variables observed (BEGOSSI, 1993).

Based on this view and based on knowledge originated in disciplines such as Geography and Anthropology among many other disciplines that for Begossi (1993) have characteristic development of human ecology, we will make a brief analysis on the territorial formation and public policies created and implemented in the northeastern semi-arid region.

III.   PUBLIC POLICIES IN BRAZIL

For Campos, (2014) in a broad public policy is the dynamic and practical process based on a legal framework through which the public manager seeks to solve social issues, constituting in this way a tool designed to provide well-being to people and their families when solving a problem that reaches the basic needs of society.

Nunes (2011) when referring to Esping-Andersen (1993) teaches us that public policies have three possibilities: a) universalist; b) corporatist and c) residualist; and in Brazil the characteristics of universalism (extremely linked to state action) and residualism (aimed at specific layers of the population) stand out.

In this passage, for Street (2012) the policy is the result of political activities; affirmed by Campos (2014) when he affirms that in what concerns the reality observed in the northeastern semiarid only in the late nineteenth century the government started to admit the prolonged droughts as a national problem that has already reached

hundreds of thousands of people in the past and currently still continue to flagellate sensitive portion of this population.

From Uderman's (2008) exposition, it can be deduced that until the middle of the regional themes did not, to the satisfaction of the Brazilian Northeast; national policies in a broader context, with development policies focused on the Center-South region of the country, excepting to this rule the policies to combat drought in the Northeast and the effort for the construction and other Brazilian urban centers.

The policies to combat drought in the Northeast had the purpose of confronting the economic damages caused to the population due to the prolonged droughts that occurred between the years of 1850 and 1900, which produced several scientific analyzes, to order of the public power, researches that served the implementation of policies to combat drought, but without unity because it was the result of the partial vision of each researcher (SILVA, 2007).

Uderman (2008) also notes that the creation of the Banco do Nordeste, the promotion of the oil industry in the state of Bahia, the expansion of the road network, integrating the major national centers and the creation of the SUDENE, ; an undertaking that emerges in importance for the development of regional development policies in this region.

Silva (2007), in criticizing the consequences and structural causes of the misery to which part of the pollution in the semi-arid region is submitted, affirms that only at the beginning of the 20th century new judgments on the subject appeared, as can be observed both in scientific production and in literature Typical local. These contributions exposed under the sociological gaze the form of occupation and exploitation of the sertanejo people and the riches of the territory by the colonizer and his descendants; where public policies to combat drought are limited to reproducing the existing cycle of domination.

Complementing the public policies to combat drought in the Northeast, we can now point to actions aimed at food security based on family agriculture (GRISA, SCHNEIDER, 2014) and income distribution, materialized by the federal government's Family Grant Program (COTTA, MACHADO, 2013); however, these actions do not fully cover the reality to which the sertanejos of the Brazilian Northeast are subjected, and mitigating actions are taken to be the situation of extreme poverty that prevails in much of the region. Thus, we briefly examined the processes of public policy formation, we will make some reverberations of this process in the elaboration of public policies of national

security and in it as it presents the agenda of public security in the country.

IV.   PUBLIC SECURITY POLICIES IN BRAZIL

The problem of public security in the country is a discussion that requires the participation of all; presenting as a characteristic the fact that they can be presented as independent (repressive) actions or subordinated to the social (preventive) macro policies used by the government (OLIVEIRA, 2002).

Thus, it is necessary to resort to the conceptual differentiation between the political terms of public security and public security policies, which for Oliveira (2002) can be thus conceptualized:

> Public security policies is an expression referring to typically police activities, it is the police action "*strictusensu*". Public security policy is an expression that encompasses the various governmental and non-governmental actions that have an impact or impact on the problem of crime and violence (p. 48).

Broadly one can infer that the public security policies in Brazil had their initial phase were initiated after the arrival of the Portuguese in the country with the Ordinance Services subordinate to the landlords; at this time the performance of existing organs reflected the social, political and economic interests of the dominant classes, acting in a subsidiary way to maintain security. This model coexisted with the militias served in the mining phase, and this coexistence continued until the end of the 17th century when the organization of the official military structure in Brazil began, an opportunity to formally predict internal policing sponsored by the public power (ARANHA, 1997).

According to Aranha (1997), official forces in the period between the eighteenth and nineteenth centuries had permanent and regular characteristics and coexisted with the private factions of an occasional and irregular character, a condition that persisted until the arrival of the Portuguese Crown in 1808, responsible for the installation of the Corps of the Royal Brigade in Brazil. During this period public security policies and public security policies maintained the characteristic of defending the interests of the ruling classes and of protecting national borders and resources, becoming a mixture of military and police force.

Aranha (1997) still affirms that the end of the seventeenth century and the beginning of the nineteenth century were

marked by numerous popular revolts, at which time official and private forces worked together to maintain the status quo, a reality that lasted until the return of D John VI to Portugal and the proclamation of independence, when official forces were employed to maintain Portuguese interests in Brazil, a fact only modified with the independence and the nomination of Brazilians to the positions of leadership of the corporations.

After the independence of Brazil the Constitution of 1824 carries out the restructuring of the military forces in the country, starting to predict the existence of the Army, regular and paid troops; of militias, auxiliary and free troops with the purpose of assisting the Judiciary and maintaining order in the Comarcas, and of police guards, auxiliary forces responsible for the persecution and arrest of criminals and for individual security (ARANHA, 1997).

As Aranha (1997) teaches in the second half of the nineteenth century, ratifying their origins is observed the use of permanent and temporary security forces in confrontations such as the Paraguayan War and Canudos.With regard to Brazilian public security policies, no significant changes were observed in the beginning of the 20th century, continuing the focus to be maintained in the interests of the State and the elites, as can be seen in the Campaign Against Lampião, a period known as Cangaço. that innovation is perceived in the public security policy through the conclusion of an agreement between the states of Bahia, Pernambuco, Sergipe and Alagoas (Queiroz, 1997).

According to Paiva (2004), the cangaço in the first four decades of the 20th century emerged and expanded in the semi-arid lands of the northeastern states, finding fertile ground in the reality suffered by the sertanejo people as a result of the long droughts and fights of kinship and / or politics existing among the dominant elites.

In the second half of the twentieth century, especially during the Military Regime, as shown by Oliveira (2018), the direction of public security policies in Brazil is observed to play a role in containing crimes, violence and existing social manifestations, a performance marked by acts of violence and serious violations of human rights, when the state's eyes were almost political police.

This brief historical account of the organization of the security forces in the country makes clear the link between security institutions and military institutions, a situation that has been foreseen in the constitution until now, and even foresees its regular use as an auxiliary force in national defense cases (BRAZIL, 1988) and to establish the linkage of institutions to the maintenance of the dominant elites.

In contrast, Kahn (2002) argues that public security policies in Brazil should be based on a medium- and long-

term preventive agenda, since traditional strategies, usually implemented by crime-fighting agencies, are ineffective in respect to the goal of reducing the growth of criminal activities. The same author affirms that the traditional model proposes a new model of coping with crime, which emphasizes the multi-agency service and the interdisciplinality in which the participation of diverse social agents and sectors of the public power in the elaboration of solutions for the security problems increasingly complex.

In the wake of this, with the redemocratization of the Brazilian state in the late 1980s, there was a need to renew public security policies for the country, with the adoption of models such as community policing or what is now called "policing citizen ", which advocates the approximation of public safety organs of the community, advocating social participation in the elaboration of the public security agenda (BAHIA-PMBA, 2003).

V. SOCIAL PARTICIPATION IN THE PREPARATION OF THE PUBLIC SAFETY AGENDA

Brazil; Rodrigues (2015) tells us that the theme of social participation presents itself as a difficulty that afflicts the various sectors responsible for the management of public policies in Brazil; and there are a number of empirical experiences in the country that provoke debates and efforts by public authorities and civil society to broaden the debate on the subject, which is so dear to the full exercise of contemporary democracy.

In academic terms, the analysis of public policy themes took off from the 1990s; emphasizing that this impulse was only possible thanks to the maturity of the presuppositions foreseen in the Constitution of 1988 and of the later legislations that consolidated the importance of the social participation in the elaboration of the public policies, a reality that requires the closer relations between the State and the social agents (BRAZIL; RODRIGUES, 2015).

Regarding public security, NEV / USP (2009) tells us that in the period between the late 1960s and the mid-1970s developed countries found that the traditional model of policing was not effective in combating urban violence verified; a condition that added to the erosion of the image of the police corporations due to the criticisms in their way of acting in front of the collective movements and the criminal violence fomented the adoption of the community policing.

Whether it is internationally or in Brazil, community policing emerges as a way of approaching public security agencies, especially the police and society. However, this type of policing requires the efforts of the social agents and the authorities involved, especially regarding changes

in the organizational culture of police institutions (NEV / USP, 2009), which provokes institutional resistance.

In this sense, we can affirm that the philosophy of community policing is based on the syllogism of the harmonious work between the community and the police in order to identify and solve the salient social problems (crimes, drugs, disorders, etc.) providing a better quality of life for the community (GT / PORT. SENASP Nº002 / 2007, 2008).

In Brazil, social participation in the elaboration of the public security agenda began only in the 1990s, when in an embryonic way community policing was applied in some states of the federation, like São Paulo and Bahia. However, this change in the policing model did not occur due to the demands of the society or the decision of the police institutions. This was done by political decision of the government, which entails years of waiting for police corporations to integrate their institutional values (NEV / USP, 2009).

In this way, the use of community policing can provide the participants with an environment of speech, listening and negotiation based on communication and subjectivity, in which different social actors freely present their opinions on the observed social and criminal problems and participate in the decisions about the ways of coping (BRASIL, RODRIGUES, 2015), contributing to the construction of a public security agenda more adequate to the social demands of the communities involved.

VI. THE BRAZILIAN SEMIÁRID

For Reis (2004) the records about the Northeast originated at the end of the sixteenth century with the Portuguese colonization, deriving from the expansion of livestock, which was moved from the coast to the interior due to the damages caused by sugarcane plantations and the need to expand the areas of Portuguese domination (AZEVEDO; BARROS, 2017).

However, the imagery of the Northeast expression is confused with the image constructed when we refer to the semiarid; however, Clement (2013) clarifies in his dialogue with the contributions made by Gilberto Freyre and DjacirMeneses in 1937, that contrary to the disfigurement in this image, the semi-arid region does not comprehend the totality of the Brazilian Northeast, since there is a zone of Coast. In this context, we added the agreste region and the swamps as typically northeastern areas.

In this way, Clemente, when interacting with Durval Muniz Albuquerque Júnior (1999), clarifies that:

> The term Northeast was "used initially to designate the area of activity of the Federal Inspection of works

against the droughts (IFOCS), created in 1919". This event was not only seen as the creation of another body to combat the devastating phenomenon of droughts, but the affirmation of a region and the subsequent constitution of a regional identity. (CLEMENT, 2013, p.103)

As Clemente (2013) reports, at the beginning of the twentieth century the administrative, cultural and political reality of the present Northeast was confused with the interpretation given to the cangaço, especially the description of the cangaço headed by Lampião, a description made from a regional historical perspective with a strong influence of identity factors of the sertanejo people such as drought, coronelismo and the mysticism of the sertanejo.

In this context, Silva, (2007) reveals that the Northeastern semi-arid environment has historically been suffering from social injustices, being the worst Brazilian social indicators in fundamental areas such as health, education and income; a condition that erroneously over the years is linked to the droughts that occur in the region, constituting this justification in a simplistic analysis of reality, since it disregards factors existing structures among the social actors that live there.

VII. STRUCTURAL CHANGES IN THE SEMIARID REGARDING REGIONAL ECOLOGY

Azevedo and Barros (2017) teach that the occupation of the northeastern semi-arid region after the discovery, especially the lower São Francisco area, occurred in a dispersed manner, mainly due to the extensive livestock production as a regional productive activity, which included the cultivation of crops for subsistence, culminating in the emergence of human groups of little expression.

This reality lasted for a long period of time, and from time to time the visits and technical studies commissioned by the public authorities, such as those carried out by Hafeld between 1852 and 1854 at the request of Dom Pedro II (AZEVEDO; BARROS, 2017), technical studies, as a rule, aimed at knowing the potential of natural resources available.

Among the environmental factors of the Brazilian semi-arid region are droughts, which in a chronic way plague the lives of the human beings who live there. Silva (2007) states that public power only came to have drought as a problem of interest in the eighteenth century, however,

the present scenario only underwent significant changes in the period between the end of the nineteenth century and the twentieth century when the implantation occurred of hydroelectric projects, irrigated agriculture and public investments in combating the droughts afflicting the semi-arid region (Campos, 2014, SANDES, 2014, AZEVEDO and BARROS, 2017).

It is evident that the investment in large projects for the semi-arid region, even fragmented, including those linked to combat the afflictions caused by the long and recurrent droughts began to begin in the second half of the nineteenth century, only to be analyzed critically in the century XX. This discussion culminated in the creation of the Hydroelectric Company of São Francisco (CHESF) in 1945, in the Superintendency of Development of the Northeast (SUDENE) in 1959 (SILVA, 2007) and in the Development Company of the São Francisco Valley (CODEVASF) in 1974, the investments made did little to improve the quality of life of the poorest population (SANDES, 2014).

According to Silva (2007), with the re-democratization of the country in the 1980s, the rulers, due to the inefficiency presented in public policies to combat drought, began to adopt the discourse of sustainability and to seek effective alternatives for the development and coexistence with the semi-arid , encouraging research by public and private institutions.

Even though the environmental and social vulnerabilities of the Northeast, which nowadays surpass the semi-arid region (MEDEIROS et al., 2013), in the last decades of the twentieth century, there are significant changes in the structure of this society, based on a process of regional industrialization, scarce in its social character and of difficult prospection as to the results that will be reached in the medium and long term, perceived in some regions, like the capitals and big cities existing in the Brazilian semiarid (BUAINAIN, GARCIA, 2013).

VIII. PUBLIC SECURITY POLICIES IN THE BRAZILIAN SEMI-ARID - HISTORICAL APPROACH

As discussed earlier, public security activities in the region that we now call semi-arid began to be initiated by the Ordinance Services led by the landlords, and their actions were confused with the defense of their political, social and economic interests; having in the seventeenth century begun its structuring based on military organizations; in this model, the financing of internal policing activities with public funds (ARANHA, 1997) already occurred.

This was the reality observed during the period of existence of the Hereditary Captaincies and sesmarias, where official troops and armed groups coexisted with the

regional political leaders; a scenario that came to undergo some modifications with the arrival of the Royal family to Brazil, an opportunity where greater rigging of the public organs and consequent reduction of the influence of the landlords were established (ARANHA, 1997).

However, it is observed that the basic structure (contingent) of security institutions were directed to meeting the needs of the Capital, in general coastal cities, markedly slavery and, as a rule, sugar cane producers, mainly coffee. Thus, virtue of the inexistence and / or low public investment in this service; once the most remote areas of colonial Brazil remained the maintenance of the model mentioned by Aranha (1997).

Thus, occupation of the interior lands by livestock and goat farming, which had the objective of supplying meat and other products to coastal cities, was not peaceful, resulting from the struggles of the large grantees and sesmeiros with the indigenous peoples. Paiva (2004) states that:

> Violence has always been endemic in the backlands of northeastern Brazil, as a result of struggles with the Indians, during the clearing and occupation of the vast interior spaces; also, of the ties between family members and large landowners. It consolidated itself with the lides in the management of the cattle and groups of jagunços, for the defense of the colonelssertanejos, in the isolation of their farms, where the Law did not arrive. (P.1)

The fragility of the public security policies for the semi-arid region can also be observed in the aftermath of the Canudos War, a community located on the banks of the Vaza-Barris River that developed under the influence of AntônioConselheiro and because of the existing social scenario came to be understood by the Government of the Republic as a group of insurgent defenders of imperialism (CUNHA, 1979; REIS, 2004).

This reality presented itself as a fertile ground for the empowerment of the large regional families, who replaced the landlords and who used the same practices previously adopted (large bands of armed jagunfos), the precursors of the bands of cangaceiros, that adapted the intempéries natural activities in all Northeastern states often illegally (QUEIROZ, 1997; PAIVA, 2004), depending on the circumstances supporting or confronting the Rulers and relatives.

Corroborating with Sandes (2014) when he affirms that today a scenario of public insecurity occurs, in which drug trafficking is the face of crime that develops most, especially in urban centers, presenting a striking feature of criminal organization with tentacles that throughout the national territory.

It should be noted that the Brazilian semi-arid region does not differ from the Brazilian reality, presenting regions with a high crime rate, such as the "Maconha Polygon" located in the São Francisco Valley, which stands out nationally for drug trafficking (Cannabis Sativa Lineu / marijuana), territory where this criminal practice presents itself with a structure similar to that of an agribusiness (SANDES, 2014, p.16).

The modern reality of the semi-arid area is reinforced by the increase in the number of crimes against financial institutions, popularly known as "robbery of the bank", a criminal procedure that has been called by the specialists as "Novo Cangaço". the cases recorded between the late nineteenth and early twentieth century (SOUSA, 2017); being notable the weakness observed in the current actions of the public power to confront the currently registered cases.

IX. PUBLIC SECURITY POLICIES IN THE BRAZILIAN SEMI-ARID - CURRENT APPROACH

Contrary to institutional discourses, as observed in the state of Bahia, in Brazil the adoption of professional policing as a model, in which policies are implemented from top to bottom, presents extremely hierarchical structures and rigorous regulation. The main function of the most senior police officers is to check if the lower-ranking police officers are complying with corporate regulations, a theoretical framework that in several studies has not presented effective results in terms of social pacification (MOORE, 2003).

Corroborating with the above, it is now peaceful that the public security organs in the country claim to adopt as alternatives to the traditional policing model the philosophy of Community Police; policing philosophy based on the assertion that effective joint work between the police and the community can play an important role in reducing crime and promoting safety, and the citizen is the first line of defense in the fight against crime (MOORE, 2003).

It complements this controversial scenario, the prediction of the development of actions by the state public power, which presents as lines of action the confrontation with drug trafficking, crimes against financial institutions (Novo Cangaço) and organized crime in general; as well as investments in technological resources, organizational management and production of evidence (BAHIA, 2017).

From this exhibition it can be observed that the reality of the Northeastern semi-arid territory is not seen in its fullness, since it disregards local anthropic factors, Human Ecology is so important, becoming an intervention of the public power for the solution of crimes of interest, in a model that approaches the one used to combat banditry in the late nineteenth and early twentieth centuries.

In this context, the real adoption of community policing as an organizational strategy, in which public security agencies are not only agents in the fight against crime, but also as public actors for solving social problems (MOORE, 2003), contributing, as a partner , mainly for the development of the community through the creation and active action of community safety councils (GT / PORT SENASP Nº002 / 2007, 2008).

X. FINAL CONSIDERATIONS

When we analyze the issue under the perspective of a Democratic State of Law, in the light of the citizens' constitution, we observe that public security policies and public security policies designed to meet the needs of the peoples and communities of the Northeastern semi-arid region are not effective; it is evident that the problems that afflict the Brazilian Northeast are not linked to the drought, but in part were built over time, due to the adoption of an inadequate model the reality of the semiarid (MEDEIROS et al., 2013), more appropriate to maintenance of the privileges and power project of certain strata of society (SILVA, 2007).

However, in this scenario, actions that seek to meet, even if not in full, the needs of this territory, such as Operation District of the Military Police of Bahia (BAHIA, 2017) or the intervention project for the implementation of the Rural Patrol of Military Police of Pernambuco (PEREIRA, SERAFIM, 2011).

On the subject, we can also highlight actions that are not specifically aimed at the semi-arid, but which, because of their importance, contribute to improving the quality of life of the sertanejos and sertanejas, as demonstrated by Anjos, Estevam e Souza (2018). data regarding the attendance of occurrences of the Maria da Penha Round of PMBA in the municipality of Paulo Afonso from May 2016 to June 2017.

It remains evident that the discussions culminate in the understanding that public security institutions should approach society as a whole, and of the peoples of the semiarid in particular, seeking to understand their problems and contribute to the development of solutions; in this scenario the adoption of community policing philosophy and community policing are fruitful fields for the launching of new, more efficient and effective public policies.

This concept also changes the focus of police activity, from the fight against crime to low cost for the preservation of basic constitutional rights and satisfaction and harmony with the community (MOORE, 2003), placing dialogue and meeting the needs of citizens as the main focus of the activities carried out by institutions linked to public security.

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Difficulties in the Control of Environmental Crimes in the Amazon

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Abstract— Amazonas is a Brazilian state of continental territorial extension, composed of a rich biodiversity and priceless natural resources for the maintenance of the Amazonian biome. Its incalculable wealth is an asset for the evasion of biological material, mainly by the audit deficiency of the Government that still benefits the polluting agent. This article presents a bibliographical review on biopiracy, water pollution and the mismanagement of solid waste, three major sources of environmental degradation, whose practice is very widespread in the State of Amazonas. The article aims to analyze potential environmental crimes practiced in the State of Amazonas and the difficulty that environmental organizations have in punishing them properly. Specific objectives are to analyze some of the main environmental crimes practiced in the State of Amazonas, as well as to analyze the forms of environmental licensing. As for the Methodology, the inductive method was used with reference, category, operational concept and bibliographic research techniques.

Keywords— About five key words in alphabetical order, separated by comma.

I. INTRODUCTION

Amazonas is the largest state of the federation, composed of 62 municipalities spread over 1,571,000 km², greater territory than Germany, Spain, Italy, United Kingdom and Greece together, but with the population corresponding to just less than 0.1% of these countries (IBGE, 2017). with 2,747km of border with Venezuela (538km), Colombia (1,644km), Peru (1,565km) (FILHO, 2018).

According to Amin (2015), the supremacy of countries such as England, France, Germany and the United States depend on access to areas rich in natural resources and the Amazon, given its size and the difficulties that the public power has in monitoring it makes it a attractive for environmental crimes. The availability of water and the way in which it is to be used in the near future.

In 2008, The New York Times, a leading American newspaper proposed a heated debate about the internationalization of the Amazon, with the following question: "Who is the Amazon?", Putting the sovereignty of the Amazonian countries in check (ARAGÓN, 2008). The newspaper quoted former US Vice President Al Gore as saying that "contrary to what Brazilians believe, the Amazon is not their property, it belongs to all of us" (BARRIONUEVO, 2018).

For Lemos (2013), the environment should not be a private good since it belongs to the whole of humanity in an indistinct way and therefore tends to be a matter of international protection. It justifies its thinking by stating that "internal instruments are not sufficient to prevent environmental damage."

This thought is opposed to the ideas of Hermann Heller (1995) when he states in his classic study on the subject that "sovereignty consists in the ability, both legal and real, to decide definitively and effectively any conflict that changes unity of territorial social cooperation ". In a much simpler but no less instructive way, "territory is a portion of the geographical space that coincides with the spatial extent of the jurisdiction of a government" (GOTTMANN, 2012).

From the above thoughts it is reasonable to conclude that only the word "sovereignty", in itself, does not guarantee autonomy without external interventions. Even a sovereign state has obligations towards other nations, since they must be recognized and consolidated, regardless of their origin, and may be subject to sanctions. In its article 225, the Federal Constitution of 1988 establishes the society's right to a balanced environment, nevertheless it also determines that the protection of the environment is the duty of the State and of the community, made all without exception responsible for its preservation for the present and future generations (BRAZIL, 1988).

Thus, the main problem of the present study is the main difficulties regarding the inspection of environmental crimes committed in the State of Amazonas.

About the objectives, the general objective is to analyze the difficulties in the monitoring of environmental crimes

in the State of Amazonas. And specific objectives are to analyze some of the main environmental crimes practiced in the State of Amazonas, such as Biopiracy crimes, water pollution, mineral exploration, as well as to analyze the forms of environmental licensing.

As for the Methodology, the report of the results will be composed on the Inductive Logical basis. In the various phases of the Research, the Referent Techniques, Category, Operational Concept and Bibliographic Research will be used (PASSOLD, 2008, p. 86).

II. THEORETICAL FRAMEWORK

2.1. Biopiracy

The illegal trade in wild animals, fauna, flora and genetic material in general is considered a very profitable practice worldwide, being the third largest illegal activity on the planet, moving approximately 2.5 billion reais in Brazil alone (DESTRO, 2012).

The network of trafficking in genetic material is extremely complex, and may be involved in other illicit practices such as drug trafficking and precious stones, for example, and not for that, these gangs are still involved in bribery of government officials, evasion of taxes, fraudulent customs declarations among others that facilitate their practice (RENCTAS, 2011).

Giovanini divides the trafficking of wild fauna into three main categories: animals for private collectors and zoos, animals for scientific purposes and animals for pet shops (GIOVANINI, 2000).

In relation to the flora there are several cases that have generated billions of dollars in damages for the Amazon. A special case was the theft of 70,000 rubber tree seeds (Hevea brasiliensis), very well reported by the journalist J. Jackson (2011), in his biography of Henry Alexander Wickham, contracted in mid-1873 formally by the Royal Botanical Garden of England, the well-known Kew Gardens, to steal the seeds. For Pozzetti (2014), the Amazon concentrated all its economy in the production of "wild rubber", that completely lost its international competitiveness since in Malaysia the planting was made of industrial form and the transport was much easier.

Pozzetti recalls a recent fact that Japan, after discovering in laboratory that the seed of Cupuaçu (Theobroma grandiflorum), generates a chocolate more profitable and tasty than Cocoa, decided to patent the name cupuaçu preventing Brazil, where the fruit is native, to use it, in an attempt to monopolize the fruit and its derivatives (POZZETTI, 2014).

In view of the above, Gomes, in his study on the control and repression of biopiracy in Brazil, affirms that one of the reasons for biopiracy to be a very attractive crime in the country is that biopiracy is not criminalized as a criminal offense. other forms of smuggling, being treated only as an administrative offense, so that the offender is subject only to the payment of fines (GOMES, 2007, p.21).

2.2. Water pollution

According to Law 9.433 / 97, which instituted the National Water Resources Policy, and created the National Water Resources Management System, water is a public domain property, as well as a limited natural resource, endowed with economic value and its management must be decentralized with the participation of the Public Power and the communities (BRAZIL, 1997; MUÑOZ, 2000).

Even though it has its own legal framework, water remains the most contaminated natural resource in the Amazon, especially in the capital Manaus, where so-called "igarapés". As mentioned by Horbe (2005, p.20), "the streams that drain the city are completely degraded by the supply of domestic effluents."

For Falcão, there is a search of the companies by the banks of the water bodies, to use them like sewers (FALCÃO, 2008, p. 02).

The pollution of the "igarapés", in the capital of the State of Amazonas, although it has reached a troubling degree, is observed and, to a certain extent, controlled by several governmental agencies. However, there are cases of water contamination that are unknown to the authorities or are poorly observed, such as the case of Leticia's Thermoelectric Power Plant in the extreme southwest of Amazonas, which uses an important effluent as a discarding area for lubricating oil (BANDEIRA, 2018, p. 49).

In the case of Tabatinga, the Federal Public Ministry filed a public civil action no. 7993-83,2010.4.01.001, as a victory for the environment, however, Bandeira (2018, page 53) points out that there is a bureaucratic barrier to be overcome , because it is a plant located on the Colombian side of the border and has an institutional security.

There are countless other cases of water pollution in the Amazon. One of the most severe degrading elements of the whole system, the mercury from the garimpos, can be cited. Herraiz (2015, p.206) estimates that 200-300 tons of mercury were discharged into the Madeira River between 2005 and 2015. For himself with the technological advancement in mining, some procedures can not be avoided, generating physical alterations and chemical properties to the environment. Metals such as mercury in contact with the soil or dumped into the environment are drained to the water bodies by surface water flow from precipitation (LIMA, 2013, p. 24). This metal is a serious contaminant for fish and aquatic animals, and with the process of bioaccumulation,

animals at the top of the food chain suffer more from this pollutant, affecting even the riverine population that incorporates these animals into their diet.

2.3. Inadequate solid waste disposal

Solid waste has been shown to be one of the major challenges to be faced by Brazilian municipalities, especially the confrontation of open dumps (OLIVEIRA, 2016, p. 593). The Amazon is composed of 62 municipalities, and until 2006 it did not have a properly sanitary landfill license, a situation that changed after a long legal relationship between the Environmental Protection Institute of Amazonas and the Municipal Environment Secretariat of Manaus (ARAÚJO, 2008, p. 16). Eight years after the enactment of Law 12,305 of August 2010, which instituted the National Solid Waste Policy, a milestone in the waste situation that remains practically the same, with the State having only one (1) landfill, of Santa Catarina that extinguished the use of dumps still in the year 2012 (OLIVO, 2018, p. 12). The municipalities of Amazonas suffer from lack of area for the construction of their sanitary landfills. Even with a large amount of land, the State has many peculiarities such as the existence of large areas of indigenous land and difficult to access. For Lollo (2001, p. 130), legislation is one of the factors that make it difficult to choose areas for landfill. Some cases like Tabatinga, there are at least half a dozen laws that make it impossible to build a landfill. We can briefly mention CONAMA N °. 004/95, which deals with the Airport Security Areas (BRASIL, 1995) and, in this particular case, it should be noted that the municipality of Letícia in Colombia has an aerodrome dangerously close to the area of the Brazilian dump.

2.4. The difficulty in environmental crimes in the amazon

The Federal Constitution of 1988 granted the Police Power in article 225, to the Public Power, as well as to the collectivity, to defend and preserve the environment:
Article 225. Everyone has the right to an ecologically balanced environment, a common use of the people and essential to a healthy quality of life, imposing on the Government and the community the duty to defend and preserve it for the present and future generations. (...).
§ 3 Conduct and activities considered harmful to the environment shall subject the offenders, individuals or legal entities, to criminal and administrative sanctions, regardless of the obligation to repair the damages caused.
For Meirelles (1987, p.93), Police Power "is a faculty that disposes the public administration to condition and restrict the use and enjoyment of individual goods, activities and rights, for the benefit of the collectivity and

of the State itself." The power of the Police in the environmental area can be exercised through inspection actions, such as preventive measures, monitoring, inspection, warning, punitive and corrective measures. In this way, the "coercive logic of environmental control resides in the application of sanctions imposed by an authority constituted by society, the State, and its organizational structures" (SCHMIT, 2015, p.10). The guarantee of the fundamental right to the ecologically balanced environment is a common competence between federative entities:
(...) it can be said that environmental police can (and should) be exercised cumulatively by all federative entities, generically referred to as Public Power; This, moreover, is clear from Art. 225, caput, of the Magna Carta. (...)
In line with the common cooperation of federative entities, the Law on Environmental Crimes includes, as authorized, for the purpose of drawing up infraction notices and instituting administrative proceedings, all environmental agencies that are members of SISNAMA, within the three spheres of Brazilian Federation (MILARÉ, 2011, p. 1135).
Therefore, activities that use licensed environmental resources, should also be inspected by the environmental agency licensed. This is because, in principle, such a body has better technical-administrative conditions to supervise.
Based on this, we have article 17 of Complementary Law 140 that reads as follows:
Article 17. The body responsible for licensing or authorizing, as the case may be, an undertaking or activity, drawing up an environmental infraction notice and instituting an administrative proceeding for the determination of infractions to the environmental legislation committed by the undertaking or licensed or authorized activity.
From this article the principle of the first licensor-inspector is extracted, which establishes the attribution of the effective exercise of inspection of a certain organ, thus avoiding "that the controlling entity interferes in the administrative discretion of another environmental body, by interfering in the merit of the license issued, to conclude for the fulfillment or non-compliance of the terms thereof "(CARIB, 2018). However, it is perceived that in relation to Biopiracy, water pollution and the inadequate disposal of solid waste, inspection is sometimes precarious. The Federal Audit Court carried out an operational audit in 1998 and identified that there are problems in the collection of fines that were applied by IBAMA, as well as an error in filling the case file. Already in 2008, another audit identified that the federal

agencies suffer from a lack of infrastructure, which makes it difficult to supervise:

The audit of bodies such as IBAMA National Institute of Colonization and Agrarian Reform (INCRA), National Health Foundation (FUNASA), National Indian Foundation (FUNAI) and ICMBio identified that the scarcity of resources and the lack of an integrated policy for the dramatic consequences resulting in the waste of public money and the rapid devastation of the forest. As an example, IBAMA's inefficiency is pointed out, reflected in the lack of inspectors, the delay in allocating seized assets and in the collection of fines imposed on those responsible. Faced with these problems, the picture reveals the precarious inefficiency and inefficiency of environmental control, which may compromise the deterrent effect sought by coercive logic.

Thus, it can be verified that environmental crimes in the State of Amazonas are undermined by the lack of infrastructure, both in economic, professional and organizational terms, which, consequently, undermine the effectiveness of environmental standards.

III. CONCLUSION

Historically the state of Amazonas has been a victim of constant losses of natural and economic resources, mainly due to the difficulty of the authorities to inspect it in its totality, either by the lack of professionals or by the logistical complexity.

In cases of biopiracy, it is possible to observe that the participants of this type of crime often have power over the enforcement agents, either through kickbacks or intimidation, using political "godfathers" to perpetuate the functioning of this mechanism. This type of crime has generated real economic crises in the state.

Traditionally the Amazon has been dependent on only one sector of the economy. In the middle of 1879 to 1920 Manaus was almost exclusively dependent on latex production, and saw its economy decline after the production of this product by Asian countries.

With the implementation of the Manaus Free Trade Zone and the Industrial Pole, the economy has once again strengthened and strengthened over time, although it has suffered constant attacks in the so-called Fiscal War.

Both water pollution and the crisis in solid waste management may, a priori, appear to be environmental problems that have little to do with the loss of economic resources, but these two crimes generate an equal or greater amount in the increase of financial losses for the State , since in the case of dumps, large volumes of money are being lost due to lack of recycling. In the case of the igarapés the government has generated a lot of expense for cleaning up.

In this context, it is necessary to strengthen the fight against environmental crimes, increasing the number of technicians involved in law enforcement 9,605 / 98, increasing the budget of environmental protection agencies, investing in passive detection technologies, such as remote sensing programs, measurements among others and to massify in society the importance of a balanced environment.

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The Development of a Basic Electricity Trainer

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Abstract— Technology never stops from innovating. Modernization goes with it rapidly. Thus education today needs to rise to the call of time through encouragement and equipping of laboratories with trainers which can be used to help students understand the basics in the world of digital electronics. This research is base on the development of a basic electricity trainer whose theory is based on ohm's law and Kirchhoff's law.Ohm's law explore the quantitative relationship between the current through a resistor and the potential difference (voltage) across the resistor. Kirchhoff's laws are rules used to completely solve a DC circuit.

We have experimentally tested Kirchhoff's Voltage Law and Kirchhoff's Current Law by measuring the sum of the voltage drops around several closed paths, and the sum of the currents at several nodes, in a resistive circuit made up of three resistors. A low resistance circuit was constructed using resistors $1k\Omega$,$2.2k\Omega$ and $10k\Omega$ Kirchhoff's Current Law, which states that the algebraic sum of the currents at a node is zero, was found to be accurate to within 1% error. Kirchhoff's Voltage Law, which states that the algebraic sum of the voltage drops around a closed loop is zero, was found to be accurate to within 1% error when applied to the low resistance circuit. With these we conclude that Kirchhoff's Laws accurately predict the behavior of resistive circuits.The basic trainer itself is made up of four sections which are the metering section,the power supply section(comprises the variable 0-30V and fixed 5V and 9V),resistor array and components such diodes,zener diodes and thermistor. The trainer is completely recommended for performance Experiments in electrical laboratories.

Keywords— Electricity, registers, Kirchhoff's Voltage Law, Kirchhoff's Current Law.

I. INTRODUCTION

When beginning to explore the world of electricity and electronics, it is vital to start by understanding the basics of voltage, current, and resistance. These are the three basic building blocks required to manipulate and utilize electricity.

At first, these concepts can be difficult to understand because we cannot "see" them. One cannot see with the naked eye the energy flowing through a wire or the voltage of a battery sitting on a table. Even the lightning in the sky, while visible, is not truly the energy exchange happening from the clouds to the earth, but a reaction in the air to the energy passing through it.

In order to detect this energy transfer, we must use measurement tools such as multimeters, spectrum analyzers, and oscilloscopes to visualize what is happening with the charge in a system.

Ohm's Law for electrical resistance, $V = IR$, states the relationship between current, voltage, and electrical resistance. If R is constant, V is proportional to I.

However, the resistance of a device can't always be assumed to be a constant, you might recall that electrical resistance varies with temperature. Diodes are designed to conduct electricity in only one direction, and thermistors are designed to be especially sensitive to temperature.

The electrical circuit contains voltage sources (power supply) and components, such as the resistors,diodes etc. that are used in the laboratory. A point in the circuit where two or more components connect together is called a circuit node. A path from one node to another is known as a circuit branch. A closed path through the circuit that starts at a particular node and passes through a sequence of components before arriving back at the starting node without the path crossing itself is called a circuit loop. All circuits have at least two nodes and at least one loop. It is possible to have several loops in a circuit, and the various loops may partially overlap each other.

These basic trainer will give the basic understanding of voltage, current, and resistance (how the three relate to each other),diode characteristics and thermistor characteristics

1.1 OBJECTIVES

To develop a basic Electricity Experimental trainer that can be used to carry out simple experiment to demonstrate the following specific objectives;

a. To verify Ohm's law.

b. To compare the potential *vs.* current behavior of a resistor

c. To determine the equivalent resistance of combinations of resistors by current-voltage method.

d. To demonstrate current and voltage divider rule.

e. To determine KVL and KCL

f. Determination of power and energy using resistance, current and voltage parameter

II.   BASIC OVERVIEW OF THE DEVELOPED ELECTRICITY TRAINER

The trainer is composed of some section,which can be regarded as standalone. For experiment to be performed on it, it needs the use of banana plugs.An Ac source is supplied

to it from source but in the trainer is a power pack of rating 32.5V,7A which converts the ac source to dc source of fixed voltages 5V,9V and a variable voltage ranging from0-30V.

The requirement of regulated DC power supplies differ widely among the various electrical and electronic devices. Figure 1 shows the generalized block diagram of the designed basic electricity trainer unit. Each block in the diagram represents a section of the circuit that carries out a specific function.
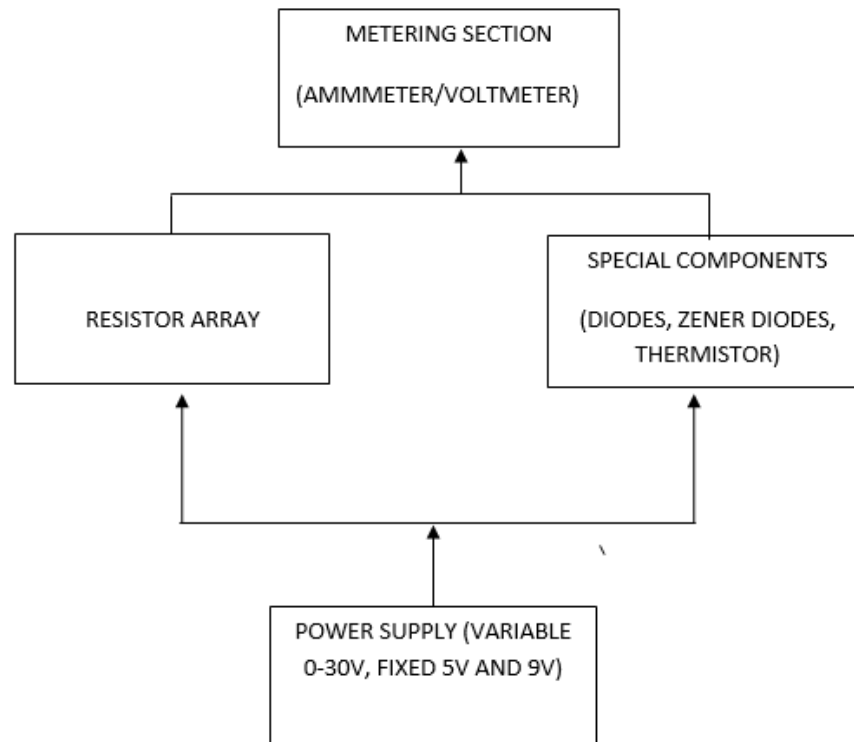
The basic and integral components of the block diagram in figure 2 above are briefly described below.

2.1   Power supply: The power pack initially takes the input supply from AC mains voltage of 220V and steps it down to a lower voltage level of variable0-30V and fixed 5V and 9V respectively. However, after construction, the desired voltage range was obtained at the output.

2.2   Resistor Array: These comprises of resistor of various values,these gives the opportunity for desired resistor value for experiment to be chosen

2.3   Metering section: comprises the ammeter which reads values between 0-10mA and a voltmeter which reads values between 0-30V. Ammeters are connected in series so

that the currentflows through them. The ideal ammeter has a resistance of zero so that it has no effect on the circuit while Voltmeters are connected in parallel to resistive elements in the circuit so that they measure the potential difference across (on each side of) the element.

2.4   Special component: These comprises of a diode and a thermistor.

2.5   Fuses: Fuses are over-current protection devices, therefore protecting the circuit and other components from damage due to excessive current.

2.6   The mains: The on/off button for start and termination of experiment

III. DESIGN AND METHODOLOGY

BASIC ELECTRICITY EXPERIMENTAL TRAINER
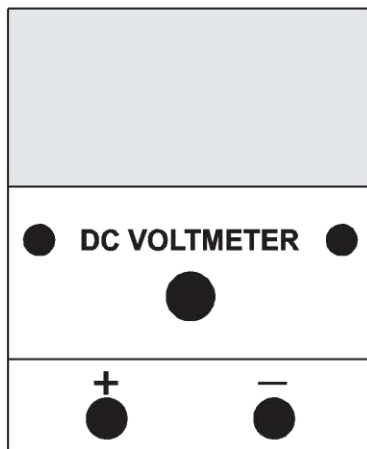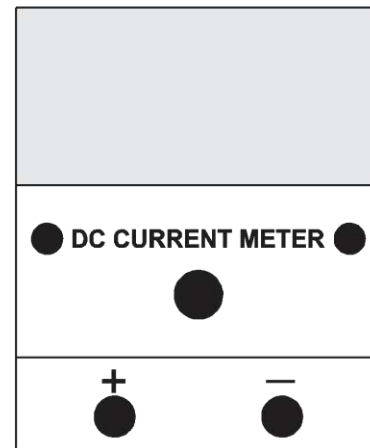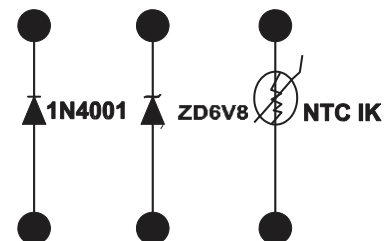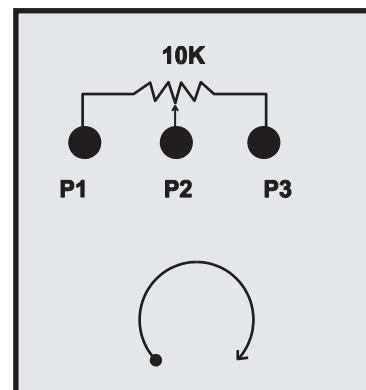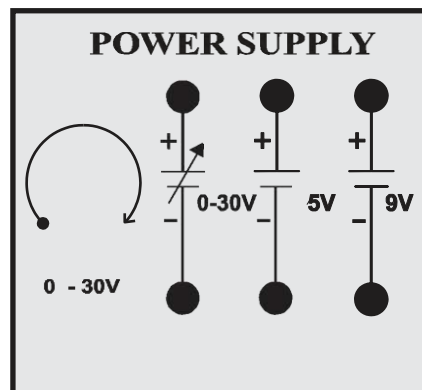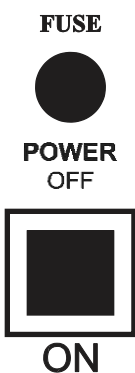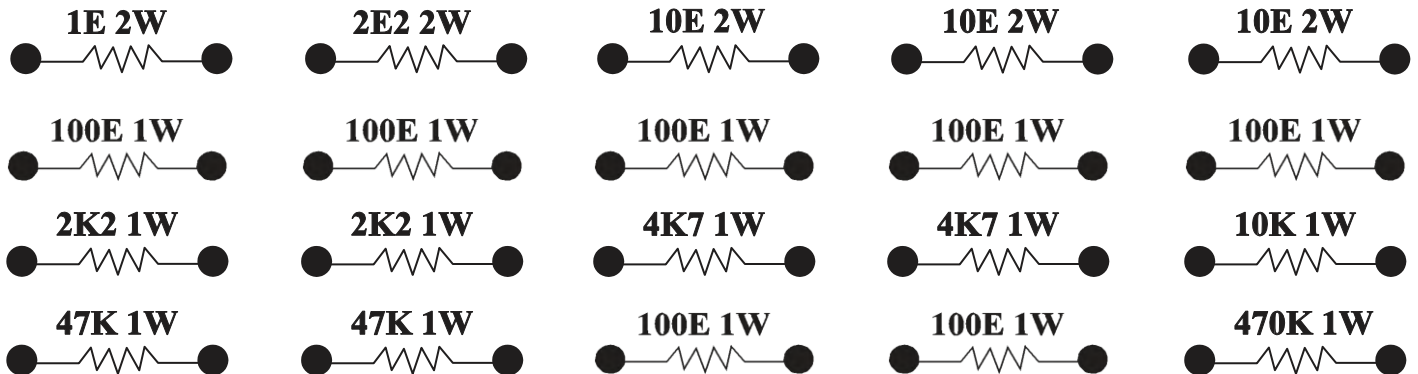
3.1 DESIGN CALCULATION
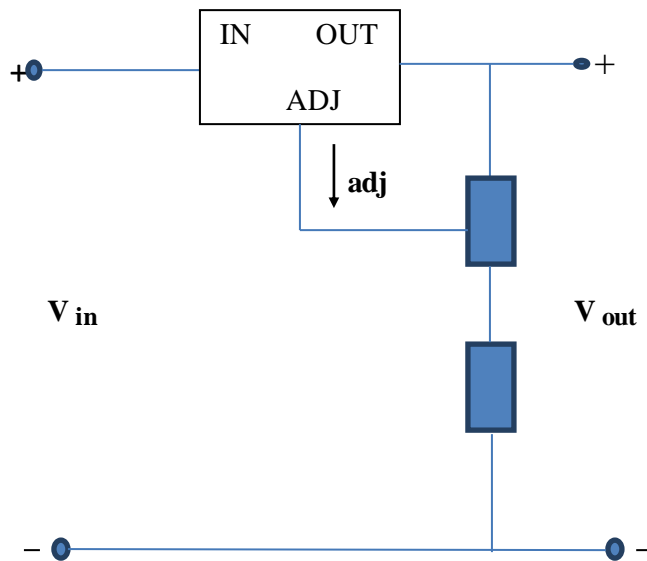
$V_{out} = 1.25 \left(1 + \frac{R2}{R1}\right) + \left(I_{adj\ R_2}\right)$

but $I_{ad}R_2 \ll 1$

$V_{out} = 1.25 \left(1 + \frac{R2}{R1}\right)$

$V_{in} = 30V$

$R_1 = 220\Omega$

$R_2 = 0 - 5k\Omega$

$V_{in} = 30V$

$R_1 = 470\Omega$

$R_2 = 0 - 10k\Omega$

3.2   METHODOLOGY

3.2.1   Theory

The fundamental relationship among the three important electrical quantities *current*, *voltage*, and *resistance* was discovered by Georg Simon Ohm. The relationship and the unit of electrical resistance were both named for him to commemorate this contribution to physics. One statement of Ohm's law is that the current (I) through a resistor is proportional to the potential difference (V) across the resistor. Ohms law is normally written as

$$V = IR \quad (V) \quad\quad\quad (1)$$

Where R is the resistance of the resistor in Ohm (Ω) when potential difference (V) is in Volt and current (I) in Ampere (A). Resistance is a measure of how difficulty to flow current through the device.

This experiment trainer will verify Ohm's law in several different circuits using banana plugs to make connections. Any device that obeys Ohm's law showing linear relationship of V and I is called Ohmic device, otherwise non-ohmic device.

Ohm's law is used to determine the equivalent resistance of resistors connected in different combinations. Fig. 3a shows the resistors connected in series and Fig. 3b shows the resistors connected in parallel.

Fig.3a: Resistors in Series

Equivalent resistance (*Req*) in series combination of resistors is given by

$R_{eq} = R_1 + R_2 + R_3 + \ldots \ldots R_n$ (2)
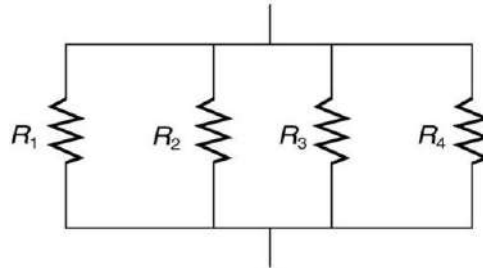
Fig 3.2: Resistors in Parallel

andthe equivalent resistance (*Req*) in parallel combination of resistors is given by

$$\frac{1}{Req} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \ldots\ldots \frac{1}{R4}. \qquad (3)$$

3.3 VOLTAGE DIVIDER AND CURRENT DIVIDER RULE
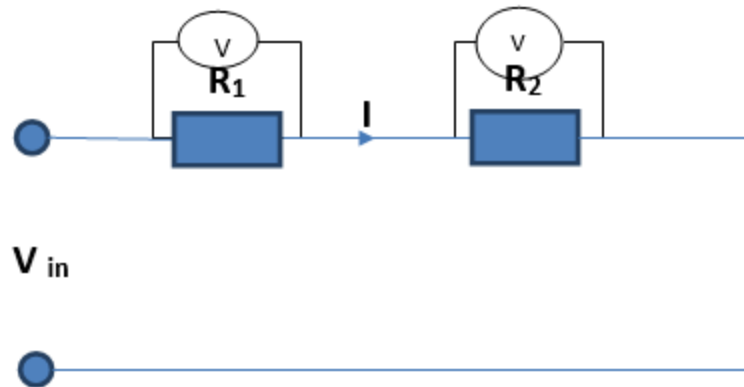
$$I = \frac{V}{R_1 + R_2}$$

$$V_1 = V_{in}\left(\frac{R_1}{R_1 + R_2}\right)$$

$$V_2 = V_{in}\left(\frac{R_2}{R_1 + R_2}\right)$$
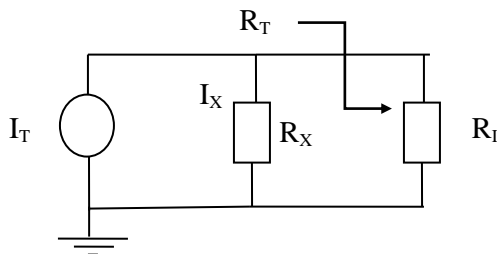
$$I_X = \frac{R_1}{R_1 + R_X} I_T$$

3.4 Kirchhoff's Voltage Law

Kirchhoff's Voltage Law (KVL) states that the sum of all voltages in a closed loop must be zero. A closed loop is a path in a circuit that doesn't contain any other closed loops. Loops 1 and 2 in Figure 3.4 are examples of closed loops.
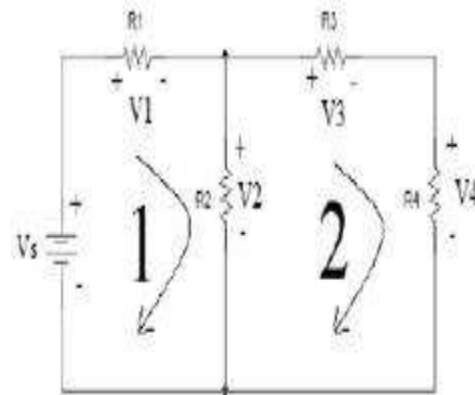
Fig.3.4: An example of KVL circuit

The perimeter of the circuit is also a closed loop, but since it includes loops 1 and 2 it would be repetitive to include a KVL equation for it. If loop 1 is followed clockwise the KVL equation is

$$V_1 + V_2 + V_S = 0 \qquad (4)$$

This equation holds true only if the passive sign convention is satisfied. In the case of KVL the passive sign convention states that when a positive node is encountered while following a loop the voltage across the element is positive. If a negative node is encountered the corresponding element

voltage is negative. In order to simplify the KVL equations, the polarities should be assigned to satisfy the passive sign convention whenever possible.

3.5 Kirchhoff's Current Law

Kirchhoff's Current Law (KCL) deals with the currents flowing into and out of a given node. KCL states that the sum of all currents at a node must equal zero. This is illustrated in Figure 3.4

.
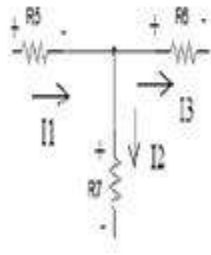
The equation obtained by KCL for the node shown in Fig. 3.4 is

$$I_1 - I_2 - I_3 = 0 \qquad (5)$$

In the case of KCL the passive sign convention deals with the direction of currents with respect to the node. Currents entering the node must have opposite signs as those exiting the node. The passive sign convention with respect to KVL can also be applied to KCL. On many schematics the polarities of resistors are already assigned, so the directions of the currents should be assigned such that the current is entering the positive terminal. This will simplify later calculations.

3.6 Experimental Test and Results

The circuit was constructed on an adaptable board as described above. 5volts from the power supply was applied to the circuit. The voltages across and currents through each of the resistors was then measured and recorded in Table 3.1.

Nominal Resistance(kΩ)	Measured Resistance(kΩ)	Measured voltage(V)	Measured current(mA)
1	0.994	0.871	0.87
2.2	2.193	1.803	0.81
10	9.85	2.621	0.25

The measured voltage values were inserted into (4) to verify KVL.

$$0.871 + 1.803 + 2.621 = 5V$$

$$(6)$$

The measured currents were inserted into (5) to verify KCL at node B.

$$0.8 - 0.7 - 0.15 = 0$$

$$(7)$$

There is no expected error when KVL and KCL are performed on the results because the expected value is zero. Ohm's law was used to calculate the resistance values using the values of the current through and voltage across each. A percent error analysis was then performed between the measured values and the Ohm's law values. A sample calculation from the analysis is shown in below.

$$\%error = \frac{measured\ value - calculated\ value}{measured\ value} \times 100\%$$

$$\%error = \frac{2.193 - 2.23}{2.193} \times 100\% = 1.6871\%$$

These errors would ultimately be used to determine the validity of Ohm's law. The calculated resistances as well as the errors are given in Table 3.2.

Resistor	Measured Value (Ωk)	Calculated Value (Ω)	% Error
R₁	2.193	2.23	1.66%
R₂	9.85	10.5	6.19%
R₃	0.994	1.08	7.94%

IV. DISCUSSION

The experiment performed verified KCL. This was shown as found that the sum of the two currents exiting the node to be equal to the current entering the node. The experimental results of the KCL test were not so close. There was less than two percent error between the measured and calculated I. This error is acceptable in stating that KCL is true. The simulated KVL test was not as expected. Equation didn't produced zero volts. However the equation added up to voltage small enough to be negligible in stating that KVL is valid. As with the KCL tests, the experimental KVL results in (6) did not meet the predicted values. Both of the equations produced values within one value away from zero. This is a large discrepancy, but it is still small enough to conclude that KVL and KCL is valid.

All of the percent errors for the calculated versus measured resistance were less than eight percent. The errors appeared to increase as the resistor number increased (i.e. R_1, R_2 etc.).

This was probably due to error accumulation in the calculations. Slight errors such as rounding in intermediate calculation steps would account for the increase. Another possible source of error was in the values of the resistors chosen. The resistors all had values in the kilo-ohm range. Such large resistance values would make it difficult to

accurately measure the small currents passing through them. This would account for part of the discrepancy. The errors were all fairly small which lead to the conclusion that Ohm's law is indeed valid.

A major source of error that applies to all three cases was the measuring process. If fingers were in contact with both leads of the multi-meter when taking resistance measurements the readings would be slightly off. This is because the meter would try to add the resistance of the body in the loop. The same type of problem could have occurred with the voltage and current measurements. If the connections were not fully made then the meter would have made inaccurate readings

4.1 Basic Diode characteristics that would be observed with the use of Multimeter or Oscilloscope

A diode is a semiconductor device,which conduct the current in one direction only.It has two terminals,the cathode and anode.When the positive polarity is at the anode the anode is forward biased and is conducting.When the positive polarity is at the anode,the diode is reversed biased and is not conduction. If the reverse biasing voltage is sufficiently large the diode is in reverse breakdown region and large current flows through it.

4.1.1 Diode characteristics

1) Voltage drop across the diode when reverse biased is $1nA(10^{-9}A)$

2) Voltage drop across the diode when forward biased is 0.6-0.7V

As the temperature increases the voltage of the knee decreases by 2mV/K

The reverse current doubles for each 10^0K increase in temperature

4.1.2 Zener Diodes

These diodes is intended to operate in breakdown region.If breakdown voltage>6V avalanche breakdown occurs,ifbreakdown voltage is <6V tunneling mechanism of breakdown occurs.
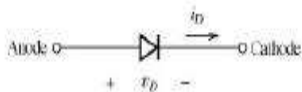
Fig.4.1: a Circuit symbol
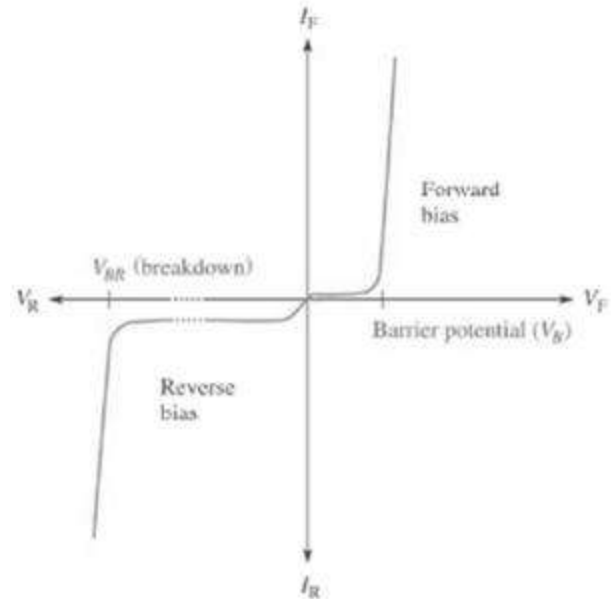
b) Volt-ampere characteristics
Fig 4.1Semiconductor diode

4.2 Basic Thermistor characteristics that would be observed if connected to a Multimeter

Thermistors, like RTDs, are thermally sensitive semiconductors whose resistance varies with temperature. Thermistors are manufactured from metal oxide semiconductor material encapsulated in a glass or epoxy bead. Also, thermistors typically have much higher nominal resistance values than RTDs (anywhere from 2,000 to 10,000 Ω) and can be used for lower currents.

4.2.1 Theory

In order to measure temperature with the thermistor, you only need to measure the resistance of the thermistor, and then substitute the resistance value in the following equation

$$T = \frac{1}{a + b(lnR) + c(lnR)^3}$$

Where:*T : Calculated temperature in (K)*
    R: Measured resistance in (Ω)

a, b and c are Steinhart-Hart Constants that have the following values

$a = 1.2407635*10^{-3}$

$b = 2.3612017*10^{-4}$

$c = 8.97975*10^{-8}$

From the above equation you will get the temperature in Kelvin. The value of a, b and c differs from one type of to another.

4.2.2 Prevalent Characteristics

1) Each sensor has a designated nominal resistance that varies proportionally with temperature according to a linearized approximation.

2) Thermistors have either a negative temperature coefficient (NTC) or a positive temperature coefficient (PTC). The first, more common, has a resistance that decreases with increasing temperature while the latter exhibits increased resistance with increasing temperature.

3) Thermistors typically have a very high sensitivity (~200 Ω/°C), making them extremely responsive to changes in temperature. Though they exhibit a fast response rate.

4) Thermistors are limited for use up to the 300 °C temperature range. This, along with their high nominal resistance, helps to provide precise measurements in lower-temperature applications.

V. CONCLUSION

Ohm's law, KVL and KCL are three of the most basic techniques for the analysis of linear circuits. The purpose of the development of these trainer is to assist students in proving these laws valid. A circuit was provided with three unknown voltages and three unknown currents. Then the circuit was built on a board. The voltage and current values were measured and placed into KVL and KCL equations to determine whether they turned out as predicted. These measured values were then used in the Ohm's law equation to find resistance.

The calculated and measured values were then compared to the expected results from the theories. All of the discrepancies between tested and expected values were small, therefore all three of the laws could be considered valid. The electrical activity of the resistors observed indicates that current passing through resistors with exhibits ohmicbehaviors. The reason for linear characteristics when plotted on a graph.

The Diodes,Zener diodes and Thermistor are present so that their electrical characteristics can be observed with the use of multimeter or Oscilloscope in an experiment.

5.1 RECOMMENDATION

This is an immense contribution to the body of academics and so it is recommended to be used in laboratories where fundamental knowledge of electrical and electronics is to be taught.

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Failure Mechanisms of Interlocked Bricks of Soil-Cement and Wood Fibers

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Abstract— *The goal is to determine the mechanisms of soil-cement interlocked brick plus wood fibers under compressive loading. For this we used experimental stress analysis techniques. Horizontal deformations (εx) and vertical (εy) of bricks were obtained with extensometers, in the configuration of five rosettes. From the values of these deformations and using the equations of the theory of elasticity, Poisson coefficients were determined and elasticity modules, and calculated the corresponding voltages each escutcheon according to the equations of the State of plane stress. To determine the trajectory of the rupture voltage-loading graphics were made of each rosette. Knowing this trajectory determined the tensions related to the modification of the brick break mechanism. The appearance of a premature cracking or excessive is parameter used to determine the State limit of use of bricks.*

Keywords— *Soil-cement bricks, wood fibers, limit states Stress analysis, elasticity modules.*

I. INTRODUCTION

The inclusion of elements in soil reinforcement for improvement of its properties was already known to peoples of antiquity. This can be confirmed by some buildings, still exist today, such as the walls of Ziggurat of Agar Quf in Mesopotamia (1,400 BC), built using interleaved layers of soil and blankets of roots. The Incas used llama wool mixed with soil in road construction resistant to time. Are also known applications of layers of leaves and twigs on layers of soft soils, prior to the construction of landfills in these soils, in the interior of Brazil and other countries, [1, 2].

One of the advantages in the use of soil-cement can cite: soil available on-site or nearby, simple fixes on their particle size and without the need for specialized labor and good thermal and acoustic comfort. The soil-cement buildings are very comfortable because the "raw land" is a bad conductor of heat. Soil-cement buildings are fire resistant also has great durability and reduced maintenance. The main drawback, however, is the wide variety of existing soils which implies in performing assays for the characterization of land used. Such tests can be performed in any laboratory for dealing with simple and routine tests.

The inclusion of fibers in the soil-cement (fragile array) is a newer technique, however using ancient concepts. The advantages are several. One can cite: good thermo-acoustic insulation, [3], improved mechanical properties (tensile strength, bending and impact) and behavior changed after cracking, because rather than sudden rupture of the material occurs after the onset of cracking of the array, plastic deformation, more suitable for construction, [4]. According to [5, 6], the cement-based composite of eucalyptus wood has excellent thermal and acoustic insulating properties, in addition to the easy workability also features excellent resistance to fungus and good adherence to different substrates. The percentage of wood in the mix influences directly on these features. In general, the fibers inhibit the amplitude of the cracks associated with ruptured, resulting in a composite material with greater tenacity. According to [2], the fibers do not prevent the formation of cracks, however, control the spread of the same along the cement mass, benefiting the mechanical properties in the post-cracking state. The main disadvantage shown by [7, 8] is the incompatibility between the chemical plant biomass and the cement. The chemical Constitution of the biomass due to the presence of sugars, phenols, resins and starch, can adversely affect the hydration of cement. These disadvantages, however, do not render the use of particular residue. It is possible to minimize or even avoid the effects of the physical mismatch by physical-chemical treatments applied to the vegetable particles.

The interlocked bricks are designed to not use any mortar of settlement is vertical or horizontal. Stability and resistance to horizontal efforts are controlled by vertical

and horizontal fittings. The misuse of this technology can result in inadequate conditions constructions such as cracks and fissures, where rodents and insects are home, endangering the health of its residents. However, when technology is well applied, buildings with quality and satisfactory resistance.

One of the first to study the stress-strain properties of soil-cement walls was [10]. The reference [11], presents stress-strain relations and elastic properties of soil-cement blocks. The results indicate that there is 2.5 times increase in resistance to the cement content duplication. The modulus of elasticity of soil-cement block ranged between 2,000 and 6,000 MPa and increases 2.5 times when the cement content is increased from 6 to 8%. [12, 13, 14, 15] feature constitutive laws of soil-cement blocks varying composition (clay, silt and cement). [16, 17, 18] use various techniques to determine the stress-strain relations of ceramic bricks, prisms and small walls.

The use of electrical extensometers (SG) along with an experimental analysis of stresses to determine the behavior of masonry structural elements, was little used. [19], presents a study about the use of the technique of "center hole" in masonry walls. Use 8 electric extensometers forming rosettes.

This work aimed to study the way the rupture, as well as get a call of a threshold from which the modification of the rupture mechanism of bricks, used electric extensometers and experimental stress analysis techniques.

II. MATERIALS AND METHODS

For the composition of the soils studied have been used, the soils of two quarries in the region of Belo Horizonte, Minas Gerais, Brazil, mixed with small portions of fine sand and thick, with the purpose of getting a soil particle size that allows you to stay within the limits recommended by [6], for the manufacture of bricks of soil-cement. The Portland blast furnace cement for general use. For the study of the waste were collected leftover wood pieces, called sawdust, of Eucalyptus grandis and Eucalyptus cloeziana. This was sifted sawdust so that only use the waste contained between the screens # 4 (4.8 mm) and # 10 (2.0 mm). Aimed at "sealing" of waste, a solution of aluminium sulphate [Al2 (SO4)3] and water (1% of water used). The residue was placed in this solution for 20 minutes. Then he was taken to the greenhouse (60° C) until their total drying. This "Proofing" or fiber protection with aluminum sulfate, according to [3] assists in the control of the degradation of the same.

2.1 Manufacture of bricks

For the manufacture of bricks of soil-cement-wood waste, was constructed a hydraulic press in such a way

that it was possible to control pressure during the pressing. For this, it was instrumented with a manometer, which was calibrated with a ring dynamometer, thus enabling the conversion of the measure provided by the instrument for the measurement of compression pressure (2.0 MPa), Fig. 1. After molding, the bricks were ferried to the humid chamber where they remained for seven days at a temperature of 23 ± 0.2 ºC and relative humidity around 100%.

Were made three bricks, a first of soil-cement to soil Homogenized 1, a second of soil-cement to soil Homogenized 3 and a third of soil-cement and 0.5% of fiber to the soil Homogenized 1. The purpose was to verify the influence of the type of soil and wood fiber in the State last brick boundary.

The brick manufacturing process consists in homogenizing, pressing and hardening of the raw materials described above, previously determined quantitatively. For this use, soils considered ideals are the sandy-silt, the sandy-clay soils, silt-sandy and silt-clay soils, being the amount of sand must be greater than or equal to the amount of fines (silt and clay). Known popularly as clay soils red and yellow land are of good quality, and, for the most part, be used. The soil should be free of organic matter, and thus avoid the use of black or dark gray soils because they are detrimental to the properties of the final product, the bricks. Lumps, boulders and roots should be removed from the soil since it reduces the quality of the brick. The screening then becomes essential for such a condition is fulfilled. To obtain a perfect brick where the resistance is optimized, it is homogenized that it be produced in conformity with predetermined parameters for the compression test in soil and soil-cement. It's worth noting, then, that the performance of the brick is made based on the equivalence between the pressing Proctor Normal and the compaction of the bricks.

(a)   *(b)*

Fig. 1: a) Brick molding press, b) Extraction of brick

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For simple compression tests in bricks, used the universal machine, model DL 30000 EMIC brand, with a capacity of 300 kN. This machine has automatic charging control and displacement. For the instrumentation of the bricks were used for each of these five rosettes from two strain gages Kyowa brand, model KFG-10-120-D16-11.

Was used a load cell, coupled to the universal machine with a capacity of 200 kN. Data provided by strain gages and by the load cell was collected by a data acquisition system.

2.2 Instrumentation of the bricks s

To catch the horizontal deformations (εx) and vertical (εy), the bricks were instrumented, each with five rosettes, formed by two strain gages (one vertical and one horizontal), at locations shown in Fig. 2a.

2.3 Test

The instrumented bricks were tested with compressive loading applied and monitored by means of a load cell, Fig. 2b.
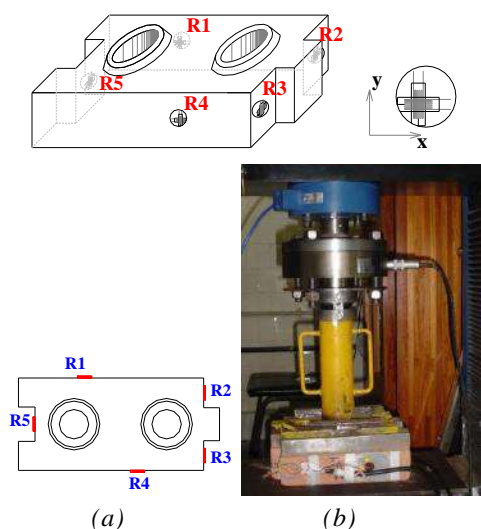
Fig. 2: a) Position and numbering of the rosettes on the brick Interlocked, b) Compression test

III. RESULTS AND CONSIDERATIONS

From the data captured in each strain gauge, and using the equations of resistance of materials, Poisson coefficients were determined in each one of the points shown and the modules of elasticity. The modulus of elasticity was determined from the constitutive law of materials (stress-strain graph), and the coefficient of Poisson (ν) from the list of horizontal deformations (εx) and vertical (εy) of each strain gages. Table 1 shows the values for the coefficient of Poisson found in three instrumented bricks. The rosettes R1, R2, R3 and R4 exhibit a similar behavior which does not occur with the rosette R5. It is observed that in every brick, for each escutcheon was found a different value for the coefficient of Poisson. The geometry of the brick collaborates for such a situation to occur. Poisson coefficient determined by the R5 was shown to be different from other due probably to the disturbances caused by the geometric configuration of the brick. For the brick manufactured with soil Homogenized 3 variation was observed between the values of Poisson's coefficient. However, the similarity between the positions was kept, which may indicate an influence of soil type used in this determination. Considering a State plan and using the Poisson coefficient values found for each point, the deformations and the modulus of elasticity, corresponding tensions were calculated in each escutcheon using the Equation. 1.

Table 1 – Values of Poisson's coefficient in bricks

Rossetes	1	4	2	3	Average	5
SC1-0% waste	0.23	0.25	0.23	0.23	0.22	0.16
SC1-0.5% waste	0.18	0.23	0.22	0.17	0.20	0.16
SC3-0% waste	0.32	0.33	0.34	0.30	0.32	0.12

$$\sigma_x = \frac{E}{(1-\nu^2)} \times (\varepsilon_x + \nu \times \varepsilon_y),$$

$$\sigma_y = \frac{E}{(1-\nu^2)} \times (\varepsilon_y + \nu \times \varepsilon_x), \quad \sigma_z = 0 \quad (1)$$

Being: E the modulus of elasticity in MPa, ν the Poisson coefficient, σx and σy normal stress in the plan in MPa.

For the analysis of the trajectory of the failure was necessary to make individual charts of each rosette, where are tensions σx and σy operating in each of them. At every turn it was responsible for the loss of load resistant capacity, indicated by the change of the level of stress. The larger of the two was crucial in assessing the trajectory. To determine the sequence of the failure, the biggest loads obtained from each point were ordered to form crescent. Table 2 shows the path of the failure,

showing the sequence of the rosettes. Observe the occurrence of similar behavior in bricks with Homogenized 1 soil and 0.5% of waste and with Homogenized 3 soil without waste. Both feature ductility more than the Homogenized 1 soil brick and 0% of waste. The soil Homogenized 3, naturally more plastic due to greater presence of clay fraction, presents a greater ductility. Already the Homogenized 1 soil with the addition of 0.5% of waste increases their ductility. It is observed that the comparison between the bricks more or less ductile showed that the failure began to form. This failure trajectory provides evidence that the ductility affects the way the rupture.

Knowing the trajectory of the failure, the stress related to the modification of the brick failure mechanism. It is known that the limit state is characterized by the impossibility of the job structure, in whole or in part, as Homogenized conditions of comfort and durability, even though she has not exhausted its capacity bearing. The appearance of excessive deformations or a premature cracking or excessive, etc. are parameters used for this determination. In this way, we studied bricks from the stress x charging curves, was responsible for the first charging indication of change in the failure mechanism, even if not apparent, as there is a possibility that is reaching its limit. One of the characteristics of the studied bricks is not use plaster, by this, any apparent rift could compromise their aesthetic features. Knowing the trajectory of the failure, the lowest loading of all five points of brick, admitted as being responsible for the stress. The values of stress for use of bricks studied vary: between 0.33 and 0.56 MPa when manufactured with Homogenized 1 soil and 0% of waste; between 0.28 and 0.86 MPa when manufactured with Homogenized 1 soil and 0.5% of wastes; and between 0.35 and 1.26 MPa when manufactured with Homogenized 3 soil and 0% of waste.

Fig. 3a the observed lines of vertical failure near the ends of the brick. The existence of holes in bricks might have caused points of fragility next to this region. Existing interlock on the brick show failures. In the grooves of the bricks are observed some lines of horizontal cracks. Close to the bosses have a slanted rupture line Fig. 3b and c.

Table 2- Failure path in bricks

Horizontal failure sequence.	
SC1-0% waste	3 ⇒ 4 ⇒ 2 ⇒ 1 ⇒ 5
SC1-0,5% wastes	5 ⇒ 4 ⇒ 1 ⇒ 2 ⇒ 3
SC3-0% waste	5 ⇒ 1 ⇒ 4 ⇒ 2 ⇒ 3

Fig. 4 shows the improvement achieved with the inclusion of waste. The bricks made of soil without residues tend to have fragile behavior. With the inclusion

of vegetable waste, tends to be more ductile. Note the opening of cracks in bricks without residues and cracks lines presented in bricks with waste.

(a)   *(b)*   *(c)*
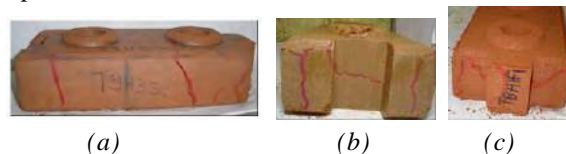
Fig. 3: Brick failure, a) longitudinal face, b) in the female fitting, c) into the male

(a)   *(b)*   *(c)*   *(d)*

Fig. 4: Brick Failure with soil Homogenized 3, a) 0% waste and b) 0.5% waste, and Soil Homogeneous 1 with c) 0% waste and d) 1% waste

IV. CONCLUSION

The geometry of the brick allowed determining distinct values of stress, modulus of elasticity and Poisson's coefficient in each point coincident with the rosettes.

The determination of the way showed behaviors similar to failure the bricks that presented greater ductility (natural plasticity of the soil Homogenized 3 – more clay- or increased ductility achieved by the inclusion of vegetable residues in the soil Homogenized 1-more gritty). The brick less ductile (soil Homogenized 1 without waste) presented a way of reverse breakdown. Knowing the time of beginning of failure was possible the determination of a probable limit of stress (possibly first sign of change of behavior of brick and also first fissure point). The tests only give evidence of its occurrence, was evaluated experimentally a brick of each type.

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Installation of Implants in the Atrophic Maxilla without the use of Bone Grafting - Systematic Review

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Abstract— Objective: *This study aims to demonstrate, through literature review in edentulous patients that present severe bone resorption of the maxilla, through alternative surgical techniques that do not require the use of bone grafts.*

Methodology : *The methodology was performed through an epidemiological survey in the main research databases and some articles with high impact factor were selected for a systematic review installation of atrophic maxillary implants without the use of bone grafting. A scan was performed in PubMed, Scielo and Capes e were found 130 articles related to the theme, 43 with bias inadequate to research and 47 with impact factor or which are much below average. These 90 articles were excluded from the review process, leaving 40 articles that were used as basis for this study.*

Results: *The feasibility of this technique became possible only with the advent of the creation of the prototypes generated from the computerized tomographies, which allow the surgical planning and the preparation of prostheses with precise fittings, made from models with dimensions and shapes identical to the area to be rehabilitated.*

Keywords— Atrophic maxilla, implant, computed tomography, prototyping.

I. INTRODUCTION

The rehabilitation in patients with a high degree of maxillary alveolar resorption has been one of the major challenges of the current implant system, due to its bone topography presenting certain characteristics that can generate difficulties such as: anatomical accidents, maxillary sinuses, incisive foramen, nasal fossa and bone quality.

The treatment of choice for a long time in these cases of severe atrophy of the maxilla was the use of bone grafts, although autogenous graft was considered the first option for the reconstruction of these bone defects, obtained through extra buccal donor sites, however it has contraindications such as the high degree of morbidity of surgeries, the long period of treatment and the high monetary cost.

Due to the difficulties mentioned in the alveolar process of atrophic maxilla, the fixation of implants in other areas such as canine pillar, zygomatic process and pterygoid process, have been used with great effectiveness for the anchorage of implants for the installation of fixed total prosthesis, since such regions have excellent bone quality allowing primary stability in fixation, which gives predictability and reliability in the results.

II. METHODS

The methodology was performed through an epidemiological survey in the main research databases and some articles with high impact factor were selected for a systematic review installation of atrophic maxillary implants without the use of bone grafting. A scan was performed in PubMed, Scielo and Capes e were found 130 articles related to the theme, 43 with bias inadequate to research and 47 with impact factor or which are much below average. These 90 articles were excluded from the review process, leaving 40 articles that were used as basis for this study.

III. SYSTEMATIC REVIEW
IMAGANTOLOGY IN IMPLANTODONTIA

In the past, according to Nevins and Mellonig (2006) dental implant treatment was dominated by surgical specialists. Based only on clinical guidelines, the well-intentioned restorative clinician could only provide limited information regarding the proposed implant regions. Because the clinical information is insufficient, the surgeon was forced to make decisions without detailed restorative guidelines, compromising the location of the implant.

The use of corrected computerized tomographic plans altered the approach of diagnosis and treatment with implants. This allowed the team of implant dentists to verify that a pre-surgically determined prosthetic plane is compatible with the maxillary and mandibular residual bone. Computerized tomography allowed visualization of the cross-sectional images of the maxilla or mandible, and these images are perpendicular to the mandible. long axis of the alveolar ridge and 95% accurate with 1 mm. The periapical radiographs are 50% accurate and the panoramic images are only 17%. Both radiographs offer no information in relation to the internal anatomy of the alveolar process or residual border (NEVINS E MELLONIG, 2003).

The lateral cephalometric radiograph provides additional information on bone quality and quantity in the premaxilla and symphysis regions of the mandible. In addition to providing important information about the spatial relationship between the jaws. However, the value of cephalometric films is limited because information about bone structure and contour is provided only for the median area of these bones and accurate information of the posterior regions can not be obtained (SPIEKERMANN et al 2008). According to Spiekermann (2008), occlusal radiography can provide information on bone quality, in addition to providing third dimension in combination with other radiographs to clarify the existence and location of residual roots, tumors, cysts, for example. In order to correctly demonstrate bone structures and to avoid incorrect interpretations, it is important that appropriate techniques are used, respecting the symmetrical positioning of the central ray and the film.

PANORAMIC

According to whaites (2003); the main drawback of this technique is that the final radiograph is a sectional radiograph. In this way, only structures within the cutting area will be evident ". Corresponding to the shape of the dental arches. Within the implantology; panoramic radiography is used as part of pre-implant planning; to obtain measurements of the alveolar bone.

According to Freitas (1998), we can observe the following structures in a panoramic radiograph: incisor teeth: pre-molar teeth: maxilla: mandible: external oblique line; internal oblique line; foramen mentale: mandibular canal: mandibular foramen; mandibular condyle: coronoid processes; styloid process; nasal cavities; nasal septum; maxillary sinuses; maxillary sinuses (posterior portion); orbit; infra-orbital foramen; zygomatic arch and pterygoid process.

Whaites (2003) cites the advantages of panoramic radiography: image information of a large area and all tissues within the focal area are presented in a single film, including anterior teeth, even when the patient is unable to open the mouth ; the image allows an easy understanding on the part of the patient, being in this way a didactic aid very useful; movements of the patient in the vertical plane only distort the parts of the image being produced at that moment; the positioning is relatively simple and a minimum of experience is required; the maxillary view allows the rapid evaluation of occult, usually asymptomatic lesions; the visualization of both sides of the mandible, in a single film and useful for the evaluation of fractures and comfortable for the traumatized patient: the overview and useful for the evaluation of the periodontal condition and the orthodontic accompaniment; the floor of the maxillary sinus and its anterior and posterior walls are well observed; both condyles are observed in a single film, thus allowing an easy comparison; the dose of radiation (effective dose) and approximately 1/3 of the use for intraoral mouth-whole examination and the development of partial panoramic techniques with resulting decrease in dose exposure.

The disadvantages, according to Whaites (2003), with respect to the panoramic radiographs are: the image presented only a section of the patient, structures or abnormalities which are not in the focal area may not be evident; images of soft tissues and air may overlap important hard tissue structures; ghost or artefactual images can overlap structures that are within the focal area; the movement of the apparatus in conjunction with the distance between the focal area and the film produces distortion and enlargement of the final image; the use of indirect action films and intensifying plates result in some loss of image quality: the technique is not suitable for children under five years of age or for patients with some deficiency; due to the duration of the exposure cycle and the shape of the focal area does not adhere to the dental arches, causing some structures to appear out of focus.

COMPUTERIZED TOMOGRAPHY

Computed tomography and a specialized technique to produce radiographs showing only a section or section of the patient. (PARAGUASSU et al., 2019)

On computed tomography the X-ray tube mounted on a GANTRY rotates through a track emitting a very thin x-ray beam. These rays are carefully collimated in such a way that they collide only in one section of the body, but under a large number of angles of this section (CASATI and TAVANO, 1998). According to CASATI and TAVANO, since body tissues are composed of different elements, they have different types of absorption and attenuation of X-rays, which will affect the detectors or radiation sensors rather than on a film of radiography The detector's response is to give rise to an electrical signal, which is directly proportional to the number of photons that are incident on it. These signals can be quantified and recorded on a computer that will draw a drawing (tomographic image) formed by multiple points (PIXELS) in a wide range of shades of gray. CT scans should be used to represent the most important structures of the facial skull, being the technique of first choice PARAGUASSU et al., (2019), tomographic images sectioned as main indications clinicam, according to whaites (2003) in implantology: evaluation of the height, thickness and texture of the jaws before implant placement and postoperative evaluation of implants. It is also possible, according to Casati and Tavano (1998), to perform, through computed tomography, an evaluation of the extent and integrity of bone cortices, as well as their relationships with anatomical structures such as vascular-nervous bundles, for the planning of osseointegrated implants.

The visualization of the radiographic anatomy by computed tomography, according to Freitas (1998), and simplified by the numerous cuts that facilitate the localization of anatomical structures bony and soft tissues concomitantly.

According to Van Steenberghe (2003) the computerized tomography gives the opportunity to visualize the health of the maxilla and the maxillary sinus; sinusitis, polyps or any pathology may be excluded. The zygoma density, length, and volume can be evaluated and special guides for the insertion of the zygomatic implants can be made prototypes (stereolithographic models) to facilitate the orientation of the zygomatic implants during surgery, with minimal errors in angulation and position.

In the jaws we can analyze structures such as: mental foramen: mandible body; region; carotid; floorboards; jugular; submandibular gland (oropharynx); parotid gland; language; asacedent branch; mandibular angle; mandibular canal; masseter muscle; lateral pterygoid muscle; palate; sphenoidal sinus; sphenoid process; posterior part of the joint cavity; frontal sinus; ethmoidal sinuses; nasal septum; fossanasal; maxillary sinus; anterior nasal spine; mastoid process of the temporal bone; foramen magnum; zygomatic arch; articular cavity and condyle of the mandible. The advantages of performing a CT scan and that one can obtain an optimal definition in each cut. However, the dose of radiation to the patient may be high, the technique requires a lot of time to be performed and a high level of patient cooperation is required, since the patient needs to be in a single position throughout the examination (WHAITES, 2003).

IV. CONCLUSION

Through a brief literature review we conclude that:

- Imaging resources such as computed tomography and prototyping are of great importance in rehabilitation planning, since they allow an accurate visualization of the regions to be rehabilitated, besides the preparation of surgical guides and the execution of previous surgeries.

- Rehabilitation through autogenous bone grafts are established techniques, but they have a high degree of morbidity, require a time and cost of treatment and do not allow the patient to use a prosthesis during the initial healing phase, thus making it impossible to satisfy immediately.

- Rehabilitating techniques for severely atrophic maxillaries, which do not require a bone graft, using implants such as zygomatic fixation, have been developed to rehabilitate the patient in a shorter time of cost of treatment and mainly lower morbidity and proportionally still immediate patient satisfaction.

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Impact of Indirect Taxation on Economic Growth in Nigeria

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Abstract— The mono-product nature of the Nigerian economy has hindered it from achieving its economic growth objectives. This inadequacy is further worsened by the fact that its revenue from its mono-product source is facing dwindling fortune. Over the years, it has been observed that revenue generated from indirect taxation has been substantial and constantly on the increase. This study therefore explored the impact of indirect taxation and economic growth as a possible means of diversifying the Nigerian revenue. Time series data were applied in carrying out this research work. Ordinary Least square (OLS) method of analysis was adopted after determining the stationary of the variable using Augmented Dickey fuller technique and finding ample long run and short run relationship among variables using the Johansen cointegration and Vector Error Correction Mechanisms respectively.. The result showed that of the two indirect tax sources, Value Added Tax and Customs and excise duties, Value Added Tax that had a positive significant relationship with economic growth. Customs and excise duties on the other hand had a negative relationship but was tested and found to be insignificant. But overall the relationship between the indirect tax sources and economic growth was found to be significant. Against the above result, we recommended among others that the number of goods on the VAT list should be increased and the burden of custom duties should be lessened on infant industries, all aimed at boosting indirect tax revenue accruing to the country and ultimately stimulating economic growth.

Keywords— Value Added Tax, Custom and Excise duties, real GDP.

I. INTRODUCTION

The mono product nature of the Nigerian economy has received series of criticism in recent times. According to Okonjo Iweala (2012:17) ... without diversification, the Nigerian economy will soon collapse.

In order for the country to achieve the requisite level of economic growth, it needs to diversify from crude oil being the sole driver of the economy. Anyaehie and Areji (2015) in their research, found that economic diversification has

the propensity to meet the basis for development (sustained growth) like meeting the poor's basic needs which revolve around the provision of jobs, food, health, clothing and shelter by opening diverse avenues of economic activity which accommodates a broad spectrum of people.

Economic diversification is a process of broadening the range of economic activities both in the production and distribution of goods and services. It does not necessarily entail increase in output but it enhances stabilization of economies by diversifying their economic base.

The mono-product nature of the Nigerian economy is such that it depends majorly on crude oil export for its revenue. In the current year 2015, Nigeria's dependence on crude oil export for revenue based on the projected price and the assumed production is 53% of the total revenue (Okonjo Iweala; 2015 Budget Speech). During the second quarter of 2012, oil revenue accounted for over 76% of government revenue (Ebosele and Adekoya, 2012). The implication of this overly dependence on oil revenue is the boom -and - burst nature of the economy (Akpokodge; 2000). In the 2015 budget speech, the following was pointed out,

" ... The IMF in October 2014 revised downwards it projection on global growth to 3.3% and 3.8% respectively. So ladies and gentlemen, the message I want to pass across here is that the world economy is not in shape over the short to medium term. On the back of this weak global growth performance comes the recent steep drop and incredible volatility in the price of oil - a phenomena that impact us greatly. This steep price decline of about 49% so far this year, has come as result of demand from our biggest markets and a supply glut that involves the arrival of new oil producers in Africa and increased exploitation of shale oil and gas in the U.S" (Okonjo Iweala; Budget speech, 2015).

Taxation forms part of the non-oil revenue sector of the economy. In the first quarter of 2014, non-oil sector became the main driver of the Nigeria economy recording 7.89% growth in real terms in the same period (National Bureau of Statistics, 2014). Tax revenue on its part, is made up of two broad components and several sub components, the broad components being Direct and Indirect taxation. Following

Atkinson (1977), we define direct taxes as those taxes that may be adjusted to the individual characteristics of the tax payer and indirect taxes as those that are levied on transactions irrespective of the circumstance of the buyer or the seller. Due to the fact that direct taxes are dependent on the individual characteristics of the tax payer, it is at the mercy of the subjective assessment of the individual paying the tax. In such a case, some contra principles of taxation such as tax evasion (reduction of actual income value in order to earn reduced tax) and avoidance tend to abound. Indirect taxation on the other hand has limited cases of evasion and avoidance as it is not subject to the individual characteristics ·of the tax payer. Indirect tax sources include Value Added Tax (VAT), excise duties, customs duties and tariffs.

Taxation has been a major source of revenue to the government contributing about 25.5% of government revenue in 2002. These revenues come mostly from indirect sources of VAT, import and export duties (custom duties). Indirect taxes contribute up to 15% of the government revenue with which it carries out certain developmental expenditures; this percentage can still be increased.

Researches, carried out by Bleaney and Gemmel (1999); Bird (2003); Arisoy and Unlukaplan (2010); and Scarlet (2011) found a positive relationship between indirect tax and economic growth. This project work therefore is an attempt to provide a channel for Nigeria to diversify its economy and achieve economic growth.

STATEMENT OF PROBLEM

The mono-product nature of the Nigerian economy has posed a lot of problem to the Nigerian economy, amongst which is the creeping growth rate of the Nigerian GDP. This has made it impossible for Nigeria to attain its vision in the areas of overall development of its economy. The current running Nigerian national development plan is vision 2020 and this plan has not materialized in terms of achieving its objective as a result of over-dependence on crude oil and its inherent price and demand instability. The vision 2020 aims at placing Nigeria among the top 20 ranking economy in the world by the year 2020, by attaining a GDP of about $900 billion and ensuring that the GDP of Nigeria grows by at least 10% every year till the year 2020 (Adeleke; 2012). So far, this has remained utopian, as the GDP of Nigeria has not been able to attain such a growth rate nor is it close to the required GDP figure with just 2 years left in the plan.

This shortcoming has exposed the need to find and develop other economic variables which has the potentials of fast tracking the growth rate of the country's national income. One of such variables is indirect taxation.

It is of no doubt that indirect taxation has had strong positive impact on the revenue of the government. In 2016, Nigeria raked in 830 billion Naira from Value Added Tax and 890 billion Naira from custom and excise duties (National Bureau of Statistics, 2014). But, there is need to if this progress recorded in the area of revenue has translated to helping the economy grow.

Stemming from the above problem stated, this research seeks to find answers to the above questions:

a) What is the impact of Value added tax (VAT) on economic growth in Nigeria?

b) What is the impact of Custom and Excise duties on economic growth in Nigeria?

Objectives of the Study

The broad objective of this study is to assess the impact of tax revenue on economic growth in Nigeria while the specific objectives are;

(i) To determine the impact of value added tax on economic growth in Nigeria

(ii) To evaluate the impact of custom and excise duties on economic growth in Nigeria.

Research Hypotheses In this research work, the following hypotheses stated in the null form will be tested.

HO1: Value added tax has no significant impact on economic growth in Nigeria.

HO2: Custom and excise duties has no significant impact on economic growth in Nigeria.

II. LITERATURE REVIEW

The Atkinson-Stiglitz theorem made a case for direct taxation as the optimal tax system to be adopted by countries all over the world. But this theorem laid down some assumptions which be met before the direct tax system can be regarded as optimal for a country, thus;

1. There are two types of households who differ only in their wage rates such that wage rate of one household is greater than the other. This difference does not exist in factor endowments.

2. There are only two goods along with labour and that households have identical weakly separable utility functions.

3. The utility function is strictly concave, and both goods as well as leisure are normal.

Atkinson-Stiglitz (1976) saw their analysis as being more useful in shaping the structure of the argument regarding the choice of optimal tax structure than in providing policy advice.

In a theoretical view, the theory agrees to the fact that taxation can indeed affect economic growth and therefore can be accepted as a policy advice to countries on the

optimal tax mix which they can employ for better working of the economy. Since the realities of the Nigerian socio-economic background are contrary to the assumptions of the theory, which is in favor of income taxes (a form of direct tax), we can infer that indirect taxation should be the optimal tax system for Nigeria.

Indirect Taxation in Nigeria

The are two main classifications of indirect taxes in Nigeria;

- Value Added Tax (VAT)
- Custom and Excise duties.

Value Added Tax in Nigeria

Following the problem of evasion and avoidance rocking the collection of person income tax and Company profit tax and the subsequent need to boost government revenue and reducing government borrowing, the Value added tax was introduced in January 1993 by the VAT decree No. 2 of 1993 and came into force on the 1st of January 1994 to. Replace the pre-existing sales tax. Ochei (2010), noted that many Nigerians believed that the tax was introduced as a means of avoiding taking loans from international agencies. Ngex.com described VAT as a consumption tax levied at each stage of the consumption chain, and is borne by the final consumer. It requires a taxable person upon registering with the Federal Board of Inland Revenue to charge and collect VAT at a flat rate of 5% of all invoiced amounts of taxable goods and services. Since inception, VAT revenue has exceeded it's projected amount. During 1994 the revenues earned from value added taxes in Nigeria exceeded the projections. They contributed 4% of the total revenue raised by the Federal Government in that year. In 1995 the rate of contribution was 5.39%. In 2017, VAT revenue accrued to the sum of... Value Added Tax is collected by government through an agency called FIRS (Federal Inland Revenue Services).

Emmanuel (2013) examined the effects of VAT on economic growth and total tax revenue in Nigeria using data ranging from 1994 to 2010. By formulating two hypotheses that VAT does not have significant effects on GDP and also on total tax revenue. He found out that VAT has significant effect on GDP and also on total tax revenue. This indicates that increase in value added tax would lead to an increase in tax revenue and economic growth (GDP

Custom and Excise Duty

Custom and excise duties are classified together because they are both administered through the Nigerian Customs Services.

Custom Duties are classified into two; Import duty and export duty. Custom duty in Nigeria can be traced back to 1860 when Nigeria started engaging in foreign trade. Then, it started as just import duties. Import duties are taxes on

Nigeria' s imports from other countries, charged either as a percentage of the value of the imports or as a fixed amount contingent on quality (Akhor & Ekundayo, 2016). Akhor et al (2016) also described Export Duty is a tax on the goods exported to other countries, from Nigeria. Meanwhile, excise duties are an ad-valorem tax on the output of manufactured goods and are administered by the country's custom services (Ekeocha, Ekeocha, Malaolu & Oduh, 2012).

Scarlet, (2011) used the standard growth functions within the autoregressive distributed lag to investigate the relationship between taxation and economic growth in Jamaica. The study employed qua1terly time series data from 1990 - 2010. The study found a significant and positive relationship between indirect tax and economic growth in the long run.

Aamir, Qayyuum, Nasir, Hussain, Khan and Butt, (2011), using panel data of direct and indirect taxes in Pakistan and India from 2000 to 2009 discovered that in Pakistan, indirect taxes have statistically significant positive impact on total revenue and by extension economic growth. The study found that if total indirect taxes increases by Rs. l, the increase in total tax revenue would amount to Rs. 1.495.

A similar study was carried out in Nigeria. Illaboya and Mgbame, (2012), carried out a study to investigate the indirect tax-economic growth dynamics in developing countries with Nigeria as a reference point. The study adopted a combination of co-integration and error correction mechanism after series of diagnostic tests which helped to check the adequacy of the model. The study found a negative and an insignificant relationship between indirect taxation and economic growth in Nigeria.

Onwuchekwa and Aruwa, (2014), carried out a related study. The study investigated the impact of value added tax on the economic growth of Nigeria. Ordinary Least Square technique was employed to test the hypotheses formulated. The result shows that VAT (which is a form of Indirect tax) contributes significantly to the total tax revenue of government and by extension the economic growth of Nigeria. VAT revenue growth had consistent increase, though it was not that explosive.

III. METHODOLOGY

Drawing from the variables used in the work of David Umoru .and M.A Anyiwe, (2013) on Tax Structures and Economic Growth in Nigeria: Disaggregated Empirical Evidence, we derive a model that establishes a relationship between the components of indirect tax (which mainly are; Value added tax, custom and Excise duties) in Nigeria and economic growth. Real GDP, used as proxy for economic

growth (the dependent variable) and value added tax, customs and excise duty, inflation (explanatory variables).

Inflation is included in the model to cancel out the effect of price changes on indirect tax revenues.

The model is specified as follows:

GDPR = f (VAT, CED, INF)

This function may be further represented in a linear econometric format thus:

LnGDPR = Bo + B1LnVAT + B 2LnCED + B 3INF+ Ui

Where:

GDPR = Real Gross Domestic Product

VAT= Value added Tax

CED = Customs and Excise Duty

INF = Inflation

B's = Slopes or the parameters of the coefficient of the regression model

Ui =Stochastic disturbance or error term.

The above model is stated in the natural logarithmic form, to standardize the variables and aid interpretation.

This research made use of data on Real GDP, VAT revenue, Custom and Excise Duties Revenue and inflation from 1981 – 2018 (37 years). This data was sourced from the 2017 CBN statistical Bulletin, World Bank development indicators and various credible journal articles.

IV. DATA PRESENTATION AND INTERPRETATTION

The use of OLS method of regression analysis is based on the assumption that the values of the variables have no unit root and hence are stationary.

Table.1.1 Summary of the Augmented Dickey Fuller Unit Root Test

1st Difference	Variables	ADF Test Statistics	5% Significance level	Lag length	Remark
	LNGDPG	-4.410302	-2.948404	1	Stationary
	LNVAT	-6.879544	-3.004861	1	Stationary
	LNCED	-6.202937	-2.948404	1	Stationary
	INF	-5.522626	-2.948404	1	Stationary

Source: Aurthor's Computation

From the result above, it is clear that all the variables are stationary after the first difference. Using the AIC (Akaike Information Criterion), the appropriate lag length was determined as 1.

Therefore, we proceed to carry out the Johansen co-integration test to find out if there exists any relationship among the variables.

Table.2: Summary of Johansen Co-integration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.746929	54.26869	47.85613	0.0111
At most 1	0.454772	24.03883	29.79707	0.1988
At most 2	0.297259	10.69470	15.49471	0.2310
At most 3	0.124846	2.933826	3.841466	0.0867

Trace test indicates 1 co integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Source: Aurthor's Computation

The table above shows the existence of at least one (1) cointegrating equation between the variables as we reject the hypothesis of none as denoted by the asterisks sign. It is therefore necessary to test the existence of short run adjustments between the variables, using the error correction model.

Table.3: Summary of VECM

Error Correction:	D(LOG(GDPR))	D(LOG(VAT))	D(LOG(CED))	D(INF)
CointEq1	-0.065369	-0.071621	0.035011	-17.34673
	(0.04429)	(0.08019)	(0.24689)	(2.84866)
	[-1.47586]	[-0.89310]	[0.14181]	[-6.08943]

D(LOG(GDPR(-1)))	0.152916	-0.269039	0.070651	19.86363
	(0.22940)	(0.41534)	(1.27872)	(14.7540)
	[0.66659]	[-0.64775]	[0.05525]	[1.34632]
D(LOG(VAT(-1)))	0.185234	0.452654	0.267423	-4.990453
	(0.11562)	(0.20933)	(0.64447)	(7.43591)
	[1.60214]	[2.16239]	[0.41495]	[-0.67113]
D(LOG(CED(-1)))	-0.026818	-0.095861	-0.181987	0.514946
	(0.04558)	(0.08253)	(0.25407)	(2.93152)
	[-0.58837]	[-1.16158]	[-0.71628]	[0.17566]
D(INF(-1))	0.000165	0.001921	0.002016	0.111365
	(0.00115)	(0.00208)	(0.00642)	(0.07403)
	[0.14357]	[0.92183]	[0.31418]	[1.50439]
C	0.012732	0.112950	0.125346	-2.552928
	(0.03009)	(0.05447)	(0.16771)	(1.93505)
	[0.42318]	[2.07346]	[0.74740]	[-1.31931]

Source: Aurthor's Computation

The result of the cointegration equation shows that the short run adjustments exist among the variables. The adjustment in real GDP, Value Added Tax, Custom and Excise duties complete in less than one year shown by their coefficients which is less than one, while inflation completes it adjustment in more than one year shown by its large coefficient.

Having established ample long run and short run relationships among the variables, we can proceed to the OLS estimates and assess fully the impact of indirect taxation on economic growth.

Table.4: OLS Regression Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.08539	0.735402	30.03174	0.0000
LOG(VAT)	0.355007	0.059373	5.979244	0.0000
LOG(CED)	-0.003554	0.072382	-0.049105	0.9613
INF	0.004937	0.001915	2.577748	0.0180
R-squared	0.944140	Mean dependent var		31.26735
Adjusted R-squared	0.935761	S.D. dependent var		0.469910
S.E. of regression	0.119101	Akaike info criterion		-1.266682
Sum squared resid	0.283700	Schwarz criterion		-1.070339
Log likelihood	19.20018	Hannan-Quinn criter.		-1.214592
F-statistic	112.6790	Durbin-Watson stat		1.214627
Prob(F-statistic)	0.000000			

Source: Aurthor's Computation

From the estimates shown above, VAT revenue and Inflation have significant positive relationships with economic growth proxied by real GDP. While a percentage in VAT on average will cause a 35% percent increase in the real GDP, holding all other variable constant, increasing inflation as well will lead to 0.4% increase in the real GDP

on average, holding other variables constant. The fact that the probability figures of both VAT and Inflation are less than 0.05 depicts that both variables are significant in the model.

On the other hand, Customs and Excise duties (CED) showed an insignificant negative relationship with economic growth. Such that a percentage increase in Custom and Excise duties on average, will reduce real GDP by 0.3%

Overall the model has been shown to be significant:

Considering the high F value and the very low probability figure of the F value (0.000), we can conclude that the model is significant. Also the coefficient of determination (R^2) has a value of 0.944140 and the Adjusted R^2 value of 0.935761 which still gives give credence to the validity of the model.\: it follows that at least, 93% of changes in the dependent variable are explained by the regressors.

Summary of Findings

The findings of this research, suggests the existence of ample long run and short run relationships between the various components of indirect taxation and and economic growth proxied by Real GDP.

Based on the hypothesis formulated earlier, the following has been discovered from the research;

a)   Value Added Tax (VAT) has a positive significant relationship with economic growth, such that increase in VAT revenue will in effect boost economic growth in Nigeria. This can be explained that increase in VAT revenue will translate to increased government expenditure in direct consumption or investment activities which will spur economic activities in the country.

b)   Custom and Excise Duties (CED) on the other hand had an insignificant negative relationship with economic growth. Such that an increase in custom duties will stunt economic growth. This can be explained in the context that Nigeria is a consuming nation and that most of the goods consumed, traded and sold in the country come from external sources. Imposition of customs and excise duties will make such good expensive and discourage demand. It may even get to the stage where companies that source for raw materials abroad will have to close shop or move to countries with fairer custom and excise duties.

c)   Inflation on the other hand showed a positive relationship with economic growth, but the small coefficient of 0.4% shows how infinitesimal this positive effect is. This can be as a result of the fact the inflation requires people to spend just a little bit more to obtain basic good sand service and thence, this extra expense and such extra expenses will translate into a positive effect on economic growth.

V.   CONCLUSION AND RECOMMENDATIONS

In executing this study, the Ordinary Least Squares (OLS) was applied after determining the co-integration of variables using the Johansen technique.

From the results obtained from the OLS, it was observed that all independent variables, Value Added Tax (VAT) and Inflation (INF), had a positive relationship with economic growth in Nigeria, while Customs and Excise duties (CED) had a negative impact, of which VAT and INF that had a significant impact on economic growth in Nigeria. The effect of CED was found to be insignificant. Based on this, the following are recommended.

1.   Government should Increase in the Number of goods and services on the VAT list from 31 to account for more sectors that have become more productive since 1994. For instance pharmaceutical products.

2.   Companies remittance of VAT revenue should be addressed by the government to ensure full compliance.

3.   Government should ensure that manufacturing industries sourcing for raw materials abroad should not be charged excessive custom duties, to enable them thrive most especially the infant industries.

4.   Government should ensure that VAT revenue is properly utilized in the provision of autonomous capital investment as against paying salaries.

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In vitro cultivation of callus cells from nodes and internodes of *Capsicum annuum* cv. All Big

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Abstract— Cell suspension cultures can be a valuable system for production of secondary metabolites. Capsicum annuum is a pepper species largely studied due to its biologically active compounds. The objective of this study was to establish a protocol for callus induction in nodes and internodes of C. annuum cv. All Big and to determine the callus growth curve, with focus on the deceleration phase, when the callus cells must be cultivated in a liquid medium in order to generate a cell suspension system. Nodal and internodal segments were submitted to media supplemented with the growth regulators 2,4-D and BA in factorial combination. After 49 days, the percentage of explants where callus induction occurred (%CI), the explant area covered by callus cells (ACCC), and the fresh weight of the explants were evaluated. In order to determine the growth curve, the explants were cultivated in the media supplemented with the growth regulators that resulted in the highest callus cell proliferation, weighing the calluses in the subsequent 49 days. The treatments that resulted in the highest %CI, ACCC and callus weight were 4.52 μM 2,4-D without BA for nodal explants and 9.05 μM 2,4-D + 2.22 μM BA for internodal explants. The growth curves of the calluses of the two types of explants followed a sigmoid pattern with six distinct phases; lag, exponential, linear, deceleration, stationary and decline. The deceleration phase started on the 27th and on the 19th day, respectively, for nodal and internodal explants.

*Keywords— **Callogenesis, growth curve, secondary metabolites.***

I. INTRODUCTION

Secondary metabolites can be efficiently produced in vitro. Research to date has succeeded in producing a wide range of valuable secondary phytochemicals in disorganized callus or suspension cultures (HUSSAIN et al., 2012). The major advantages of a cell culture system over the conventional cultivation of whole plants are: (1) useful compounds can be produced under controlled conditions independent of climatic changes or soil conditions; (2) cultured cells would be free of microbes and insects; (3) the cells of any plant could easily be multiplied to yield their specific metabolites; (4) automated control of cell growth and rational regulation of metabolite processes would reduce the labor costs and improve productivity; (5) organic substances are extractable from callus cultures (Vanisree et al., 2004).

Capsicum annuum L. is a species of hot pepper which has been largely studied because of its biologically active compounds (Koffi-Nevry et al., 2012). The insecticidal effect of its extract has been demonstrated, causing antifeedant effect in *Spodoptera litura*, a dangerous pest of many economically important crops, and in *Achaea janata*, which attacks leaves of *Ricinus communis* (Devanand and Rani, 2011); its seed powder showed toxic effect against *Sitophilus zeamais* and *Callosobruchus maculatus*, insects that cause damage in stored maize and cowpea, respectively (Oni, 2011). Acaricidal effect were reported against the two-spotted spider mite *Tetranychus urticae*, with high mortality in larva, nymph and adult stages (Erdogan et al., 2010). Its bactericidal or inhibitory effects have been demonstrated against *Streptococcus mutans* (Santos et al., 2012) *Vibrio cholerae*, *Staphylococcus aureus* and *Salmonella typhimurium* (Koffi-Nevry et al., 2012), *Ralstonia solanacearum*, *Clavibacter michiganensis* and *Erwinia carotovora* (Games et al., 2013). Antifungal effects have been reported against *Colletotrichum lindemunthianum*, *Candida tropicalis* (Diz et al., 2011) and *Alternaria solanii* (Games et al., 2013). The identification of the bioactivity of *C. annuum* substances encourages the evaluation of their utilization as alternatives in the control of agricultural pests.

This research is part of a project in which in vitro produced secondary metabolites from Capsicum species are being tested against agricultural pests and diseases. As such, this study provides a protocol for callus induction from nodes and internodes of *C. annuum* cv. All Big and an identification of the callus growth pattern, focusing on the deceleration phase, when the callus cells must be subcultured into liquid medium in order to produce cell suspension cultures and the production of secondary metabolites.

II.   MATERIAL AND METHODS

The experiments were carried out at the Plant Tissue Culture Laboratory at Embrapa (Brazilian Agricultural Research Corporation) in Porto Velho, Brazil. Seeds of *C. annuum* L. cv. All Big were purchased at the local market and submitted to disinfestation procedures by washing with running tap water and a detergent agent for five minutes, immersion in 70% ethanol for one minute and in a 1.5% (v/v) sodium hypochlorite solution for 15 minutes, and then rinsed three times with sterile water. Under aseptic conditions, the seeds were individually inoculated into test tubes with 10.0 mL of an MS (Murashige & Skoog, 1962) basal culture medium supplemented with 30.0 g L-1 sucrose and 6.0 g L-1 agar, pH 5.8, autoclaved at 121°C for 20 minutes. After 45 days of cultivation, the plants were approximately 8 cm tall. Under aseptic conditions, the explants were produced by cutting the leaves in explants of 1.0 cm2, which were individually inoculated into test tubes with 10.0 mL of an MS basal culture medium as mentioned before, supplemented with 2,4-Dichlorophenoxyacetic acid (2,4-D) (0, 4.52, 9.05 or 18.10 μM) and 6-Benzylaminopurine (BA) (0, 0.44, 2.22 or 11.10 μM) in factorial combinations. All the explants were incubated in a growth chamber at 26±1°C under light provided by cool white fluorescent tubes (50 μmol m-2 s-1) 16 hours a day. The treatments were arranged in a completely randomized design. After 49 days, evaluations were done by assessing the percentage of explants where callus induction occurred (%CI); the explant area covered by callus cells (ACCC), according to Mendonça et al. (2013), who established the following scores: 0 = 0%, 1 = 25%, 2 = 50%, 3 = 75% and 4 = 100% of leaf area covered by callus; and the fresh weight of the explants, by using a precision scale. Variance analyses and Tukey tests (P<0.05) were performed by using the Assistat 7.5 statistical program.

In order to determine the growth curve, the explants were individually transferred, with the adaxial face up, into test tubes (25 x 150 mm) containing 10.0 mL of an MS basal culture medium as mentioned, supplemented with the growth regulators combination that resulted in the highest callus cell proliferation: 4.52 μM 2,4-D without BA for nodal explants, and 9.05 μM 2,4-D + 2.22 μM BA for internodal explants. The explants were incubated in a growth chamber under the mentioned conditions. In the subsequent 49 days, calluses were carefully separated from the culture medium and weighed. From these data sets the lag, exponential, linear, deceleration and decline phases of callus growth were determined; these data were submitted to regression analysis (Gomes, 2009).

III.   RESULTS AND DISCUSSION

In both the nodal and the internodal explants, there was no callus induction on the MS medium without growth regulators, which indicates the necessity of their supplementation for callus formation (Table 1). The absence of callus induction on nodal explants (and low callus induction on internodal explants) was also observed when the highest concentrations of the two growth regulators were used simultaneously - 11.10 μM BA and 18.10 μM 2,4-D, what implies that there is no need to test higher concentrations for callus induction. All the other concentrations of 2,4-D and BA, in combination or not, led to the induction of calluses on the explants. The calluses thereby produced were friable and whitish. As mentioned by Souza et al. (2014), friable calluses are distinct from compact calluses, as the former are characterized by loosely aggregated cells, with lower density and the latter are thicker aggregates of cells with higher density. The friable calluses have different cell types with different structural and histochemical characteristics, mainly characterized by the presence of cells in rapidly small growing, isodiametric, with high frequency of cell divisions (Souza et al., 2011). This kind of callus can be used to initiate cell suspension cultures, for the cells can easily disperse in the liquid medium.

In nodal explants, callus induction in 100% of the explants was observed in the media supplemented with 4.52 μM 2,4-D without BA; 9.05 μM 2,4-D alone or in combination with 0.44, 2.22 or 11.10 μM BA, or 18.10 μM 2,4-D without BA. Different results were obtained for internodal explants, where callus induction in 100% of the explants occurred in the media with 2.22 μM or 11.10 μM BA without 2,4-D; or 4.52 μM 2,4-D without BA; or in the combinations of 9.05 2,4-D with 0.44, 2.22 or 11.10 μM BA. Santos & Smozinski (2017), who studied the proliferation of dedifferentiated cells from internodes of C. annuum cv. Yolo Wonder also found a positive interaction of 2,4-D and BA, but they observed a low efficiency of each of them alone.

Table 1 - Percentages of callus induction (CI), scores for area of the explant covered by callus cells (ACCC) and average fresh weight in nodal and internodal explants of All Big plants submitted to different combinations of BA and 2,4-D in the culture medium, 49 days after inoculation.

2,4-D (μM)	BA (μM)			
	0	0.44	2.22	11.10
	Percentages of CI in nodal explants			
0.0	0 bC*	40 bB	80 aA	20 bBC
4.52	100 aA	80 aB	80 aB	80 aB
9.05	100 aA	100 aA	100 aA	100 aA

18.10	100 aA	20 bBC	40 bB	0 bC
Percentages of CI in internodal explants				
0.0	0 bC	40 bB	100 aA	100 aA
4.52	100 aA	80 aB	60 bC	60 bC
9.05	80 aB	100 aA	100 aA	100 aA
18.10	20 bB	40 bA	40 bA	27 cAB
Scores for ACCC in nodal explants				
0.0	0.0 bB	0.4 cB	3.0 aA	0.2 cB
4.52	4.0 aA	2.0 bC	3.0 aAB	2.4 bC
9.05	3.6 aA	3.8 aA	3.8 aA	3.4 aA
18.10	0.2 bB	1.3 bA	1.2 bA	0.0 cB
Scores for ACCC in internodal explants				
0.0	0.0 bB	0.6 cB	2.0 bA	2.0 aA
4.52	0.2 bB	2.0 bA	0.6 cB	2.4 aB
9.05	2.8 aB	3.2 aB	4.0 aA	2.8 aB
18.10	2.8 aA	0.4 cB	0.4 cB	0.3 bB
Average weight (mg) in nodal explants				
0.0	6 cB	22 bB	148 aA	24 bB
4.52	899 aA	328 aB	46 bC	36 bC
9.05	148 bD	404 aA	283 aB	189 aC
18.10	7 cA	11 bA	11 bA	7 bA
Average weight (mg) in internodal explants				
0.0	2 bB	16 bB	86 bA	11 bB
4.52	3 bB	24 bA	10 bB	18 bAB
9.05	181 aB	333 aB	850 aA	220 aB
18.10	133 aB	8 bB	5 bB	9 bB

*Averages followed by the same capital letter do not differ in the same row by Scott-Knott test at 5% probability; averages followed by the same lower case letter do not differ in the same column by Scott-Knott test at 5% probability.

In relation to the scores for ACCC, the highest values were obtained with 4.52 µM 2,4-D without BA for nodal explants, and with 9.05 µM 2,4-D + 2.22 µM BA for internodal explants. Confirming these results, the weight of the explantes (and, of course, the calluses formed around it) was highest, for both kinds of explant, in the same concentrations of growth regulators that led to the highest ACCC. Santos & Souza (2016), aiming at the establishment of a protocol for cell suspension from leaves of C. annuumm cv. Etna, recorded 100% callus induction, score 4.0 for explant area covered by callus cells and the highest callus weight by supplementing the media with 4.52 µM 2,4-D + 0.44 µM BA.

The growth curves of the calluses of the two types of explants followed a sigmoid pattern with six distinct phases; lag, exponential, linear, deceleration, stationary and decline (Fig. 1 and 2).
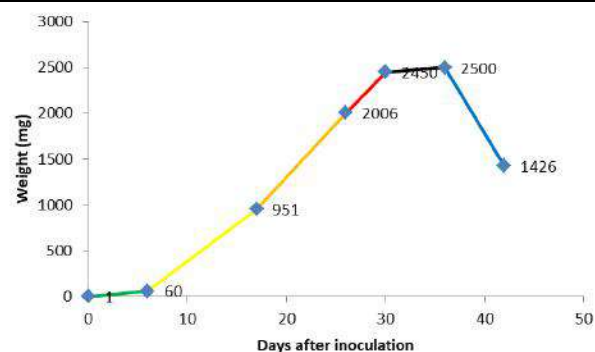
Fig.1: Growth of nodal calluses of C. annuum cv. All Big cultivated in an MS medium supplemented with 4.52 µM 2,4-D, with the lag (green), exponential (yellow), linear (orange), deceleration (red), stationary (black) and decline (blue) phases.

The nodal calluses presented a lag phase from the day of inoculation to the 6th day of cultivation, exponential phase from 7th to the 17th, linear from the 18th to the 26th, deceleration from the 27th to the 30th, stationary from the 31st to the 36th, and decline from the 37th to the 42nd day.
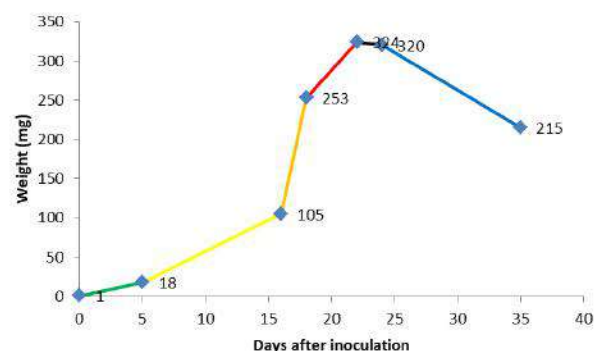
Figure 2 - Growth of internodal calluses of *C. annuum* cv. All Big cultivated in an MS medium supplemented with 9.05 µM 2,4-D + 2.22 µM BA, with the lag (green), exponential (yellow), linear (orange), deceleration (red), stationary (black) and decline (blue) phases.

In the internodal calluses, the lag phase occurred from the inoculation to the 5th day, exponential phase from 6th to the 16th, linear from the 17th to the 18th, deceleration from the 19th to the 22nd, stationary from the 23rd to the 24th, and decline from the 25th to the 35th day.

IV. CONCLUSION

The pattern of the callus curve is dependent on the species and explant under consideration (Feitosa et al., 2013) and the sigmoid pattern is peculiar to dedifferentiated tissues (Peixoto et al., 2011). The focus of callus growth curves is to determine the beginning of the deceleration phase, which is the exact moment to

subculture the calluses into a new liquid medium in order to establish cell suspensions (Santos et al., 2010). In this case, the adequate moment to subculture callus cells from nodal and internodal explants of *C. annuum* cv. All Big into a liquid medium is on the 27th and on the 19th day, respectively.

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Probability of the average monthly wind speed in Mossoró-RN, Brazil, through the probability density function of beta distribution

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Abstract— *The objective of this paper was to determine the expected wind speed (km/day) as a function of the daily average values, at various levels of probability, recorded during thirty-eight years (1970-2007) for the city of Mossoró-RN. Based on the Kolmogorov-Smirnov test, we found that the beta distribution can adequately describe the wind pattern, for all months of the year. We found average wind velocity values of 219.0 km/day demonstrating the great possibility of using this meteorological element as an alternative source of energy for the region.*

Keywords— *probability distribution, wind, beta density function, alternative energy.*

I. INTRODUCTION

The wind was one of the first forms of energy used by man. In the past, in different situations, wind energy has been used routinely, and today the modern technology allows its use with maximum efficiency.

Due to the energy crisis in 1973, the oil price increased in the period of 1973-1986 and wind technology experienced a resurgence, which has led to the emergence of the current wind turbines capable of producing electricity at competitive prices concerning the traditional sources. Energy consumption is one of the main problems nowadays, and the largest percentage of energy consumed comes from petroleum. Several governments have been planning short- and long-term electricity supply strategies due to the rising electricity consumption in recent years. This concern justifies more effective and rigorous planning for these strategies to meet the needs of the population.

The debate over the use of the available energy sources in the country such as solar, biomass and wind energy is providing alternatives to overcome the shortcomings of the energy crisis in recent years. According to Lima (2003), about 20% of the world's energy comes from renewable resources.

Energy from wind is one of the solutions. The slight market growth in favor of wind energy is responsible by the decrease in the prices of wind turbines over the last decades, which together with the evolution of the technology and operational characteristics has become more competitive concerning other generations sources.

The zero cost of its fuel (wind), low maintenance cost, the short time required for its installation and operation, among other factors, has consolidated the space of wind energy among the potential sources of energy (Terciote, 2005).

The wind energy is one of the most important and promising technologies in the complementary generation of clean energy. Brazil has great potential for generating energy from wind. According to the Atlas of Brazilian Wind Potential, published by the Electric Energy Research Center of Eletrobrás, the Brazilian territory can generate up to 300 gigawatts, but currently, the installed capacity is 8.12 GW, that is less than 3% of the potential (Abeeólica, 2015).

To a medium and long-term energy planning, reliable information on available energy resources is needed. The lack of information on the variability, trends,

and factors influencing the availability of renewable resources is the main barrier to the adoption and investment in projects of renewable energy production such as solar and wind power (Martins et al., 2005).

Knowledge of steering wind behavior and velocity, as well rainfall, temperature, relative air humidity, evaporation, global solar radiation, dew, fog, hail, frost, and snow, among others, is an essential in decision-making related to agricultural activities and the need to explore clean sources of energy. In this sense, the statistical distribution of wind speeds is an important tool for the evaluation of wind energy potential and its performance in energy conversion systems.

A theoretical distribution is an abstract mathematical form or specific format of a frequency of values of a given variable. Some of these mathematical forms appear naturally as a consequence of certain species of data generating processes, and they may concisely representing variations in a set of data. Even when there is no strong natural basis behind the choice of a particular theoretical distribution, one can empirically find that this distribution model represents a set of data very well. The specific nature of a theoretical distribution is determined by particular values of entities called distribution parameters. Theoretical distributions, also called parametric distributions, because their specific attributes depend on the numerical values of their parameters. For example, a normal or Gaussian distribution is characterized by the bell shape. However, to say that the average January temperature in a given locality is well represented by a Gaussian distribution is not very informative about the nature of the data, without specifying what Gaussian distribution represents the data. The knowledge of these distributions has important practical consequences because the methods of analysis for the observation data (random variable) that follow different theoretical distributions are different.

The random variables associated with most of the experiments can be represented by families of statistical distributions, which are mathematical models and whose properties such as mean, variance, and geometric form are a function of few parameters. Although there is an infinite diversity of families of statistical distributions, their interest is varied, and only a limited number has a broad field of application. A distribution family is a distribution that depends on one or more parameters. These parameters are classified based on their geometric or physical interpretation, and determine the location, variability, and shape of the distribution, and belong to one of the following types: i) location parameter; ii) scale parameter and iii) shape parameter (Pedrosa and Gama, 2004).

The study of the behavior of rainfall, relative humidity, evaporation, wind direction and speed, global solar radiation, dew, fog, hail, frost, and snow, among others, is an important tool in decision making related to agricultural and human activities in construction and tourism. Among these climatic variables, the global solar radiation, defined as the total energy emitted by the sun, which affects the terrestrial surface, with wavelengths between 150 and 4000 nm (Rosenberg et al., 1980; Slater, 1980; Sampaio et al., 1999; Cargnelutti Filho, 2004) is fundamental in relation to agricultural activities.

The simple construction of a histogram of frequency for the visualization of the sample data is insufficient to infer, among the several known probability density distributions, which one best fit the data under study. Therefore, it is necessary to use criteria tests and Goodness-of-Fit tests to verify if the probability distribution of the data can be represented by a certainly known probability distribution function.

There are several distributions of probability for discrete and continuous random variables. The Bernoulli, Binomial, Negative Binomial, Hypergeometric, Geometric, and Poisson are suitable for discrete data. Continuous random variables are adjusted to Uniform, Normal, Log-Normal, Gamma, Weibull, Gumbel, Exponential, Beta, Chi-square, Student's-t, Fisher-Snendecor distributions, and others.

Studies of probability distribution adjustments or probability estimates using theoretical probability distribution functions for climatic variables such as rainfall (Berlato, 1987; Botelho and Morais, 1999; Sampaio et al., 1999; Catalunha et al., 2002; Murta et al., 2005), air temperature (Mota et al., 1999; Buriol et al., 2000; Assis et al., 2004) and the solar radiation (Buriol et al., 2001; Assis et al., 2004) have benefited the planning activities, reducing probable climatic risks.

Goodness-of-fit tests such as Kolmogorov-Smirnov, Qui-square, Cramer Von-Mises, Anderson Darling, Kuiper, Lilliefors, Shapiro-Wilk and the Maximum Likelihood Logarithm (Campos, 1983; Assis et al., 1996; Moretin and Bussab, 2004; Cooke, 1993) are used to compare the empirical probabilities of a variable with the theoretical probabilities estimated by a distribution function under test. The sample values can be reasonably considered as coming from a population with that theoretical distribution. The Maximum Likelihood Logarithm shows a good quality of fit if its value is negative and the lowest possible (Cooke, 1993). In the Goodness-of-Fit tests, the null hypothesis (H_0) assumes that the sampled distribution does not differ from the theoretical distribution specified (Normal, Log-Normal, Beta, Range, Log-Pearson, Gumbel, Weibull and others), and the estimated parameters are based on the sample data (Assis et al., 1996; Catalunya et al., 2002).

The Log-Normal distribution has proven to be satisfactory to fit data of maximum air temperature in the

city of Iguatu, Ceará, Brazil, according to the Chi-square and Kolmogorov-Smirnov Goodness-of-Fit tests (Araújo et al., 2011). For the precipitation data of Pernambuco State during the months of January to July 2015 (Lima et al., 2015), a set of distributions was adjusted (Normal, Log-normal, Gamma, Beta, Weibull 2P and Weibull 3P), and different distributions were suitable for distinct months of the year. Weibull 3P best fit the months of January February, March, May and July, while April was best fitted by a Normal function and June by a Gamma function (Lima et al., 2015). Rodrigues et al. (2014) tested the Exponential, Range, Log-normal, Pareto and Weibull probability distributions to modeling the intensity of droughts in Laranjeiras do Sul in the State of Paraná, in a historical series of 30 years. All distributions analyzed, except the Pareto distribution, presented a good fit, but Gamma and Weibull distributions were more suitable to the observed data. The corrected Akaike information criterion, the likelihood ratio, and the histogram comparison indicated that the Gamma distribution obtained better adjustment of the data, followed by the Weibull distribution (Rodrigues et al., 2014).

Kist and Virgens Filho (2015) modeling the rainfall data in the state of Paraná for a historical series of thirty-year (1980-2009) in 29 locations, found that the Mixed Exponential distribution adjusted better to the data, followed by Gamma and Weibull distributions. They conclude that if the software used to adjust the distributions does not provide the Mixed Exponential distribution, the data can be better simulated from the Gamma distribution.

Gumbel probability density distribution model was used for data of absolute minimum monthly and annual temperatures (May to September) and frost incidence, for a series of thirty years referring to twenty locations in the State of São Paulo. The parameters of the probability density function of the distribution were estimated for all locations and periods analyzed and showed a good fit between the observed frequencies and the Gumbel distribution, independently of the time of occurrence and locality. Using suitable probabilistic or stochastic models, the risk levels of absolute minimum temperatures and frosts can be estimated at different periods of the year using the calculated parameters (a and p), based on historical series of this information.

Some papers use empirical classification employing the relative frequency of occurrence of minimum temperatures to estimate the unconditional probabilities. The problem, according to Soares and Dias (1986), is the sample size, which may be insufficient to obtain stable probability values. Conrad and Pollak (1950) recommend series of at least thirty years to obtain representative results. For example, Camargo (1977), in a study of the occurrence of low temperatures in Campinas

(SP), for the period from 1890 to 1975, considered temperatures under a meteorological shelter below 2.5 °C as representative of frost. Ortolani et al. (1981), found 2ºC as a predictor of frost, using the historical series from 1962 to 1980, in eight localities of São Paulo. The adoption of 2 ° C as the limit was based on the average difference between the air temperature in the meteorological shelter and the grass temperature in frost nights, which is of the order of 5.6 ° C (Fagnani and Pinto, 1981). Considering the air temperature of 2 ° C, therefore, the leaf has a temperature of -3.6 ° C, close to the value found by Camargo and Salati (1967) and Pinto et al. (1977, 1978) as the limit for the appearance of damages in coffee trees. Using a relative frequency, with a series of twenty years of data, Soares and Dias (1986) defined for the city of São Paulo the probability of occurrence of daily minimum temperatures, at monthly level, lower than 10 and 15 ° C.

The use of suitable probabilistic models introduces mathematical precision, allowing for more consistent studies of historical data series. Arruda et al. (1981) tested the Extreme Values and Normal distributions for absolute minimum temperature in a series of 50 years for the regions of Campinas for June and July. The authors found concluded that both distributions are recommended to describe minimum temperature data. Silva et al. (1986) in a series of 69 years of daily minimum temperature data for April to September in the city of Lavras (MG), found that the Extreme values distribution best fit the data. By using the model of extreme values for annual absolute minimum temperatures, referring to several locations in the State of São Paulo and Mato Grosso do Sul, Camargo et al. (1990) identified areas of frost risk, observing large gradients of probability values.

The climate is a factor of great influence in the control of the growth of the plants. Moreover, agricultural productivities are probabilistic elements (random variables), in the sense that they depend on climatic variables, such as temperature and global solar radiation of the region during the growing season of a crop. Dallacort et al. (2011), for example, found that the probability of precipitation in Tangará da Serra is between 40 and 50% probability for the rainy months and between 30 and 40% for the months without rainfall, using the Incomplete Gamma distribution. Based on the results, this type of research assists in the elaboration of irrigation projects for the municipality of Tangará da Serra in the State of Mato Grosso, Brazil.

The use of probability density functions is directly linked to the nature of the data. Some functions have good estimation capacity for small numbers of data; others require a large number of observations. Due to the number of parameters of your equation, some can take

different forms, suitable for a larger number of cases, being more flexible. Respecting the representativeness aspect of the data, the estimates of the function parameters for a given region can be established without prejudice to the precision in the estimation of probability (Catalunha et al., 2002).

The adjustment of probabilistic models to daily rainfall data, plant growth productivity and a summary of these data represents an efficient technique for the analysis of this information. Each frequency distribution can be approximated through the use of probability density equations with some parameters extracted from the sample in question. The use or not of a distribution resides in its capacity to estimate the observed data, based on its parameters, and this capacity is measured through Goodness-of-Fit tests (Almeida, 1995).

Some previous papers have described the wind patterns to suggest control practices such as the use of windbreaks and also to identify sites with wind potential for energy (Munhoz and Garcia 2008; Pereira et al., 2009; Beruski et al., 2009). Pereira et al. (2009), for example, conclude that in the winter and spring, the winds blow with intensity higher than the average, with September having the highest values. According to the authors, in the summer and autumn, the winds have values below the average. The mean wind velocity data indicate that the wind potential can be exploited in the municipalities of Cascavel, Ponta Grossa and Clevelândia among the analyzed sites, which are also the most outstanding areas for the implementation of windbreaks. Beruski et al. (2009) concluded that the gamma distribution was better at adjusting the mean wind speed data, considered a good model to represent the data of the region of Lapa, PR.

Based on the given information and in the absence of studies using probability distribution functions to describe the wind pattern for Rio Grande do Norte, this work has the objective of determining the monthly average values assumed by the wind speed in the city of Mossoró, RN, through the Beta probability density distribution, analyzing the potential for generating energy.

II. MATERIAL METHODS

The average wind speed data in km/day were obtained from a series of 38 years (1970 to 2007) of the data records of the UFERSA Meteorological Station (Federal Rural Semi-Arid University) in Mossoró. The data was sampled at 10m, coordinates 5º11' S e 37º20' W, 18m of altitude, average annual temperature of around 27.5 °C and relative humidity of 68.9% (Carmo filho et al., 1991). According to Köppen's climatic classification, the climate of Mossoró is of the type BSwh ', that is, hot and dry.

In each month of the year, the data of the series were adjusted to the beta probability distribution model.

The beta density function can be expressed as follows (Falls, 1973; Haan and barfield, 1973):

$$B(x) = \frac{1}{(b-a)} \frac{\Gamma(p+q)}{\Gamma(p)\Gamma(q)} \left(\frac{x-a}{b-a}\right)^{p-1} \cdot \left(1 - \frac{x-a}{b-a}\right)^{q-1}$$

a and b correspond to the smallest and highest value of the data series, respectively, Γ is the symbol of the gamma function of the respective variables, p and q are parameters of the beta distribution and x is the value of the variable under analysis. The estimation of the parameters p and q is done from the moment's method (Pearson, 1934). The density function of the beta distribution takes the following form:

$$B(x') = \frac{\Gamma(p+q)}{\Gamma(p)\Gamma(q)} \cdot \left(x'\right)^{p-1} \cdot \left(1 - x'\right)^{q-1}$$

In which, $0 < x' < 1$, for $p > 1$ and $q > 1$. The numerical integration of this equation configures the probability of values occurrence to any value of x within the considered interval.

The main method to estimate its parameters is the maximum likelihood method, whose estimators have the four desirable properties of a good estimator which are: non-biased or non-addictive, consistent or coherent, efficient as well as sufficient, which must satisfy the condition $\alpha > 0$ (by definition) (Thom, 1958 e 1966; Catalunha et al., 2002; Bussab and Morettin, 2017; Casella and Berger, 2018).

The moment's method is a statistical inference tool to obtain estimates of population parameters, being one of the simplest and oldest to obtain estimators of one or more parameters of a distribution. The estimators are obtained by replacing the moments of the sample in the expressions representing the moments in the population, i.e., the basic idea is to use the moments of the sample to estimate the corresponding moments of the population, and, from there, to estimate the parameters of interest (Murteira et al., 2001). Let X_1, X_2, ..., X_n be a random sample of a given population with probability function (density) f.d.p,: f(x; θ_1, θ_2, ..., θ_k) that depends on k parameters. Assuming that there are ordinary moments of population x, these are functions of k parameters. The method of the moments consider that the estimators of the ordinary moments are given by ordinary sampling moments, that is, $\hat{\mu}'_r = m'_r, r = 1,...,k$. Some forms of estimating the parameters of the Beta distribution were developed, contributing, along with their flexibility of forms, to their use in several areas.

We used the Kolmogorov-Smirnov test to evaluate the fit of the mean values of monthly wind speed to the beta probability density function. This test uses the values estimated through a specific and known theoretical (or real) distribution of the event F(x), which in the case of this study corresponds to the values determined by the

Beta density function, to data coming from an empirical distribution estimated with the observed values S(x). As a way of characterizing the study area, the present work estimated the wind speed values at the following probability levels: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90 and 95%. The analysis was performed in the free statistical program VTFIT (Cooke, 1993; Campos, 1983; Siegel, 2006).

III.   RESULTS AND DISCUSSION

We observed that the highest wind speed was verified in October and November, and the lowest values in the months of March to May (Table 1 and Figure 1).

Table.1: Estimated average values of wind speed (Km/day) in function of probability level [p(x ≤ X)] for the city of Mossoró-RN, 2018.

PROBABILITY LEVEL	JAN	FEV	MAR	ABR	MAI	JUN	JUL	AGO	SET	OUT	NOV	DEZ
5	615.57	530.08	419.14	519.49	383.04	400.02	476.46	546.28	574.01	636.22	638.95	628.65
10	583.41	505.79	380.98	439.08	343.72	368.89	434.18	504.36	553.42	603.61	609.52	593.00
15	557.26	484.01	355.87	385.42	318.04	345.57	404.11	474.92	536.84	579.75	587.21	565.89
20	534.14	463.53	336.41	344.04	298.24	326.08	379.85	451.42	522.27	560.05	568.34	543.04
25	512.89	443.85	320.11	309.88	281.75	308.91	359.07	431.48	508.90	542.83	551.57	522.85
30	492.88	424.66	305.84	280.56	267.36	293.31	340.65	413.95	496.34	527.27	536.19	504.50
35	473.73	405.78	292.95	254.72	254.42	278.85	323.94	398.18	484.32	512.88	521.79	487.49
40	455.21	387.04	281.03	231.53	242.51	265.24	308.51	383.74	472.68	499.34	508.10	471.51
45	437.07	368.34	269.81	210.42	231.32	252.27	294.08	370.36	461.27	486.44	494.93	456.34
50	419.16	349.58	259.12	191.01	220.70	239.79	280.45	357.82	449.99	474.00	482.12	441.80
55	401.33	330.62	248.71	172.99	210.41	227.67	267.44	345.98	438.74	461.89	469.55	427.77
60	383.46	311.36	238.49	156.16	200.34	215.80	254.93	334.71	427.42	449.99	457.08	414.13
65	365.41	291.68	228.30	140.33	190.34	204.09	242.81	323.91	415.94	438.16	444.62	400.78
70	346.97	271.41	218.00	125.37	180.28	192.42	230.99	313.49	404.14	426.31	432.02	387.65
75	327.92	250.34	207.38	111.17	169.97	180.69	219.33	303.38	391.89	414.26	419.13	374.60
80	307.97	228.16	196.19	97.63	159.14	168.74	207.73	293.49	378.93	401.83	405.74	361.53
85	286.59	204.38	183.98	84.67	147.42	156.33	196.05	283.72	364.93	388.70	391.50	348.29
90	262.90	178.09	169.95	72.25	134.06	143.12	184.02	273.96	349.15	374.36	375.83	334.62
95	234.58	147.10	151.74	60.22	116.96	128.18	171.11	263.94	329.83	357.46	357.15	319.93
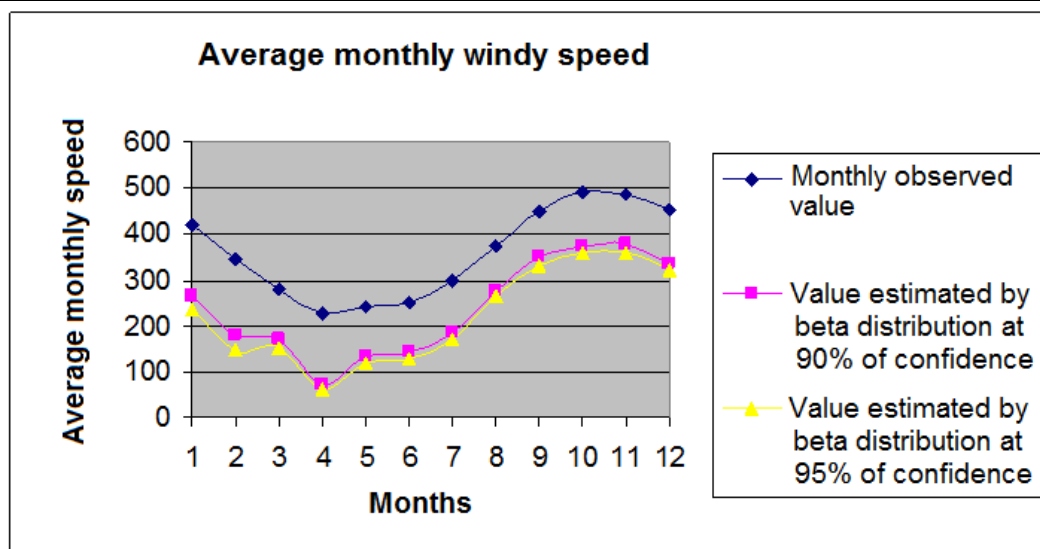
Fig.1: Average values of wind speed of the Mossoró city, RN, Brazil, 2018.

The wind speed varies depending on the region and the season. In general, in Brazil, the strongest winds occur in early spring and the weakest in early summer (Bíscaro, 2007), this fact confirms the analysis of the data in Table 1 and Figure 1. It should be verified that the highest value of the average wind speed for Mossoró, RN, occurred in October and November. Similar results were obtained by Leite and Filho (2006) in Ponta Grossa, PR.

The period of highest average wind velocity occurred in the spring, from September to December; and the lowest average speed occurs in March to May. The wind speed is directly proportional to the values of the radiation balance. Therefore, it explains the low values of wind speed in late summer and early fall (Bíscaro, 2007).

The present study provided subsidies for the use of this available energy to guide energy engineering studies, as well as in related areas. It was verified that the region of Mossoró, RN, constitutes a possible region for obtaining wind energy, this is because the North and Northeast regions of Brazil have the highest wind power, which seen occur in and November. The highest wind speed values were 357.46 Km/day and 357.15 Km/day (95% of probability), respectively (Table 1), and that the lowest values were found from March to May, with an average 100 km/day (Figure 1).

The maximum value, therefore, presents a small probability of occurrence. We can verify that the probability of occurring a value less or equal to this event would be greater than 95% (Table 1). It is also noted from Table 1 that at a 95% probability level, the estimated wind speed is 116.96 km/day for May. Similar results were obtained by Martins (1993), Marques Júnior et al. (1995) and Silva et al. (1997) for other regions. In these studies, all the authors were unanimous about the local possibilities for using this climatic element as an alternative energy source. The average speed in Mossoró is higher (486.91 km/day) than the found by the authors (220.37 km/day), showing to be a region of high potential for the rational and directed exploration of wind energy.

The estimated theoretical and calculated probabilities by the beta function for the wind speed data were all adjusted to the 10% probability level according to the Kolmogorov-Smirnov Goodness-of-Fit test. The results indicate that the meteorological event discussed can be adequately represented through the distribution of beta probability density function when analyzed monthly average periods. Thus, the adjusted model for this random climate variable can be used by researchers in general to perform probabilistic forecasts, estimate wind speed values, make comparisons between phenomena of the same nature, and analyze the location of historical series and study variability or scale of this variable. Also is possible to analyze the asymmetry and kurtosis or flattening of frequency distributions of the variable under investigation, as well as to make statistical inferences, through the construction of confidence intervals and the application of hypothesis tests or of significance, among other types of statistical analysis.

IV.   CONCLUSIONS

The mean velocity data of the winds indicates a possible wind potential to be used in the region of Mossoró, RN, and should be evaluated by complementary studies.

The beta probability density distribution showed a good fit for all months of the year, and is therefore adequate for this type of study, in this locality and evaluated times.

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Impacts of Mining in Conservation Units in the Brazilian Amazon

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Abstract— *The aim of the study was to investigate the relationship between the intensification of environmental degradation, measured as deforestation, and authorized mining activities within Conservation Units in the Amazon biome using a mixed methodology combining the use of the Leopold matrix and analysis of satellite images obtained through Google Earth and Qgis. The hypothesis was that mining activities in federal Conservation Units, indirectly increase deforestation at the edges of, and even inside, Conservation Units due to interest from other sectors of the economy. In order to determine mining incidence, the characteristics of institutional environmental management mechanisms in Conservation Units, and the profile of requests for and issuance of mining licenses in protected areas, a sample of 30 cases was selected and studied. Databases from several agencies were also employed and the Leopold matrix was used to identify and classify different types of environmental impact and detect correlations among them.*

Keywords— **Amazon biome, Environmental Impact Assessment, Greenhouse gases, Mining Activities, Protected Areas.**

I. INTRODUCTION

Protected areas are defined spaces set aside for environmental conservation or preservation, and according to the International Union for Conservation of Nature (IUCN, 2013), they cover approximately 14.6% of the Earth's surface and are fundamental policy tools for biodiversity conservation. In Brazil, the establishment of Conservation Units (COUNs), following either a sustainable use model or a full protection model, fulfills that goal from the environmental policy perspective (Rodrigues, 2014), but these models have legal loopholes that allow economic activities with high environmental impact, especially in sustainable-use COUNs. These activities are mostly related to agriculture, animal farming, and plant and mineral extractivism, which mainly cause vegetation loss, soil impoverishment, flooding and river silting, temperature increases, and habitat loss for plants and animals.

Habitat destruction is one of the main environmental impacts of mining. According to Gomes, Palma and Silva (2001), during mining activities, it is frequently observed that the species with greater locomotion escape, and sessile and sedentary species are crushed to death. In this study, we adopt the definition of environmental impact by Sánchez (2006) as an environmental unbalance caused by economic activities and address mining in particular.

The aim of the present study was to evaluate the incidence of legal mining in COUNs in the Brazilian Amazon, main source of natural products in the world (Andrade, 2007). Deforestation was considered the dependent variable. A sample of 30 cases was selected to determine mining incidence, the characteristics of institutional environmental management mechanisms in COUNs, and the profile of requests for and issuance of mining licenses in protected areas of the Amazon biome.

II. MATERIAL AND METHODS

The methodology was based on descriptive statistics. The Leopold matrix was used to identify and classify different types of environmental impact and detect correlations among them. Satellite images were analyzed using Google Earth Pro software and Qgis software, and 30 cases of mining were identified within the states composing the Amazonia Legal. The existing mining activities were studied, a check-list model of the resulting impacts was proposed, and a correlation matrix was created for these impacts.

Databases from several agencies were used. The Amazon Deforestation Monitoring Project (Projeto de Monitoramento do Desflorestamento na Amazônia Legal – PRODES) database was used to develop the deforestation indicator, and data on the characteristics of COUNs and the National System of Conservation Units (Sistema Nacional de Unidades de Conservação - SNUC) were obtained from the Chico Mendes Institute for Biodiversity Conservation (Instituto Chico Mendes de

Biodiversidade - ICMBio). Data on mining operations were obtained from the National Department of Mineral Production (Departamento Nacional de Produção Mineral - DNPM).

III. PROTECTED AREAS AND CONSERVATION UNIT MODELS IN BRAZIL

Protected areas are defined and delimited geographical spaces whose main function is the conservation and/or preservation of natural and cultural resources (Medeiros, 2003). In Brazil, environmental resources are of little political value, and there is little coordination of environmental policy (Wanderley, 2009). A perverse effect of this from the environmental perspective is public policies related to infrastructure development and energy safety that have required land-use changes in federal CUs without due assessment of the economic potential of the ecosystem services provided by the protected areas, such as climate regulation or erosion control (Vatn, 2010).

The economic potential of COUNs is related to activities such as (1) the exploitation of forest products; (2) carbon reserves, which are especially important to the governmental goal of restricting greenhouse gas (GHG) emissions; and (3) the production and conservation of water resources (Rodrigues, 2014; Shiki, S., Shiki, S. F. N, 2011). Act 9985 of 07/18/2000 created the SNUC to establish and regulate COUNs, which are designated as either fully protected or sustainable-use units. The political and institutional mechanisms that create COUNs (except for Ecological Stations and Biological Reserves) are participatory; namely, they require public consultation to decrease the possibility of friction during their establishment.

Fully protected COUNs include Ecological Stations, Biological Reserves, National and State Parks, Natural Monuments and Wildlife Refuges, and sustainable-use COUNs include Environmental Protection Areas, Areas of Relevant Ecological Interest, National and State Forests, Extractive Reserves, Fauna Reserves, Sustainable Development Reserves, and Natural Heritage Reserves (ICMBio, 2011). These areas quantitatively and qualitatively benefit a variety of economic sectors such as the considerable water resources composing the reservoirs of hydroelectric plants that supply energy to cities and industries. However, these benefits have little social and political value (Medeiros *et al*., 2011), and they are not considered viable indicators of economic growth in political evaluations, thus exacerbating the tradeoff between economic growth and environmental conservation (Rodrigues *et al*., 2015).

Regarding their potential to decrease GHG emissions in Brazil, COUNs maximize the potential for fighting climate change (through forest carbon sequestration), especially through changes in soil use (Domingues;

Bermann, 2012). Deforestation is a predominant factor in the Brazilian emission framework because it was responsible for more than 60% of the total Brazilian GHG emissions in 2005. According to Medeiros (2003), in addition to avoiding emissions due to forest burning, conservation units prevent the emission of gases originating from activities such as animal farming and agriculture, especially methane (CH_4) and nitrous oxide (N_2O), which have higher global warming potential than CO_2; these gases were responsible for 10% to 19% of the Brazilian greenhouse gas emissions in 2005.

Approximately 80% of global GHG emissions originate from the burning of fossil fuels, meaning that economic activities mobilize and release C that has been deposited and retained in the subsoil for millions of years into the atmosphere (IPCC, 2007). Although the actual value is unknown, forest carbon sequestration under an optimistic scenario may be equivalent to approximately 12 to 15% of fossil fuel emissions (at the current emission rates) over the next 50 years (Brown *et al*., 2001).

Although this is a positive scenario from the perspective of Brazilian environmental assets and the use of COUNs for carbon sequestration, as well as the reduction of GHG emissions, there is a gap between the existing resources (capacity of COUNs for forest carbon sequestration) and the effective political valuation of COUNs in national climate change policies. The economic, as well as the fundamentally political (because they directly and indirectly affect human populations), importance of ecosystems resides in the diversity of their benefits to humans, called environmental services, such as climate regulation, carbon storage and sequestration, biodiversity conservation, and soil conservation and regeneration (Daly, 1990).

Many of the environmental services provided by COUNs are seriously compromised due to the incredibly fast pace at which externalities are imposed by a high-carbon economy and the very poor and inadequate economic (and consequently political) valuation of environmental goods and services, by both the market and the government (Fearnside, 1997).

It should be highlighted that although the type of use model determines whether communities have greater or less access to COUNs, as well as the presence of extractive activities, conflicts over land-use planning in areas that encompass COUNs may communicate a false dilemma regarding the implementation of conservation measures that either restrict direct and full human interference or allow extractive activities that affect the environment but are regulated by the responsible environmental management agency. Ostrom (1990) noted the limitations of exclusive approaches to the management of common goods, such as the environmental assets in COUNs.

The inclusion of the communities within or around sustainable-use COUNs in their co-management (through a Management Council) affects the distribution of power in decision making and political participation, resulting in higher responsiveness and transparency in policies and practices related to sustainable extractive activities (Almeida, 2012; Colchester, 2004). Because sustainability is a broad concept with little cohesion from the political policy perspective, extractive activities with high environmental and social impact, such as mining, are included in COUNs, or COUNs are in areas directly influenced by mining activity (Sánchez-Vázquez, L. *et. al*, 2016; Rodrigues, 2016; Walter, M, 2008). To evaluate the incidence of mining as a vector of deforestation in COUNs in the Brazilian Amazon biome and its dependence on the characteristics of the mining permit profile and COUN management, the following aspects are of interest.

IV. RESULTS AND DISCUSSION

4.1 ENVIRONMENTAL IMPACT OF MINING: CASE STUDIES IN THE AMAZON BIOME

In addition to impacts that directly affect the interior of COUNs, deforestation around COUNs are of equal concern because they are predictive of future actions that will impact the protected area, especially in a scenario where lack of political interest has implicated in the lack of control of deforestation processes, such as the reality in the Amazonian ecosystem (Fearnside, 2006). These impacts occur as edge effects; i.e., forest fragments located in the middle of the CUs remain intact, while trees on the edges of those fragments may be removed or slowly die, increasingly exposing the edges to external actions that can alter the environment and may decimate an entire area (Martins, 2012).

Edge effects may result from exposure to climate, the presence of parasites, the introduction of invasive species, and other biological and/or chemical factors that degrade the environment (Odum, 2013). Additionally, edge effects alter the transition areas between plant communities; these areas are known as ecotones and are very important to the functional consolidation of COUNs and biodiversity conservation. However, deforestation was adopted as an indicator of environmental degradation in the present study, so possible edge effects are considered because agricultural, timber extraction, and mining activities tend to expand according to their goals and may destroy habitat near protected areas.

4.2 CONSERVATION UNITS DIRECTLY IMPACTED BY MINING

The deforestation of the Amazon, especially illegal logging, has been one of the great challenges in Brazil. The UN climate summit (COP 21) in Paris in 2015 established the goal of eliminating illegal deforestation throughout Brazil, intensifying the challenge of meeting that goal (Bastian, 2016).

Mining, the independent variable and object of the research in the present study, is an indicator of deforestation in COUNs in the Amazon biome. Mining Titles in the Brazilian Amazon is shown in Fig. 1. Generally, mining activities directly impact either Extractivist Reserves or National Forests. The case of the state of Pará, the second largest producer of minerals in Brazil, illustrates this incidence of mining activities in protected areas of the Amazon biome.
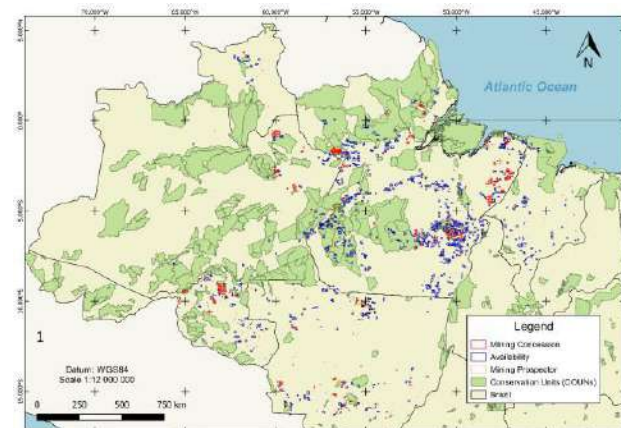
Fig. 1: Mining Titles in the Brazilian Amazon
Source: Qgis (Image altered by authors, 2017)

An analysis of 30 COUNs, including a study of deforestation up to 2014, identified mining activities within and around COUNs, Fig. 2. These activities in protected areas and their resulting impacts can be observed by analyzing satellite images from Landsat satellites specifically prepared for analyzing the Earth.

This correlation between mining and the degradation of the surrounding is observed when we consider the relationship between mining interests, assessed based on processes initiated by the DNPM that range from permits for mineral prospecting to extraction licenses, and deforestation in CUs, which is measured in km² by the National Institute of Space Research (Instituto Nacional de Pesquisas Espaciais – INPE).
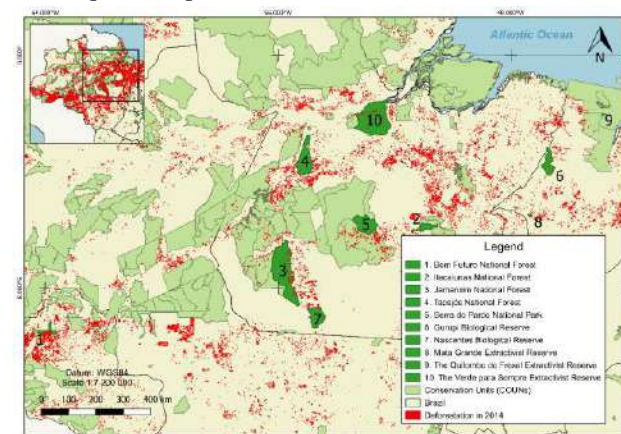
Fig. 2: Spatial Association between Deforestation and Mining

Source: Qgis (Image altered by authors, 2017)

According to data from PRODES (2016), both deforestation and the mining interests in COUNs in the Amazon biome increased between 1997 and 2005. Of the 30 studied COUNs, the following 10 exhibited the highest deforestation between 1997 and 2014:

The Quilombo do Frexal Extractivist Reserve (Maranhão) is an extractive reserve in which deforestation reached 100.11%; i.e., the amount of original vegetation cover removed exceeded the delimited area of the COUN, according to data from the INPE. Similar to other COUNs, an area licensed for mining is located at the border of the Quilombo do Frexal Extractivist Reserve.

The second COUN with the highest level of deforestation was also an extractive reserve; 91.2% of the vegetation was removed from the Mata Grande Extractivist Reserve (Maranhão). Although the cause of the deforestation was not identified, there are several licensed mining areas around this COUN, namely, a 24.89-hectare area located 607 meters away.

Itacaiunas National Forest (Pará) is currently the third most deforested COUN, with a 42.91% vegetation loss. There is intensive mining activity around this forest originating from the Carajás mining complex.

The Sossego Mine, one of the largest mines in the region with an area of 9.33 km² and a perimeter of 30.4 km, is 32.8 km from the COUN, and the Carajás Mine, with an area of 42 km² (4,204 hectares) and a perimeter of 53.0 km, is 38.6 km away.

Additionally, the Bom Futuro Mine has a 32.3-km perimeter and an area of 19.7 km²; it is located approximately 19.5 km from Bom Futuro National Forest (Rondônia) and is responsible for the deforestation in this region. The largest open pit mine, for bauxite extraction, has had the greatest impact. Bauxite is used in aluminum production, and its extraction may result in illegal hunting and deforestation in addition to hydrological disturbances. Other types of environmental damage originating from this mine can be identified in the impact matrix (Fig. 3).

GOLD MINING ENVIRONMENTAL IMPACT MATRIX - BOM FUTURO MINE

Factor classification
Δ Significant factor   ■ Less significant factor

Impact classification
● Very important impact   ◆ Less important impact

Activity columns: MC = Mining complex; OPE = Open pit excavation; TD = Tailings disposal; OP = Ore processing; WD = Waste disposal; SS = Support services; TIE = Transport of inputs and equipments.

MC	OPE	TD	OP	WD	SS	TIE	Category	Impact	Soil quality loss	Soil contamination	Groundwater level reduction	Water availability reduction	Surface water quality deterioration	Groundwater quality deterioration	Air quality deterioration	Habitat loss	Changes to aquatic ecosystems	Resource base reduction	Visual impact	Discomfort	Degradation of the built environment	Loss of cultural resources	Possible injuries and deaths	Impacts on human health	Spread of infectious diseases	Reduced agricultural production	Increase in commercial activity	Increased demand for public services	Population growth	Disturbance to community life	Workforce training	Increased tax revenue	Decreased disposable income
■		■					RESOURCE CONSUMPTION	Raw materials	◆																								
Δ			Δ		Δ		RESOURCE CONSUMPTION	Energy																								◆
							RESOURCE CONSUMPTION	Manufactured goods																			◆					◆
							WATER CONSUMPTION	Groundwater				◆		◆																		
■	■	Δ	Δ				WATER CONSUMPTION	Surface water					◆																			
Δ	Δ			Δ			LAND USE	Soil degradation	●							◆		◆														
				Δ			LAND USE	Groundwater pollution																								
Δ				Δ			LAND USE	Erosion	◆																							
■	■			■			LAND USE	Animal migration	◆							◆																
Δ	■			Δ			LAND USE	Vegetation loss	◆				◆			◆																
							LAND USE	Irregular occupation of soil								◆																
Δ	Δ						AQUATIC EMISSIONS	Diffuse sources					◆	◆																		
							AQUATIC EMISSIONS	Point sources					◆	◆																		
■	Δ					■	ATMOSPHERIC EMISSIONS	Gases and smoke							◆									◆								
Δ		Δ				Δ	ATMOSPHERIC EMISSIONS	Particulates													◆			◆								
Δ							SOIL EMISSIONS	Solid waste		◆																						
	Δ	Δ	Δ	Δ			SOIL EMISSIONS	Soil infiltration																								
	■	Δ				Δ	OTHER EMISSIONS	Noise																						●		
		Δ					OTHER EMISSIONS	Seismicity																						◆		
							OTHER EMISSIONS	Radiation																								
	Δ						ACCIDENTS	External spills		◆			◆																			
Δ							ACCIDENTS	Mining area spills											◆			◆		◆	◆					◆		
Δ			Δ	■	■		SOCIAL ASPECTS	Employment generation															◆	◆			●	◆	●			
Δ			Δ				SOCIAL ASPECTS	Professional training																							●	
■			Δ				SOCIAL ASPECTS	Demand for goods and services																			●					
■							SOCIAL ASPECTS	Business opportunities																			●	●				
							SOCIAL ASPECTS	Tax revenue generation																								

Fig. 3: The Leopold Matrix
Source: Prepared by the authors

The Leopold matrix is a checklist of human actions that may cause environmental impacts and the environmental components that may be affected by those actions. However, the Bom Futuro National Forest was likely already impacted as it is possible to verify in the Fig. 4, referring to the period from 1996 to 2016, with 10 years gap between images. The COUN showed already a deforestation in the initial registry (1996) and, in 2006, had a deforestation registered in 36.55%. The deflorestation was expanded as can be seen in the image of 2016.
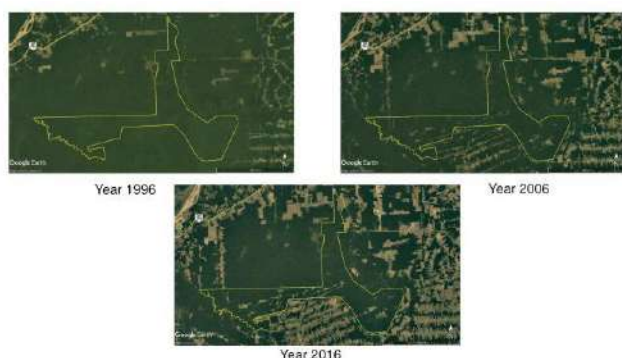
Fig. 4: Deforestation in Bom Futuro National Forest
(Years – 1996, 2006, 2016)
Source: Google (Image altered by authors, 2016)

The Gurupi Biological Reserve (Maranhão) was the COUN with the fifth highest degree of deforestation, although no mining or extractive activities were identified around this COUN. However, the DNPM has identified many mining interests within and outside its borders. In this COUN, 28.53% of the original vegetation has been removed, and in addition to mining requests, there is great interest in mineral prospecting and extraction.

The Nascentes Biological Reserve in the Cachimbo Mountains had the sixth highest degree of deforestation, 16.7%. A large area that had been deforested for pastures and plantations was identified along the northern border of the reserve. Regarding mining, only prospecting permits were found for this COUN, but current data from the DNPM (2016) indicate that there is a request for mining in a 2.72-km² deforested area with a 13-km perimeter located a few meters from the CU. Therefore, it directly influences the CU.

Jamanxim National Forest (Pará) was the COUN with the seventh highest loss of original vegetation at 11%, and because this forest is very near the Nascentes Biological Reserve in the Cachimbo Mountains, it is affected by the same impacts described above (Fig. 5).
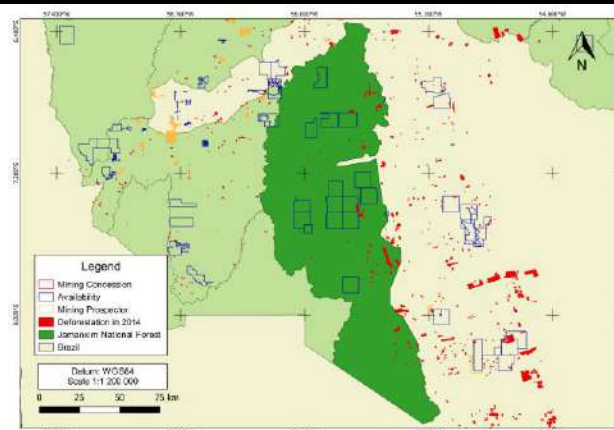
Fig.5: Incidence of mining titles in the National Forest Jamanxim
Source: Qgis (Image altered by authors, 2017)

However, although there is mineral prospecting in this COUN, it is more affected by the deforestation in its surroundings that is fueled by highway BR 163, which directly affects both the Nascentes Biological Reserve and Jamanxim National Forest among other COUNs.

Serra do Pardo National Park, with a deforested area of 6.6%, is also located in Pará, the state with the highest mining activity in the country. The entire area to the south of this COUN is occupied by mining interests, most of which are in prospecting or prospecting request phases.

Tapajós National Forest is also located in the state of Pará, and it presents 6.5% deforestation within its protected area and 47.3 km of deforestation in a "fishbone" pattern in its surroundings due to the construction of a highway. There are many requests for mining and mineral prospecting, especially gold mining, in the surroundings of this COUN.

The Verde Para Sempre Extractivist Reserve, also in the state of Pará, presented a 4% deforested area, and an analysis of Google Earth images identified more than five licensed mining areas 74.9 km to the west. However, most deforested areas are to the south, where the first cuts within the COUN were also observed.

4.3 AREAS OF INFLUENCE AND MANAGEMENT MECHANISMS

To evaluate whether the impact of mining is in fact reflected in the COUN, influence areas, which are the areas experiencing possible physical, biotic, and/or socioeconomic changes resulting from mine implantation and/or operation, were established. Criteria were established to categorize COUN Indirect Influence Areas (IIA), Direct Influence Areas (DIA), and Directly Affected Areas (DAA) by mining operations.

In the present study, IIA were considered the areas bordering mines at a distance up to 20 km and up to 500 m from the licensed area when the area was considered of interest but currently without extraction. Directly Affected Areas were the areas with mining operation

infrastructure, and DIA were considered the licensed areas of interest without current extraction.

Regarding the management mechanisms, this study considered cases where the COUN was managed by management councils, management plans, or other management tools. Institutional activities characterized by a higher level of shared responsibility seem to facilitate the implementation of public policies (Ostrom, 1990). However, environmental policies are characterized by their pronounced transversal character, so to increase their efficacy, these measures should, in general, use the same actors throughout the environmental policy formulation and implementation cycle. Public resource management is characterized by political transversality in that it involves several institutions with their own "environmental agendas" that will ultimately influence each other in terms of environmental quality due to the low degree of political coordination between different government sectors and civil society (Sanchez, 2013).

Of the 30 COUNs evaluated, only 16 possessed all the mechanisms conducive to good management. Of the remaining 14, there was no management plan for the Quilombo do Frexal Extractivist Reserve, and there was no management mechanism for the Mata Grande Extractivist Reserve, Bom Futuro National Forest, and Itacaiunas National Forest, except for the COUN establishment document. These were among the most deforested areas in the Amazon biome

V.   CONCLUSION

The present data revealed the importance of mining to the Brazilian economy; mining generates jobs and income and strengthens bonds with other countries through international commerce. By contrast, mining is considered a threat to species diversity in natural areas and the main hydrographic basins.

Analysis of the data on mining in COUNs within the Amazon biome revealed that Pará is the state with the most mining interests, presenting several licenses in the areas surrounding COUNs, ranging from prospecting licenses to the presence of already active mines extracting minerals to supply several branches of industry.

Gold is the most abundant mineral in the Amazon biome, which is worrying because gold extraction generates large amounts of waste material contaminated with heavy metals, typically in concentrations that are harmful to the health of humans, environment, and the species present.

There were mining operations in the surroundings of Itacaiunas and Bom Futuro National Forests in the state of Pará and the Mata Grande Extractivist Reserve in the state of Maranhão that directly affected the COUNs. The remaining COUNs also presented mining interests in their surroundings, but these were considered of indirect influence.

Despite the evident mining interests in the surroundings of Jamanxim and Tapajós National Forests, the main cause of environmental degradation identified through satellite image analysis was the construction of the state highway. This does not rule out impacts resulting from mining, but their effect was minimal compared to that of the highway.

Of the 30 cases studied, only COUNs with internal management tools exhibited no significant internal deforestation. This was the case for Serra da Cutia National Park, which possesses both a management plan and a management council and has experienced no significant deforestation since its creation. In contrast, mining licenses existed in most cases where there was pronounced deforestation, including the 10 cases highlighted in the present study, even when the COUN and its surrounding areas were classified as ecological corridors. Although no extraction was identified within the COUNs, these licenses indicate a trend toward increasing environmental impact in the protected areas.

Thus, it can be stated that mining activities are positively correlated with increased deforestation in federal COUNs. In conclusion, there was a spatial association between the existence of mining licenses and deforestation in the studied Amazon COUNs that were most heavily impacted. It should be highlighted that this association is related to other local economic activities, especially animal farming, and to infrastructure, such as highways, bordering the COUNs. The character of COUNs demands internal management mechanisms (such as management councils and management plans) that restrict external pressures and their risks. However, institutional conflicts over environmental policies allow for incongruence between the goals of a government sector such as the DNPM, the holder of a mining operation within the perimeter of a protected area, and environmental regulation and monitoring agencies such as ICMBio that conflict with these directives when they act to protect COUNs. In a sensitive biome such as the Amazon, not only is greater protection necessary for COUNs, but also, greater and dully responsive protection is needed for the institutions that manage mining operations in Brazil and the COUNs.

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Conceptions of interculturality in Physics Education in Bahia

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Abstract— This work constitutes a reflection on the function of Physics teaching within an indigenous school scope and the possibility of interculturality as epistemological basis in the elaboration and production of intercultural indigenous learning materials in Physics teaching. In this sense, it is important to highlight the compatibility between the idealized learning material and the local context, having as proposal the interculturality and the study of Physics to found a meaningful learning of the physical processes. At the same time, the relationship between teacher, student and community represents the differential of an intercultural education in the whole indigenous school system.
Keywords—Interculturality; Physics Teaching; Indigenous Education.

I. INTRODUCTION

What is Physics teaching for at indigenous school? And why the local knowledge and its culture are considered inferior to Physics teaching? Is there a possibility of intercultural dialogue in Physics teaching? Through these questions we feel the need of an epistemological approach with respect to the interculturality in Physics education.

The concept of interculturality defended here moves the mutual recognition of all cultures without knowledge hierarchisation and superiority. From this standpoint, we try to observe and understand worldviews of indigenous people, particularly the Pataxós, and their conceptions related to physical phenomena. The proposed question from this is: what are their conflict in relation to the hegemonic knowledge presented by the occidental society?

The intercultural perspective whilst promotes the recognition, allows the appreciation of other systems and cultures, without envision ranking but complementarity, enabling the construction through dialogues whose knowledge overcome the limit between modern and traditional, written and oral, rational and emotional, inherent concepts to learnings and to human relations (MARÍN, 2009).

Since the invasion of Brazil by the Portuguese, in the colonization process the missionaries sought to impose their culture to the people who was settled here. The ethnocentrism, obviously, forestalled them to recognize and understand the peculiar meanings of indigenous cultures. As Fleuri (2009, p. 3) points,

> [...] By the epistemology of orthodox thinking the western settlers were not predisposed to recognize other people and their culture, in its otherness, as autonomous subjects, as sovereign social groups with who would be possible to dialogue on equal terms and, in reciprocity, learn together.

Unfortunately, this ideological vision of the settlers is present on High School Physics textbooks of indigenous schools of Bahia and they transmit the content with a totally western perspective, with the aim of reduce the content to simple mnemonic information, not recognizing the local knowledge and its culture as important processes to a meaningful learning. This harms the teaching-learning process since recognize another culture as significant is what allow the groups to communicate with each other.

The concept of culture that we adopted is essentially semiotic, because we assimilate the culture as the total accumulated of cultural patterns, in other words, of "organized systems of meaningful symbols" (GEERTZ, 1989) on the basis of which human organize and guide the aim of these actions.

Comprehension of human being in its essential dimension can be find justly on the cultural particularities of peoples. Therefore, from a scientific view it is necessary to seek to understand it on cultural phenomena, not on empirical similarity between the behavior of the different social groups, but on the relationships established between different groups with different cultural patterns (Ibidem).

To Quijano (2002), this reflection is made from the intercultural perspective, because he believes that this is a possibility of analysis that allows to descolonize the

knowledge and consequently the imaginary sustained by it.

This approach elicits the proposition of interculturality with the decolonization of power and knowledge. Therefore, it is about the cultural and historical rationale on the production of an alternative material contextualized with the indigenous reality and that incorporate its cultural diversity, complying the cultural wealth of the cultures as significant on the learning process of the student.

Reflect about the response of local knowledge relation, identified for some as inferior in relation to the global knowledge in a determined context, led us to study the history of power relations between the dominant and dominated culture.

The axis of this reflection allow us to question the historic separation of nature and culture on Physics teaching, enforced by the Eurocentric vision on the rationality of positivism that is the basis of normal science defended by dominant class. We understand that normal science is the state of a science in which researches and results are predictable, in other words, it is not concerned about create newness but on specialize in that is already established by the current paradigm. Actually, the experiences intention is not to create novelty, "The result is already known previously, the fascination is how to arrive on this" (KHUN, 2009, p. 60).

The challenge of teaching Physics on indigenous community is try to understand their culture and particularities, engaging with the community and mainly listening to them, not only talking about them or for them. Dialogue with the other not refraining from doing a judgement of the called knowledge common sense (called so by normal science), using our own conceptions about science, may be the biggest paradigm.

Therefore, can we think about teaching Physics in indigenous communities if we do not respect the cultural approach produced on the local we are inserted? We think not, since on this panorama the relation between teaching Physics and the culture are woven and we consider that Physics is a share of social and cultural traditions. In addition of being human constructions, the sciences are, consequently, social and historical constructions too.

II. INTERCULTURALITY IN PHYSICS TEACHING

Physics teaching linked to interculturality in an indigenous context is a challenge to theoreticians of current Education. In Brazil, the coexistence of different cultures has always existed and has always been part of our reality. However, on an oppressing way, the dominant ideology has always searched for the devaluing of

dominated cultures along the colonial and post-colonial period.

We verify that traditional school was in charge of transmitting the dominant world perspective, language and culture, and it was an effective institution in its purposes of reducing, denigrating and marginalizing the indigenous language, world perspective and local knowledge. Moreover, on this process the textbook had the primary role due to its educational function of knowledge diffusion.

In the view of Fleuri (2009), "[...] Father Antônio Vieira considered that the difference of so many languages of the different indigenous peoples founded by the colonists in the Americas was a work of the demon [...]". In our view, diversity of languages was an obstacle to the colonists in recruitment of labour to maintain the economic demands of the invaded territories.

Interacting with other people spark to us the comprehension of the respective meanings allocated to their actions, causing a discomfort in terms of the behavior of the others because the determining logic of the cultural context is distinct from the characteristic logic of our culture patterns. To understand the behavior of another person it is necessary to understand the logic of organization of the meaningful symbols developed by this person's group (Ibidem).

At the same time, the comprehension of the logic of different cultural patterns enables to understand the specificity of the logic of our cultural patterns and the relativity of the meanings we attribute to our actions. Thus, reflecting on our actions from other cultural patterns perspective, we can discover other meanings that our own actions may take on and thereby discover different ways of directing them.

Referring to Indigenous Education, D'Ambrósio (2001, p.76) instruct us that the teaching may use contextualized resources and instruments, because "contextualization is essential to any education program of native and peripheral populations". And he explains too that "it is possible to avoid cultural conflict that result from the introduction of "white mathematics" in indigenous education" (Loc. cit.). By analogy, we believe that Physics teaching may be approached considering the cultural context, in what way the problems founded on Physics textbooks bring an appropriate treatment of formulation and solution of physical phenomena problems founded in the school community at hand, in other words, referring to the weather, agriculture, fishing, to one that applies to community daily life.

> [...] the daily life is impregnated of the knowledge and tasks specific of the culture. At all times, individuals are comparing, classifying, quantifying, measuring,

explaining, generalizing, implying, and somehow, evaluating, using material and mental instruments that are specific of their culture. (Idem, 2002, p. 22).

It is argued that Mathematics should be thought from the needs and/or concrete situations of the specific community. In this case, we seek to encourage the survival of indigenous culture through a Mathematics teaching proposed by Ethnomathematics as follows:

[...] the math practised by cultural groups such as urban and rural communities, groups of workers, professional categories, children of a given age group, indigenous societies and so many other groups thate conform to each other by objectives and traditions commons to the group (Idem, 2001, p. 9).

Agreeing with the author, we believe that both Physics and Math should be linked to real and natural phenomena; and a great example of this is in indigenous school education. Indigenous common sense, for example, the ancients, fathers, mothers and chiefs are inexhaustible source of scientific knowledge.

The Ethnophysics proposed by our work appropriates Ethnomathematics to discuss the possibility of incorporation of indigenous culture in Physics teaching at indigenous schools. As a field of study, Ethnophysics is emerging slowly from Ethnomathematics researches. Therefore, it is a new field of study in Western Science. However, because they are similar researches at least methodologicaly, we can base our Ethnophysics study on some Ethnomathematics benchmarks.

Until now, having as assumption the few founded research, it is possible to consider that they aim to motivate Physics learning while try to relate someway the traditional knowledge on Physics to the classroom school knowledge. Consequently, It should be pointed the uniqueness of the studies in this indigenous catchment area.

By analogy, for Souza (2013), an ethnophysics view means consider ontologically the view mode, the mode of interpreting, understanding, explaining, sharing, working, dealing and feeling physical phenomena. In other words, the pedagogical work with Ethnophysics request appropriation of the cultural memory, codes, symbols and macro social universe of the research subject.

The inclusion of Ethnophysics on teaching and learning process can allow the student to "understand how the knowledge creation and transfer of each group happens when they "practice science"" (SANTOS, 2009, p.108). The "practice science" is producing a knowledge that controls consciously the procedures of its

constructions. Although there is not the mastery of scientific concept, the indigenous carries out the activity because the indigenous village chief, his father, grandparents or other relative taught him to do that way. Thus, he is able to solve a problem and explain the phenomena related to his daily with his own conceptions. We believe that Ethnophysics enables to understand nature and its phenomena in its general aspects associated to a culture or to the specific popular knowledge of each ethnic group, from the concepts operated by the subject on each context. Therefore, promoting the dialogue with experiences and collective categories in relation to the phenomena and technologic solutions with the conceptual framework of scientific physics (SOUZA; SILVEIRA, 2015), it is provided a mutual understanding, resultant from the translation of empirical to abstract and vice versa.

III. INTERCULTURALITY CHALLENGES IN PHYSICS EDUCATION

Trying to understand and accept new cultures is not an easy relation on our daily. History reveals that many of these relations between different peoples and social groups have resulted in holy war, genocides, process of settlement and domination. According to Geertz (1984, p.54), "understand the culture of a people exposes its normality without reduce its particularity", bringing, according to History, deeply conflicting and dramatic relations.

Persuant to Messeder (2018, p.10), "culture is a symbolic tapestry that organize and guide collective meanings of being and of being in the world, a cognitive and perceptive map translated to codes of behavior, relations of human being with nature and with themselves". Culture as language only can be understood in its context and specific logic of conception, enunciation and practice.

So, understand these processes of intercultural relations become the condition to understand not only the logic that lead to destruction or mutual subordination, but especially to discover the creative and dialogic possibilities of the relations between groups and different cultural context, making the intercultural didactic material differentiated and appropriate to certain realities.

In the conception of D'Ambrósio (2002), the intercultural relations should be comprehended in a global dimension at which the mass media would facilitate the transport of this cultural plurality. Thereby:

[...] the relations between individuals of the same culture (intracultural) and mainly the relations between individuals of distinct cultures (intercultural) represent the creative potential of the species. As well as

biodiversity represents the way to the emergence of new species, cultural diversity represents the creative potential of humanity (p. 28).

To Fleuri (2009), intercultural relations are not relations whose meanings are configured from singular or individual perspectives, neither are consolidated in a short time. Cultural patterns formation and educational processes inherent to that are configured at the paradoxical intersection of many perspectives that, consequently, are constituted in a dynamic and conflicting way. And although every act has educational effects that contribute to the configuration and transformation of cultural patterns, these are only constituted in historical processes of long duration.

For this reason, the intercultural perspective involves a complex comprehension of the education searched by it – apart from teaching strategies and even the immediate interpersonal relations – understand and promote, slowly and progressively, the relational and collective context formation of meanings elaboration that guide people's life from collaborative principles.

Studying a people, a community or only a group of rural workers is insert yourself in the intended daily. It is talking, hearing, understanding the process, understand the origin, never losing the individuality, but considering the activities generalization, analyzing each word, perceiving in small details the scientific background that exists, remembering that "nevertheless, these descriptions and interpretations will be always from the view of a scientific view" (SILVA, 2003).

Therefore, to achieve the proposed goals, we believe that the ethnographic methodology is the most suitable to our purpose since the study of intercultural relations only can be developed from the interpersonal relationships in their historical facticity. To a research with this character,

> [...] it is not the occurrence while occurrence that interest the ethnographer, the brute social discourse of which construction he did not participate; primarily, it is the occurrence meaning of the speak – speech act, of some small parts of the informant speech – that can lead to the comprehension of the reality (Ibidem, p. 4)

In this regard, the relation between people is a relation between projects, purposes, meanings. And the relation between cultures, that occurs in the meeting of persons from different cultures, calls into question all the symbolic apparatuses on the basis of which each subject is oriented. That is what the intercultural relation is about, in our view. Subjects, people from different cultures that

attribute distinctive meanings to their actions, when interacting they put into question not only the meaning of their action or speech, but put on the line all their cultural referential that allow them to grant meaning to each one of their actions, words and feelings (FLEURY, 1996).

Therefore, the relation of Physics teaching and, consequently, of Physics textbook with the student should has as epistemological basis the intercultural and ethnographic context, allowing, thus, the dialogue of the community, that brings intrinsically its previous knowledge, in other words, more general, serving as a bridge to more specific knowledge, namely, scientific. Therefore, it should recognize the importance of culture on the construction and appreciation of local knowledge or of an ethnicity.

IV. METHODOLOGICAL PROCEDURE

This work aimed to construct strategies to implementation of an intercultural Physics teaching in Pataxó indigenous schools, as well create purposes of alternative learning material to support teaching practice.

Systematic bibliographic studies were done to characterize the fundamental concepts present in Physics of the First Year of High School, in the contents of kinematics, vectors, dynamics, universal gravitation and hydrostatic, that are taken in a school year, in different contexts of epistemological approach, as well as detail study of their main characteristics in indigenous reality.

Thereafter, the studies have focused in the conceptual exploitation and on the use of interculturality to organize the concepts studied in Physic within an alternative model of intercultural educational.

V. CONCLUSION

This study aimed to verify the possibility of an intercultural dialogue in teaching and the construction of a didactic material of Physics focused on students of first year of High School, in addition to investigate the role that the Physics teaching has in the context of indigenous High School. This journey was guided by the concept of interculturality. In this connection, it was exploited the concepts of interculturality, valuing the indigenous knowledge on the entire journey.

The study convinced us of the great didactic-conceptual advantage of ethnophysical knowledge use to represent and model the main concepts of Physics. This is mainly due to the ability of dialogue between indigenous culture and natural phenomena studied in Physics. The relation of cultural appreciation in the indigenous context was fundamental to the construction of didactic material and the acceptance by the school community. We believe that the local conceptions, pedagogic practices of the teachers and the comprehension of the process are

fundamental to the meaningful answer by indigenous students.

The compatibility between the produced teaching material and the local context, having as purpose the cultural appreciation of indigenous people in the study of Physics is fundamental to a meaningful learning of physical process focused on the students of first year of High School. At the same time, the relation between teacher, student and community arises as a differential, overpassing the interculturality in the whole process of indigenous school education.

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The struggles of traditional communities in land and territory in the Brazilian Semiarid

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Abstract— *This item features the hinterland of pasture fund communities in Bahia and provides an overview of the involved conflicts and impasses in their struggles for land and territory according to their socio-cultural tradition. What happens in Bahia is an innovative experience in terms of political identity formation and social and economic organization in the territory, from the conflicts over the possession and use of land, which focuses on changes in land tenure policy of traditional communities in the region. The Social Struggle by Pasto Funds Movement came from peasants who were not represented by the existing movements and organizations and have organized to fight for the legal right to land and territory, which for centuries occupy in collective ownership system, and public policy that promote social development, economic and environmental importance Do not defeat their lifestyles that protect and conserve the fauna and flora of the savanna biome. Traditional communities organized grazing background, who live from the extraction and management of small loose animals, are guardians of the natural and cultural heritage of the Semi-arid, with a way of life that protects and preserves the fauna and flora of this genuinely Brazilian biome.*

Keywords— Cultural identity, Grass background, Natural patrimony, Social movements, Traditional Communities.

I. INTRODUCTION

This article aims to characterize the pasture fund communities of Bahia Hinterland and give an overview of conflicts and dilemmas involved in their struggles for land and territory, with lifestyles that protect and conserve the fauna and flora of the savanna biome. In the world and in Brazil for collective tradition of use of land for production, breeding and extraction. What happens in Bahia is an innovative experience in regularization policy and land reorganization in the context of the Brazilian semiarid region.

The Social Movement of Struggle by Pasto funds came from peasants who were not represented by the

existing movements and organizations and have organized to fight for the legal right to land and territory, which for centuries occupy, with public policies that promote social development, economic and environmental without destroying their way of life. Several agrarian reform settlements face major difficulties in enabling the semiarid region. One of the factors associated with this stems from not having considered the vocation of the biome at the time of distributing the lands were allotted to the practice of agriculture in small plots surrounded, which are part of a biome conducive to extraction and management of small animals loose.

In Brazilian history, which is forged by the interaction and conflict between people, there were many communities that have developed their own ways of organizing, independent of the official social model lived in the country, for example, fishermen, and coastal gatherers. In the Semi-Arid they formed from the cattle cycle of decline, when the farms were abandoned along with its cowboys and aggregates. For many years this population found himself abandoned by the government, both at the time of the Empire and the Republic. This isolation led her to create their own means of living in society and meet their material and existential needs according to their culture (GERMANI; OLIVEIRA, 2008).

In recent decades the regional situation is undergoing changes and communities have access to the market, technical assistance and formal education, introduce new elements in their culture, change their way of seeing and living with the Brazilian semiarid region. While they have incorporated urban habits, they feel the need to keep their identity and claim their rights for centuries have been denied. With the advent of citizen Constitution of 1988, these communities, along with other peoples and traditional communities (indigenous, Roma and African descent), won the legal right to live in accordance with their traditions without giving up their rights to Brazilian citizens.

Following this introduction, this paper presents the components of the political and socio-cultural identity in

the territory. The following includes the characterization of traditional peoples and communities and, more specifically, the establishment of pasture fund communities in Bahia. The text is permeated by the long struggle of the pasture fund communities to assert their rights to land and territory, followed by closing remarks that highlight the role of these communities in the conservation of the biome and ways of life in the Brazilian semiarid region.

II. MATERIALS AND METHODS

According to researchers in the area of methodology of scientific research (GIL, 2010), all scientific research must follow a specifically defined method to achieve the results of the questions proposed in the research.

This method is composed of a set of characteristics that guide the accomplishment of the research. These are the nature, approach, purpose, data collection procedures - as well as techniques and procedures - and data analysis procedures.

From the point of view of nature, the research carried out constitutes a basic research, since it did not seek to present solutions to an existing problem, but rather to understand a certain reality and how it presents itself in the context in which it is inserted (GIL, 2010).

Regarding the approach, we opted for qualitative research, since it emerges in the context of a view that questions the research models established in modern science (SENA, 2016).

Considering that previous models of methodology have for a long time made invisible the subjectivities of the realities investigated without worrying about aspects of the context in which the studied phenomenon is inserted, the qualitative research will affirm that there are aspects of several phenomena that often can not be quantified and therefore need another look at their object of study.

Thus, the qualitative approach presented itself as a coherent possibility to be used to direct the research accomplishment. Because it is appropriate "to the studies of history, representations and beliefs, relationships, perceptions and opinions, that is, the products of the interpretations that humans make during their lives, the way they construct their material artifacts and themselves, feel and think "(MINAYO, 2008, p.57).

III. TERRITORY AND CULTURAL IDENTITY

As a rule, the animals need to demarcate territory, as a survival strategy, especially as regards the use of natural resources indispensable for their existence. With the human being is no different. Since its origin it seeks to find and defend territories to ensure you comfort and safety. In this process, the subject is shaped by the environment at the same time where this changes, seeking

to make it as livable as possible, through the use of its natural resources. Then comes the notion of territory and territoriality, developed by different authors. According to Saquet and Vargas cited Ferraro and Bursztyn (2008, p. 3):

> Human beings in society are their places of life, their territorial, through everyday activities such as leisure, work, social, displacement, religion and consumption. Are specific places that make up the territory of each person or social group, the territory is covered by these specificities. Territoriality is the concretion of spatiality in specific places as a result of the practice of a certain conception of life, production and intervention in space.

In converging perspective to this, Castro emphasizes the territory as access space and control of resources by different social groups:

> Territory is the space to which certain group guarantees its members stable rights of access to and control of resources and their availability in time. [...] The work that continually recreates these relationships brings visible and invisible aspects [...] contains multiple dimensions, bringing together technical elements with the magical, ritual, and finally, the symbolic (CASTRO, 2000, p 166. - 167).

According Haesbaert you can group the various conceptions of territory in four basic areas:

> 1 - The political dimension: Refers to the space-power relations, in general, or legal-political, that relate to the spatial relationships that are established in the nation-state sphere. In these, the territory is seen as a delimited space and controlled, through which it exerts a certain power, most often, but not exclusively, related to the political power of the state.
>
> 2 - Cultural dimension: In this design, cultural or symbolic-cultural content defines the territory from the web representations and subjectivities that are rooted in part of the territory, giving it identity. In this sense, the territory is seen as a product of appropriation / symbolic value of a group in relation to their living space.
>
> 3 - Economic Dimension: The economic dimension focuses on the space as a resource and / or incorporated into the clash between social classes; capital and labor ratio as a product of regional division of labor.
>
> 4 - natural Dimension: A naturalistic perspective employs a notion of territory based on the relationship between society and nature, especially in regard to the natural behavior of men in their physical environment. This is an old idea and little known in the social sciences, currently (Haesbaert cited DANTAS; MORAIS, 2008, p. 7).

Demarcate and keep the territory requires a constant struggle, for various social groups see the same geographical areas as its seek and win them at any cost. In the case of the territories of traditional communities in the Brazilian semiarid, are perceived at least three groups that claim his possession: the communities that live and depend on that territory for more than a century; farmers and squatters, who claim to be heirs of land grants and own these lands and make them business opportunities through its sale to agribusiness, mining and wind power; and also the state should regulate and define its use and disposal in the midst of conflicts of interest.

In this conflict for the possession of the territory are used various enforcement mechanisms, from the physical to symbolic and veiled violence, causing communities fall apart and that new members do not wish to follow that way of life or remain in place, facilitating the conquest of the territories by other stakeholders. In the case of pasture fund communities, this conflict occurs with agribusiness and various forms of manifestation:

> This dispossession is by means of diverse and relatively autonomous processes such as education, consumer industrial products, household ownership of land, proletarianization of the children, labor ideology and integration of industrial clusters. Thus capitalism can be seen as a suffocating process for traditional communities, whose strength comes from political elements, economy and culture, which simultaneously expand the territory and deterritorializes, promotes rooting and fluidity in geographic space (Saquet, cited FERRARO; BURSZTYN, 2008 , p. 3).

Thus, belonging consciousness to a territory and its own culture is vital to the existence of a social group as the pasture fund communities whose territory and their own cultural identity suffer the pressure of conflicts and threats of his deconstitution and dispossession.

According to Santos (1985), the concept of culture was developed in Europe from the eighteenth century, in order to understand how each conquered people understand the world and thus be better able to master it. However, the term culture is much earlier and referred originally to the act of caring for and cultivating the land. From this vision we have to use the term as well as care and refinement of the soul and mind, giving rise to the idea of cult subject. Hence it can be considered culture the term for what people individually or in groups think about the many aspects of life and how they relate to the environment and with other human beings and population groups. Assuming that the most advanced culture, and therefore, to be followed, it was the European culture - based principle in the Christian tradition and subsequently

The concept of culture becomes important when in contact with other social group. Internally, in their social group, the individual lives their customs and ways of seeing and being in the world from learning from older, there is no question what or why, because there is no other way for comparison. By contact with another group, the subject starts to make comparisons about their way of life and how others live (SANTOS, 1985).

One of the most efficient ways and even primitive domination is culturally subjugate the defeated group. Eliminate your thinking and introduce the thinking of the ruling means that there is no resistance by the dominated. Hence the importance of strengthening cultural traditional communities that organize and fight to remain free. be recognized as subjects of history and culture is the first step to be recognized as rights of citizens and to enforce these rights.

In Brazil, regarded as noble culture has been the urban culture, Aryan, Eurocentric, capitalist, and "duty" of the state acculturate the population from this paradigm (SANTOS, 1985). So long, more important than providing conditions for the people of rural areas develop, in many cases, it has been clear them of his presence, freeing them to capitalist exploitation. For this, the state has used the artifices of religion, the media and school to show the supposed advantages of European culture in relation to other cultures.

However, in another perspective, culture can also be an important ally in the resistance of traditional communities to the expansionist advance of capitalism on their territories. As they are conceived and position themselves as subjects of culture and history amounts to self-esteem and resistance force. Thus, the cultural and symbolic space has been a major battleground between the expansion of agribusiness and traditional communities. And belonging to a social group recognized as pasture fund is important in the struggle for life in the regions in conflict. Ferraro (2008) stresses that, as well as segments of urban workers are strengthened in pursuit of their rights, by joining a union and that a federation and confederation,

IV. TRADITIONAL PEOPLES AND COMMUNITIES

According to Conti and Rabbit-Peixoto (2013), by the fact that it is a concept under construction, it is understandable that there is no consensus about its meaning and its use in different contexts. Thus, authors such as Diegues (1996), Santilli (2005), Cunha and Almeida (2001) and Barreto Filho (2001) call "traditional populations," Vianna (1996) uses the singular term "traditional population," Little (2002), Dayrel, and Costa Filho (2012) prefer to use "traditional peoples" and still others call "traditional communities", "local communities" and finally "traditional peoples and

communities," which are part of the pasture fund communities.

Among the elements that identify people and traditional communities are: economic activities, production focused mainly for consumption, ethnicity, region, geographical location, religion, way of life / culture, the standard land , the connection with ancestral lands, their own language, social and own and traditional political institutions, the degree of kinship and cronyism. Dayrell, Costa Filho and Costa (2012) argue that five questions linked featuring people and traditional community and based on them to their rights: identity, social organization, territory, production and culture system.

As Santos (1985), during the colonial and imperial period Brazil was run by a Eurocentric policy, which did not admit the existence of other forms of social organization that were not based on this vision. African culture and the native, for example, were considered backward and savage subcultures that they should drink culture of civilization. However, many population groups resisted and managed to maintain their traditions using strategies like the silence and isolation, with cultural rites in private environments and many of them even chose to take refuge in geographically remote places to protect their cultural identity.

From the Federal Constitution of 1988 these peoples and traditional communities, through joint action, achieved their legal recognition and the ability to take advantage of constitutional rights, without, for this, have to deny their cultural identity. At first, the Constitution cites only the Indians, in Article 321 and the Maroons in Article 68 of the Transitional Provisions. But in 2007 it was promulgated Presidential Decree No. 6,040, of February 7, 2007, establishing a National Policy for the Sustainable Development of Traditional Peoples and Communities and incorporates other peoples and traditional communities. In its Article 3 this Decree provides the following definitions:

Traditional Peoples and Communities: culturally different groups and are recognized as such, which have their own forms of social organization, which occupy and use territories and natural resources as a condition for their cultural, social, religious, ancestral and economic, using knowledge, innovations and practices generated and transmitted by tradition;

Traditional Territories: the space necessary for the cultural, social and economic reproduction of traditional peoples and communities, whether used permanently or temporarily, noted, with regard to indigenous peoples and Maroons respectively, the provisions of articles. 231 of the Constitution and 68

of the Transitional Constitutional provisions and other regulations;

Sustainable development: the balanced use of natural resources, aimed at improving the generation of this quality of life, ensuring the same opportunities for future generations (BRAZIL, 2007, article 3.).

Officially, these criteria are identified: indigenous peoples, with 734,127 inhabitants (220 ethnic groups, 180 languages) and 110 million hectares; Maroons, with 2 million inhabitants and 30 million hectares; tappers, with 36,850 inhabitants and 3 million hectares; tappers and chestnut, with 815,000 inhabitants and 17 million hectares; the breakers of coco-de-babassu, using 2 million hectares and account for 18 million people; those affected by dams, with 1 million people driven from their lands and territories; and finally pasture funds, with 140 thousand people (CONSEA, 2008), occupying an area of approximately 700,000 to 1,200.000 hectares (FERRARO, 2008).

In addition, contains the yard people, gypsies, faxinais, fishermen, coastal, caiçaras, silversmiths, hinterland, fishermen, Azoreans, pampas, vargeiros, Pantanal, geraizeiros, veredeiros, caatingueiros, barranqueiros, on which there is still no accurate data. It is estimated that together peoples and traditional communities occupy about 1/4 of the national territory, disappear 5 million households and 25 million people (CONSEA, 2008).

A recurring question in the literature on traditional peoples and communities is the distinction between peoples and communities. The word refers people to a discussion that has been buried since the days of the Empire, when, with the independence of Brazil went to seek national unity, not recognizing the existence of other forms of political organization other than the official. At the time of colonization, Brazil was a vast territory occupied by several people with different cultures, languages and religions. According to IBGE (2010), in the year1500 lived in Brazil about 6 million people in more than 900 people, many of whom disappeared. In addition to the points in common with the traditional communities, people have particularly their own languages and religions that distinguish them from other population groups and enrich Brazilian culture. Today people are considered indigenous peoples, people of the yard and the Roma people, the latter are a people with no fixed territory. The other denominations, self-defined with the above classifications and among them are the pasture fund communities, integrate the traditional communities.

Worldwide there is a collective tradition of use of land which are unfavorable to agriculture, but conducive to the development of other productive systems. The case of

pasture fund communities in the Brazilian semiarid, shows that the hinterland, skillfully develop the small livestock loose and extraction, and thus guarantee their integrated ways of living with nature.

Ferraro (2008) mentions that apparently ancient traditions are invented from the social as reactions to new situations and are part of political capital building strategies, understood as mobilization, organization, political recognition and strength of social groups. In the pasture fund communities in recent years, this junction between tradition and innovation is evident.

> The pasture Fund and Close communities are socioeconomic formations that constitute a unique model of use and ownership of land whose social expression goes beyond its productive importance. They built historically, a particular model of life in Bahia's semiarid region where the customs, grounded in relationships of kinship and cronyism, created consensual rules and guide the common use of land for small livestock linked to individual use of scattered plots, where plant and reside (GERMANI, Oliveira, 2008, p. 16).

The pasture fund communities are a way of life of a social movement with social identity, political and cultural, rooted in a given territory, which strengthens as they create opportunities policies favorable to its consolidation. By 1982, pasture fund was a regional name (Uauá, Curaçá, Canudos) of pastoralist communities, applied to the common areas as natural pastures for goat breeding. From that period is regional denomination began to generalize and unite pastoralist communities from various parts of the state of Bahia where similar realities had other names ("loose", "loose soil", "loose goat"). Today, when speaking of the pasture fund refers to a whole related to a territory (hinterland, savanna), a story (the corrals), culture (hinterland), an identity, a standard production, a pattern of relationships the environment and social relations. People refer to the pasture fund to designate physical basis of productive activity and the community as possession immemorial recognized internal and externally. pasture fund is also the reason for the mobilization or movement, "for which we had to fight and organize ourselves as a movement of grazing funds." pasture fund as identity associated with the physical basis, "we are pasture fund" and how cultural identity, "pasture fund: our way of life in the backwoods" (motto of the state joint pasture funds). In 2008 "pasture fund" means a "way of life" and a social movement with growing political capital (FERRARO, 2008, p. 168).

The author points out that the way of life of these communities is traditional, just change their organizational strategies adopted to deal with the conflicts that arise in defense of ownership and permanence in the territories. When conflicts are internal communities solve restructuring and strengthening its social capital, ie reviewing its internal organization in order and strengthening reciprocal links between them. When conflicts are external, adopt strategies to seek support outside the communities, strengthening its political capital through the joint and the support of other communities, groups, institutions and even the government and the media.

As Germani and Oliveira, through the resistance organization, pasture fund communities confirm their traditional ways of producing, find alternative ways and appropriate modern productive coexistence techniques with semiarid conditions without necessarily breaking with its unique way of life farmer. Their way of life, based on the collective use of the land for the breeding of animals and the extraction of fruit, wood, fiber and wood, dating from the eighteenth century. With the end of the cycle of sugarcane and cattle in the Northeast and the Bahia government move to Rio de Janeiro, the allotments were abandoned or returned to the Empire, and cowboys and aggregates began to manage the public lands or abandoned by cattle Colonels , many of them now occupied by pasture fund communities (GERMANI; OLIVEIRA, 2008).

Some farms, in fact, belonged legally to its users, by purchase, gift or inheritance. Most of the land, however, was occupied without constitute legally owned by their occupants. Two main reasons have favored the consolidation of the collective mode of use of these lands for grazing funds: first, for not having legal title to the family owns no fence or leaves surround the area; Second, in this semi-arid region the rains are irregular in time and space, which means that it is possible and quite normal to happen raining heavily in one area and there is one kilometer away not rain - a phenomenon known as "mango rains" - creating green spots with abundant pasture and dry patches with little or no pasture. If it was divided into lots and the area surrounded,

The same applies to trees umbuzeiro and other plants used in the extraction. They are concentrated in certain soil and stains are not evenly spread throughout the area. So the best way to use the land socially and avoid conflicts with neighbors and relatives is to use it collectively without fences. Parallel to the conference area, every family has a small plot of individual land which is fenced and used for subsistence farming and grazing agriculture, mainly spineless cactus, to provide animals in dry periods of the year.

In this semi-arid region with these specific characteristics, emerges an innovative movement: the Social Movement of Struggle by Pasto Funds. He appeared in the backlands of Bahia, consists of a group of farmers who were not represented by the existing movements. Although they are associated with some

Rural Workers Union, did not feel politically represented in their demands for land rights, which for centuries occupy, as well as access to public policies that promote social and economic development sustainable without destroying their way of life.

To recognize and be recognized as pasture fund, these communities accumulate strength to face situations of conflict. Usually they seek in any case, to avoid conflicts. Communities that today define themselves as traditional pasture fund communities were considered, like many others, as a site, farm or village. Were the agrarian conflicts that made them if they were part of the pasture fund category, which came into being and strengthen from the need for regularization of their lands, now threatened by squatters and the state itself (FERRARO, 2008). It is a social and identity movement that comes into existence to respond to a need, in reaction to a probable risk and, also,

Unlike other movements that seek the transformation of a broader reality, the pasture fund communities organize and struggle to maintain their stay in the possession of the land and territory. This uniqueness makes the distinct movement of other movements of struggle for land, which sometimes hinders a joint due to the specificities of their struggles flags. Still, it has managed to articulate with other movements around common agendas, for example, the discussion for an agrarian policy that incorporates in his speech the terms agrarian reform and regularization of lands of traditional communities.

Strategically movement is organized into local associations, in each community association; central regional associations and a state joint pasture fund. The associations are organized with the support of NGOs and remains on its own. The central and state joint were created in order to make the dialogue with the state and remains with the logistical support and often financial support of organizations. The movement faces ups and downs in their activities, being more active when there are threats of invasion of some communities (FERRARO, 2008). Faced with the constant pressure there are also communities who do not believe that the approval of the State is required to maintain "a land dwindle want."

> Originally, the cells of pasture funds are resistance cells of a multiple diaspora (Indigenous, African and European), they are cells of a Brazilian diaspora. Front of the conflict, pasture funds cell, is configured as spontaneous movements or voluntary, defined by this origin, sewn by the solidarity derived from living the common problem. They are linked to the territory and thus arise in order to resolve the matter present there (FERRARO, 2008 p. 384).

In 2008 there were 600 grazing bottom communities (FERRARO 2008), with 400 recorded as pasture fund associations in the Bahia Agricultural Development Coordination. The Pasture Fund Articulation estimates that this number could reach 2,000 communities, through an active search for work of these communities and the incentive for them to autorreconheçam as such and carry their registration at the Bahia Secretariat of Human Rights.

The Pasture Fund Movement received an achievement in the State Constitution 1989, Article 178 recognizes the category pasture fund communities and provides for the regularization of their land. However, it is the state government that regulate land rights, which, by law, can not be permanently, but as a concession of use for a specified time. Amid growing pressure from agribusiness interests on the one hand, and on the other, the pressure of pasture fund communities for the regularization of land, is the Bahia state government with its slow bureaucracy in resolving this conflict secular.

In 2013 the government proposed to regularize the lands of communities that autorreconhecessem by the year 2014, by a use assignment agreement for a period of 20 years. The Pasture Fund Movement reacted vehemently, and a historic achievement, succeeded with the state extended the deadline for self-recognition by 2018 and broaden the terms of use of concession contract for 99 years, renewable for an equal period. Still, today the forces that threaten these communities remains active and show, above all, in charcoal, the projects of wind power parks in irrigated agriculture projects in mining and in the interest of expanding local farmers average.

Among the advances achieved over these years of resistance and proposal by the pasture fund communities, this legal achievement in relation to the defense and protection of its territory is another milestone in asserting their rights. Thus, together with other traditional communities, they are actually in guardians of the natural and cultural heritage of the semiarid region, for its ability to protect and conserve the fauna and flora of this genuinely Brazilian biome. Therefore, a contextualized education is crucial to drink in the tradition of communities and strengthen values of this social system as mutual respect, trust, orality, the collective use of property, reciprocity and care of people and nature.

V. CONCLUSION

As you can see, from the occupation of the land and agrarian conflicts in the Bahian backlands, emerges a social movement called the Pasture Fund Movement, which organizes an impressive aggregate social segment in the bottom category and pasture closure, which strengthens the mobilization for the regularization of their land often threatened by speculators and by the State.

However, for some the question remains about the social, cultural, economic and environmental benefits that these communities make to society to justify the recognition, protection and legalization of their territories and the appreciation of their cultures. Some even consider them as a "delay" social, economic and cultural that should give way to progress and contemporary development.

Under the bias of capitalist expansion interested in this discourse is justified even supported by the use of violent actions against these communities. Conceptions of this kind show that society with its institutions, such as schools and others, find it difficult to develop the formation of critical and open to contact with the plurality and diversity of Brazilian citizens. Gradually the sense of justice and solidarity lose space for individualism and competition. Economic development based on human exploitation and natural resources at any cost have proved unsustainable, also in the backlands of Bahia. Rescue and protect human values of traditional communities of pasture fund integrated into the savanna biome is one of the links is lacking in formal and informal education for it to be rooted in the culture and tradition of those communities. Despite the low level of education of its adult population, these communities resist and build an economic and human socio-cultural and supportive system, without abandoned children and with respect to space and time of the people, based on reciprocity, trust and strength of tradition oral and word, which often is more important than the documents and formal protocols introduced late in its life forms.

The pasture fund communities are an innovative social movement in their social organization and their way of life in accordance with the biome. According Semiárido EMBRAPA (2000), only 4% of the irrigated lands are semiarid; 16% are cultivable without irrigation, dependent on rainfall; 46% are good for medium-sized animals grazing and 34% of the land soil and vegetation is so brittle that if modified, do not recover, becoming deserted areas rapidly. However, these areas are good for the extraction of fruits, medicinal herbs, beekeeping and small animals. A wise way, the pasture fund communities are holders of traditional knowledge and handle the resources and lands changing them minimally.

The base communities and grass closure are also innovative because, to be constituted as a social category, also preserve the cultural and political identity, which conforms from the conflicts over the possession and stay on land and territory.

What is happening in the interior of Bahia, by force of organized social movement, it is an innovative experience in terms of land tenure policy. Several settlements made by the National Institute of Colonization and Agrarian Reform, and even regularized quilombo areas are struggling to be viable and, among other reasons, one of

them was the fact of not having been considered the biome vocation in distribution and demarcation of lands. Several settlements are on land suitable for grazing of animals loose and extraction in open areas without fences, however, were allotted to the practice of agriculture in small plots surrounded and became unviable.

The pasture fund communities with their way of life and management of the savanna, have an important contribution to the agrarian reform and land regularization of traditional communities according to each specific situation where they are. They are guardians of the natural and cultural heritage that needs to be recognized, protected and disseminated as a good way to live and live with the Brazilian semiarid region.

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Evaluation of Water Quality for Bathing Conditions in Formigueiro Beach- Porto Nacional - To

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Abstract— *The environmental problems are currently in the spotlight in the news media around the world, although in a negative way. This theme arouses great curiosity among people. The water, which is an exhaustible natural resource, has been suffering severely through misuse and lack of awareness regarding humanity's natural assets. With the population growth, cities are now receiving industrial facilities, and this leads to an increase of the waste dumped on the surface, affecting the bed of rivers and lakes, and consequently affecting water quality. Besides this means of pollution, there are several other forms such as garbage thrown into the water, uncontrolled mining, among others. All samples from the three analyzed points had Escherichia coli values lower than 200 NMP/100 ml of sample. Thus, according to Resolution nº 274, the E. coli values found in this range allowed to classify the analyzed locations as safe and excellent for carrying out primary contact activities, or, bathing for most of the analyzed period. The following project had the objective of analyzing the conditions of the water in the Formigueiro Beach, used by bathers that come into primary contact, as well as the normative that competes to it, also focused on the environmental issues as: degradation, polluting sources, means of use, sustainability and bathing.*

Keywords— **Environmental problems, bathing conditions, Quality.**

I. INTRODUCTION

Brazil is home of a huge quantity of water, and this is really a privilege. Regarding water resources, it has a large volume of water in its territory, which has been used for several purposes. With this great quantity of water supply, it serves for multiple uses, such as: sourcing, fishing, recreation, irrigation bath, among others.

According to Tucci and Bertoni (2003), the population growth in general has greatly affected nature. Without having any other means to proper use the resources, or perhaps by carelessness and lack of a control check, people continue to pollute the springs so that the three main areas of use - residential, industrial and agricultural environments- all discharge their dirty and/or contaminated water into clean water, thereby reducing the scarcity of natural resources and also the loss of water quality.

All water we use in our daily activities and random uses, the final destination of them will be the rivers. By means of this article, it was analyzed some causers of the contamination of these waters and what the relation with the bathing. According to (VALLE & SILVEIRA, 2000) the transmission of infections related to pathogenic organisms, with some examples such as bacteria, viruses and protozoa, are commonly transmitted by water. While most waterborne diseases affect the gastrointestinal tract, others can affect parts of the body such as muscles, the nervous system, and organs such as the heart.

In order to carry out this research, the classification was done using objective criteria, based on the monitoring of the indicators of the fecal coliform group. Then, it was analyzed whether they were in agreement with the parameters decreed by CONAMA Resolution 274/00, determining if the waters are proper or unfit for recreation purposes.

This study on the parameters served to verify the water quality, as well as to correlate the values obtained during the period, which demonstrated the current state of the conditions of the chosen place in relation to the bathing, being able to indicate measures where can be developed environmental preservation methods.

II. MATERIAL AND METHODS

STUDY AREA

The municipality of Porto Nacional is located in the central region of the state of Tocantins, approximately 64 km from the capital of Palmas, which

has an area of 4,446 km². Currently the city has 52,700 people. (IBGE, 2019).

The São João river basin is extensive and it is located between the parallels 10°46'43 "and 20°41'20" south latitude and between the meridians 48° 14'16 "and 48°24'51" longitude west, southeast of the municipality of Porto Nacional, with an area of 82 km². It counts with a tropical climate with rainy summer and dry winter (the warmest months coincide with the period without rains,

August and September), precipitations around 1,600mm and average annual temperatures around 26°C; and the predominant vegetation is the savanna, as shown in figure 01.

The chosen location for this research was the Formigueiro Beach, located in the Jardim Querido sector, located in the Tocantins River basin, as shown in figure 02.
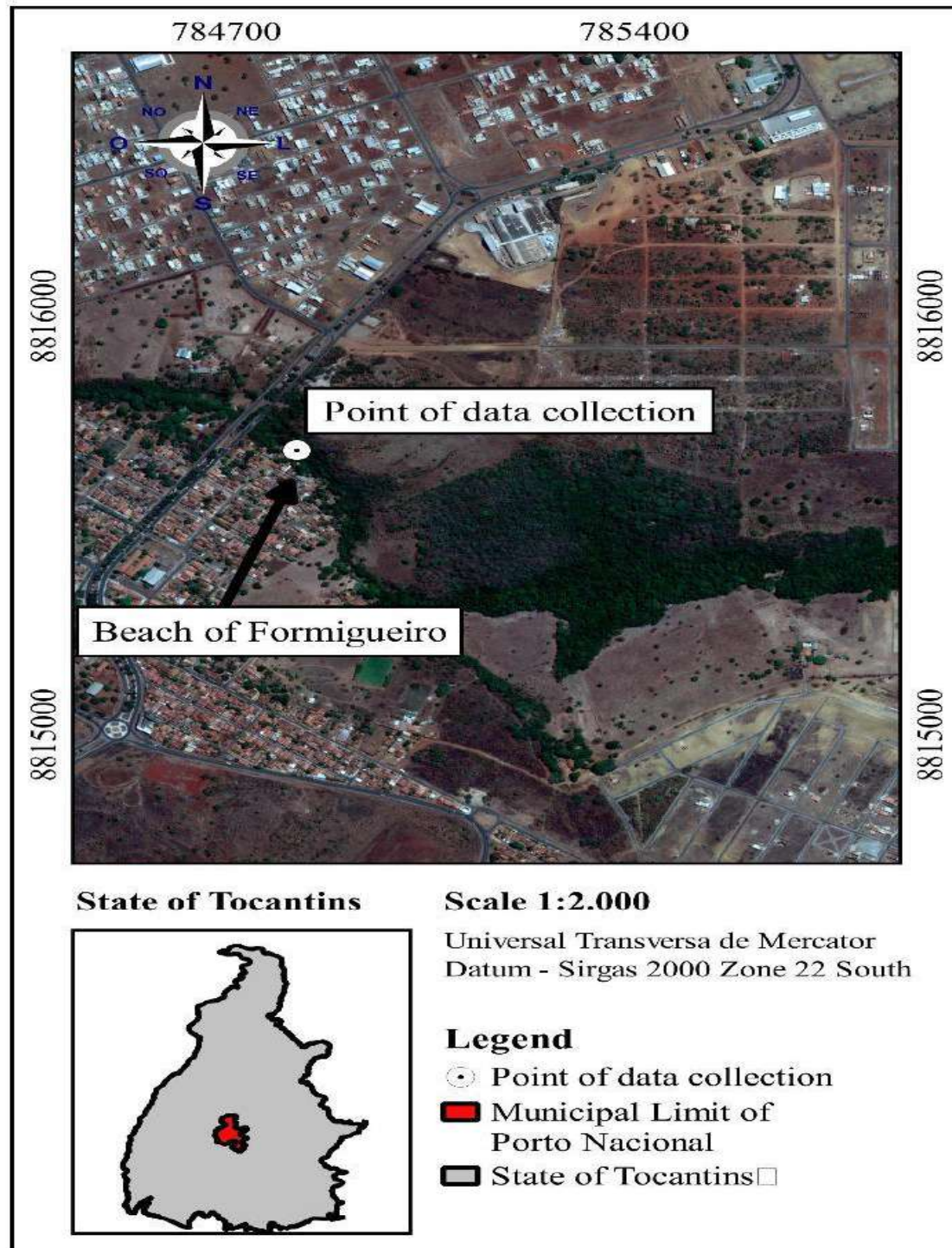
Fig.2: Location and collection map of the Ribeirão São João Basin

Water analyses

The samples were collected initially from the month of August and continued until December of 2018. Serving as basis for the beginning of the analyses, the parameters were: total of coliforms and Escherichia coli (verification of the bathing conditions index). Next, it was performed the methodology in locu, allowing thebeginning of the laboratory methodology.

Field Methodology

The samples were collected on a weekly basis after the selection of the collecting points. We used 100 ml sterilized glass containers, approximately 25 cm deep. The points chosen for collection were selected according to the number and concentration of people bathing in the locations, following Art. 5, single paragraph of CONAMA Resolution No. 274/2000.

Laboratory Methodology

The samples collected in a 1L flask were transported to the Laboratory of Chemistry of the Instituto Federal do Tocantins - Porto Nacional Campus, where the microbiological analyses were carried out on the E. coli group, based on the filter membrane technique according to the methodology described by Standard Methods (APHA, 2005).

BATHING CONDITIONS

According to Aureliano (2000), bathing conditions is a parameter based on the analysis of the quality of the water that will come into contact with people. This verification is performed based on the samples collected in locu, and they later go through laboratory tests to check if the water fits the parameters necessary to be used for recreation. Follow the classification of the water according to table 01.

Table.1: Classification of water regarding its bathing conditions according to Resolution 274.

Category	Fecal Coliform(NMP/100ml)	Escherichia Coli (NMP/100ml)
Excelent	< 250	< 200
VeryGood	< 500	< 400
Satisfactory	< 1000	< 800
Unsafe	Above 2500	Above 2000

*NMP: Most probable number by 100 ml. In 80% plus of one set of samples obtained in each of the previous five weeks.

SOURCE: Resolution Nº 274/2000 Do CONAMA;

This study was based on the most probable number (MPN) of microorganisms of the fecal coliform bacteria type found in 100 ml of water sample. Being carried out during the two seasons of the year, at the end of the dry period and beginning of the rainy season, from August to December 2018.

III. RESULTS AND DISCUSSION

It were performed in this study analyses of fecal coliforms and Escherichia coli (E. Coli) in the Formigueiro beach. The results for the whole period of the analyses showed that the water at the research site was always above 2,419.6 NMP / 100 ml. Carvalho Souza (2016), conducted a survey on a beach located in the same city of Porto Nacional, with the monitoring of 3 different points, (PI), where it was verified that the density of E. coli presented variation from 36.3 to 103.4 NMP / 100ml at the point (PII) were much better, ranging from 14.4 to 56.9 NMP / 100ml already at the point (PIII) range from 19.3 to 71 NMP / 100ml.

The water analyses on Formigueiro beach during the months of August to December 2018 showed results that fit the bathing conditions standards at its analyzed point, where there was a variation between 45.8 MPN / 100 ml and 55.8 MPN / 100 ml respectively. In the collection period analyzed, the Formigueiro beach obtained very little or no concentration of visitors or bathers due to the fact that the analyses were carried out on working days and outside the busy season of the beach.

Thus, if we compare this result with the one obtained in 2016 atPorto Real Beach, we noticed that the difference of results can be described by many factors, such as the number of bathers and the wastes received, which are two crucial factors. In terms of flow of tourists and bathers, the beach of Formigueiro is less propitious than the beach of Porto Real; on the other hand, the contribution of animal feces (chickens, cattle, etc.) and human feces from private cesspits and creation of animals along the banks of the basin weighs against Formigueiro beach, which may increase the risk of contamination in the water of that region.

The notion of water quality is linked to the objectives of use attributed to water bodies, so that these uses require different levels of water quality, which vary according to the intended purpose of a given water source (MAGALHÃES JR, 2003A; SPERLING , 2005). After the laboratory tests were carried out in a period of five consecutive months, E. coli values were determined. Bacteria were present in all samples, but the values were acceptable when compared to CONAMA Resolution 274/2000, according to the graph 01.

Graph.1: Parameter evaluated in Formigueiro Beach

TRADUÇÃO DOS TERMOS DO GRÁFICO:
Gráfico demonstrativo das análises da água na Praia do Formigueiro = Demonstrative graph of the analyses of the water on Formigueiro Beach

IV.   CONCLUSION

Therefore, Formigueiro Beach is of a great importance to the community of Jardim Querido. Its waters serve to supply several tank trucks daily, providing water for a car wash located near the shores of the beach, generating income for the residents. It is also used for bathing, leisure, among other multiple uses. Therefore, it is necessary to implement preventive actions, seek partnerships with the city hall and responsible institutions, so that there is a preservation of water, mainly through the awareness of bathers, and also through measures and policies of maintenance by the public administration.

Finally, according to the values obtained during the research, it was verified that that water can be used for recreational activities, since it meets the parameters determined by CONAMA Resolution 274/2000, presenting values below the recommended level and being classified as EXCELLENT.

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Comparative Analysis main Methods Business Process Modeling: Literature Review, Applications and Examples

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Abstract— *Purpose: The offer of business process modeling methodologies is very extensive, making it difficult for BPM scholars to make a sustained choice. In this context, this paper aims to present the main modeling methodologies, with applications, examples and comparisons. Approach: A systematic bibliographic survey and a comparative analysis of these notations used in the implementation of BPM projects were carried out. Findings: According to the bibliometric analysis, the business process modeling notations most portrayed in the works surveyed are: BPMN, UML, EPC e IDEF. From the construction of a consistent overview that allows the comparative analysis of the methodologies, in order to select the one that best suits its specificities it can be verified that, although they share the same objective, each notation has its specific characteristics. Originnality/Value: This study has the main purpose of providing a basis for the adequate indication of the application of studies in the area, in particular those for papers, dissertations and theses.*
Keywords— *BPM, Business Processes Modeling, Business Processes Methodology.*

I. INTRODUCTION

From the 1990s, organizations have experienced an evolution in terms of structural and technological models, bringing new paradigms to change and knowledge (Silva, 2015).

This fact has demanded a new attitude in the personal and managerial styles, directed for a differentiated and emerging reality. In this sense, contemporary companies are gradually becoming organized in a way oriented to the processes that permeate them, following the logic of them, and no longer the departmental reasoning of the functional approach (Malamut, 2005).

Nowadays there is an environment of high competitiveness in the organizational world, this fact leads the current organizations to create and implement mechanisms that promptly and effectively promote the development and optimization of their information systems. In fact, the agility factor is increasingly an aspect of differentiation among organizations, for them to act and respond in advance to the pressures, needs and opportunities of the market.

In this way, companies started to focus on their business processes in order to present high levels of competitiveness and realize that these processes are key factors of organizational success. A Business Process Management (BPM) approach through a set of organized activities ensures greater control, flexibility and ability to align processes with organizational strategy (van der Aalst, 2013). One of these activities present in this approach is the business process modeling that has the ability to define and change organizational processes in a more logical and structured way (Silva, 2015).

The offer of different types of process modeling methodology is quite extensive, making it difficult for project designers to make an appropriate and sustained choice. In this sense, Silva (2015) carried out a study in order to produce a solution to support the analysis of business process modeling notations, with the purpose of facilitating the selection of a methodology in the stage of process modeling, in a BPM approach by the teams that perform it.

This article aims to analyze the main methodologies of business modeling, based on a systematic bibliographic survey, and present a comparative discussion of these main methodologies used in the implementation of BPM projects in organizations, based on the study carried out by Silva (2015), with the main purpose of serving as a basis for indicating the appropriate methodology to apply BPM projects. Additionally, these results are configured as a theoretical reference for application in papers, dissertations and theses.

The paper is organized as follows: Section 2 addresses the theoretical framework on Business Process Management and Business Process Modeling Section 3 presents the research method applied in the article; section 4 presents the results of the bibliometric analysis, showing the main methodologies used in the BPM context; section 5 contains a comparative analysis of the main Business Process Modeling Methodologies from the study carried out by Silva (2015) and section 6 points out the final considerations of this work.

II. THEORETICAL FRAMEWORK
2.1 Business Process Management - BPM

BPM is a holistic management approach (Draghici, Draghici, Olariu & Canda, 2012) developed with great focus on the adoption of Information Technology (IT) (Brocke & Sinnl, 2011). The methodologies, techniques or tools used, act by designing, approving, controlling, as well as analyzing business processes involving the organization, humans, applications, documents and any other source of information (Pyon, Woo & Park, 2011), being increasingly used by organizations in order to promote the effectiveness and efficiency of their business. In addition, according to Toor and Dhir (2011), it strives for innovation, flexibility and integration with technology, all with a focus on aligning the organization with customer needs.

BPM can also be evaluated as a continuous, structured, analytical and multisectoral process improvement that presents several critical factors (Trkman, 2010), to which are associated several methods that allow companies to establish a high orientation for business processes (Skrinjar&Trkman, 2013). It is worth stressing how important is the understanding and involvement of top management, the recognition of information systems, clear responsibilities, as well as a culture that is responsive to business processes (Draghici*et al.,* 2012).

According to Siriram's (2012) understanding, BPM demands a systemic and balanced view, since the business process links the organization, resulting in a harmonization of resources, such as processes, people and systems. For the author, BPM actions demand the assimilation of a niche area, so that one can focus on the critical processes, which are aligned with the strategic objectives of the organization.

For Repa and Bruckner (2015), BPM is a well-established management model for managing the life cycle of a business process, including design, execution and analysis. Haddar, Makni and Abdallah (2014) complement this definition, indicating that BPM is based on the design of a model that satisfies a set of quality criteria, which is a non-trivial task due to the complexity

of the current Business Processes.

In fact, the heterogeneity of these kinds of projects motivated the search for approaches to assist in the design of high quality models at reduced costs. BPM can also be evaluated as a continuous, structured, analytical and multisectoral process improvement, presenting several critical factors (TRKMAN, 2010), to which are associated several methods that allow companies to establish a high orientation for Business Processes (SKRINJAR and TRKMAN, 2013). According to the Association of Business Process Management Professionals, BPM is a managerial discipline with a structured approach to identifying, executing, measuring, monitoring and controlling Business Processes whether they are automated or not, to achieve consistent and targeted results, aligning business processes with the organization's strategic objectives, creating value, and enabling the organization to achieve its business goals more quickly (ABPMP, 2017). BPM, according to Arevolo (2006), seeks to map and improve the company's business processes by means of a life-cycle approach composed of the phases of definition, modeling, testing, distribution, execution, monitoring, analysis and optimization of business processes, as shown in Figure 1.
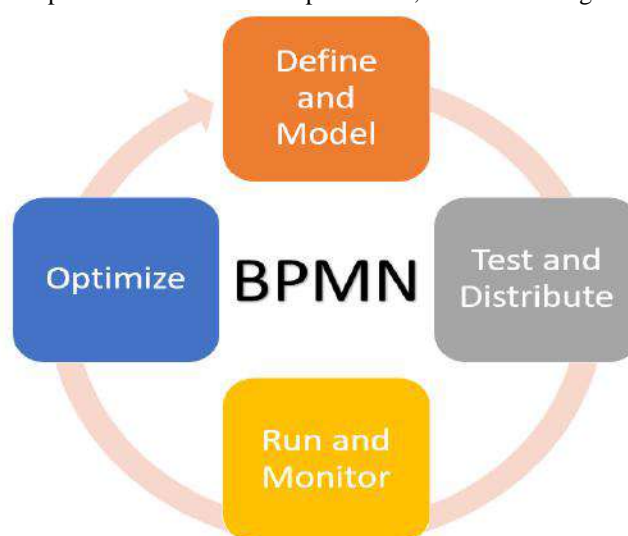
Fig. 1: BPM macroprocesses
Source: Adapted from Arevolo (2006)

Studies in the area of BPM, approach this organizational model as a global vision of the business and highlight the transition from a functional management to a process-oriented management, suggesting the application of BPM from a systemic approach, in which the interrelations of the processes in their contexts are highlighted. Unnecessary and misdirected steps are eliminated and remodeled using the resources available in the main processes (Segatto, Pádua & Martinelli, 2013). It is worth noting that to achieve the desired effectiveness it

is important that BPM is not only addressed as a simple set of IT tools, but rather as an environment in which a process-oriented view and the media requires the organization of the business as a whole (Cho & Lee, 2011). For this, it is necessary to have a well-organized team (Neubauer, 2009), to have knowledge of processes in their individual or collective form (Seethamraju, 2012), and a good selection of crucial processes (Cho & Lee, 2011). Finally, it is observed that in order to understand the operation of the processes and what the existing types, it is essential to determine how they should be managed in order to obtain the best result (Siriram, 2012). Thus, in order to reproduce an organizational structure by processes, it is necessary to have a defined scenario of the company through the mapping of activities, rules and relationships that make up the processes, as well as an adequate business process modeling methodology.

2.2 Business Process Modeling

Process modeling is an activity of representing the processes of an organization that allows the analysis of its current form so that it is improved in the future (Toor & Dhir, 2011) since organizations need to understand them (Rub & Issa, 2012) in order to be able to improve them. A modeling is useful for describing and graphing the important aspects of a given process, distinguishing people, departments, and the link between them (Climent, Mula & Hernández, 2009) in order to portray them or to represent them adequately, emphasizing the aspects that need to be communicated and treated (Vergidis, Turner & Tiwari, 2008).

In general, the process modeling aims to describe characteristics of business processes, showing its structure, the sequence of activities and their relations, the resources used, among others. This is an important tool for understanding and analyzing processes (Rub & Issa, 2012) and has been widely used by organizations to document and improve their operations (Smirnov *et al*., 2012).

For Silveira, Cruz and Schmitz (2016), process modeling has been developed as a technology to describe processes such that they can be understood and developed with greater transparency.

Through this modeling it is possible to plan, create procedures and document them in a consistent way, making it possible to demonstrate the reality of the company and make changes according to the desired future situation (LEOPOLD; MENDLING; GÜNTHER, 2016).

According to Pinggera et al. (2015), real process models present a wide range of problems that converge to the syntactic, semantic and pragmatic quality dimensions of a model. For the authors, the syntactic and semantic quality is related to the construction of the model and addresses the correct use of the modeling language and the extent to which the model truly represents real-world behavior, respectively. In addition, pragmatic quality addresses the extent to which a model supports its use for purposes such as understanding the behavior and development of the system. For the different aspects that constitute a business process to be captured, it is necessary to use methodologies, techniques and standards of process modeling (Cull & Eldabi, 2010). Some of the available techniques are: Business Process Modeling Notation (BPMN),Cognition enhanced Natural language Information Analysis Method (CogNIAM), Extended Business Modeling Language(xBML), Event-driven Process Chain (EPC), Integration DEFinition (IDEF); Unified Modeling Language (UML), Petri Nets, Rapid Application Development(RAD), among others (Toor & Dhir, 2011).

Process modeling methodologies are a set of graphical constructs and rules for how to combine such elaborations. In this universe of methodologies of business process modeling, there are very simple to extremely sophisticated languages. For Georges (2010), the most sophisticated methodologies of business process modeling are those aimed at the development of information systems whether these transactional systems, supervisory systems or workflow management systems. In subsequent sections will be described the main methodologies for representation of business process models, raised through bibliometric research.

III. RESEARCH METHOD: BIBLIOMETRIC ANALYSIS

For the definition of the main methodologies of business process modeling, the bibliometric revision research method proposed by Marasco (2008) was used. For the composition of the bibliographic portfolio, the Scopus database was defined.

Research was carried out in journals without temporal delimitation of published studies. The total amount of works found in this database was a result of the keyword combinations searched in the titles and abstracts. In the step of defining the keywords for the bibliographic review, the keywords "Business Process Modeling" AND "Business Process Management" or "BPM" were used, as shown in Figure 2.

Fig. 2: Keywords of bibliometric research

Business Process Management	Business Process Modeling
"Business Process Management" *"BPM"*	AND *"Business Process Modeling"*

Source: Elaborated by the author (2019)

The works found with these two combinations of terms were mostly chapters of journals, books, norms and articles of congress, in which the results of the bibliometric revision will be presented. Thus, 243 papers were obtained.

IV. MAIN BUSINESS PROCESS MODELING METHODOLOGIES

The origin of the term Business Process Modeling emerged in 1967 in a paper by S. Williams entitled "Business Process Modeling Improves Administrative Control," published in Automation Journal (WILLIAMS, 1967). Since then, this term has gained momentum and a very large number of methodologies and business process modeling languages have emerged (GEORGES, 2010).

In the beginning, business process modeling was done using flow and data representation languages from other areas, such as flowcharts, flow control diagrams and PERT (Program Evaluation and Review Technique) diagrams. Such process modeling languages, which were developed in the first half of the twentieth century, were not enough to model all the aspects necessary for the development and deployment of information systems, emerging the need for the development of more elaborate business process modeling languages that could represent the different aspects necessary for the development and implantation of information systems. Considering Business Process Management as the fundamental object of this review, the Business Process Modeling Methodologies most discussed in the articles collected in the Scopus database from the bibliometric revision are BPMN, UML, EPC and IDEF. The BPMN methodology stands out for being present in about 55% of these published works, as shown in Figure 3, followed by UML (21%), EPC (12%) and IDEF (7%), other methodologies are about 5%. The results of a survey conducted by Kocbek et al. (2015) also showed that BPMN is the default language in the process modeling field.
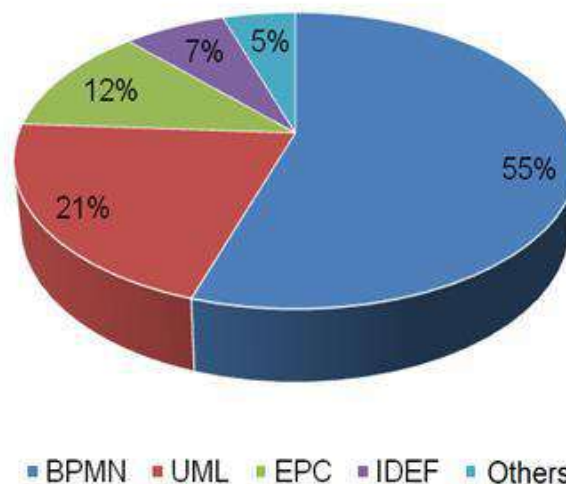
Fig. 3: Business Process Modeling Methodologies addressed in articles in the Scopus database Source: Elaborated by the author (2019)

In the following subtopics, the main methodologies raised from the bibliometric review applied in this study will be discussed, highlighting works present in the scientific literature with the application of such notations.

4.1 Business Process Modeling Notation (BPMN)

BPMN is the largest and most widely accepted methodology for business process modeling (Pavani & Scucuglia, 2011). It is the result of an agreement between several companies of modeling tools, which had their own notations, with the purpose of creating a unique and standard language for business process modeling capable of facilitating the understanding and training of the end user (Almeida, 2009).

BPMN is a set of graphical conventions to describe business processes, specifically designed to coordinate the sequence of processes and the exchange of messages between processes. Zhang, Liang, Shi and Ma (2012) agree with this idea by emphasizing that BPMN represents processes in a standardized way, facilitating the understanding of the organization's stakeholders and employees.

According to Rachdi, En-Nouaary and Dahchour (2016), BPMN is an emerging modeling method that has received much interest and support from academia and industry as an open standard for Business Process Modeling. In addition to being one of the latest modeling notations standardized by OMG (Object Management Group) and BPMI (Business Process Management Initiative), BPMN is considered easy to use for all stakeholders of the organization (managers, analysts, developers, etc.) (KOCBEK et al., 2015) and allows to model a business process with a single type of Business Process Diagram (BPD), avoiding the fragmentation of

the problem inherent in other modeling languages such as UML.

BPMN notation is used to model the current state of processes called AS-IS (current state). Process simulations are performed with the features that the notation offers, they allow to automate the activities in a simple and quick way with the control through visual indicators, thus generating a proposed model with improvements known as TO-BE (future-state) (SCHERUHN; VON ROSING; FALLON, 2015).

The BPMN notation is based on four large aggregates of symbolic elements for the representation of processes: the connection objects; flow objects; swimlanes or sting rays; and artifacts. Through these categories it is possible to find the representative elements of events, activities, roles, workflows, etc. (Chiarello, Emer & Neto, 2014).

Among the most recent papers are publications that apply BPMN methodology in the following areas: health (Onggo et al., 2018), manufacturing (Witsch & Vogel-Heuser, 2012), offshore (Joschka et al., 2015) (Petrasch & Hentschke, 2016), educational (Strîmbei, Dospinescu, Strainu, & Nistor, 2016), e-commerce (Bukhsh, Van Sinderen, Klaas & Barratel, 2017), service (Geiger, Harrer & Lenhard, 2016), etc.

Joschka et al. (2015) described a holistic approach to O & M processes in the field of offshore wind farm power generation. The acquisition and visualization of the process is performed by a risk analysis of all relevant processes. From then on, a tool was designed, which is able to model the processes defined in a BPMN notation, as well as connect and simulate them. n addition, the notation was enriched with new elements, representing other relevant factors that could only be displayed with a much greater effort.

Figure 4 shows the return trip process modeling by personnel transfer vessel.
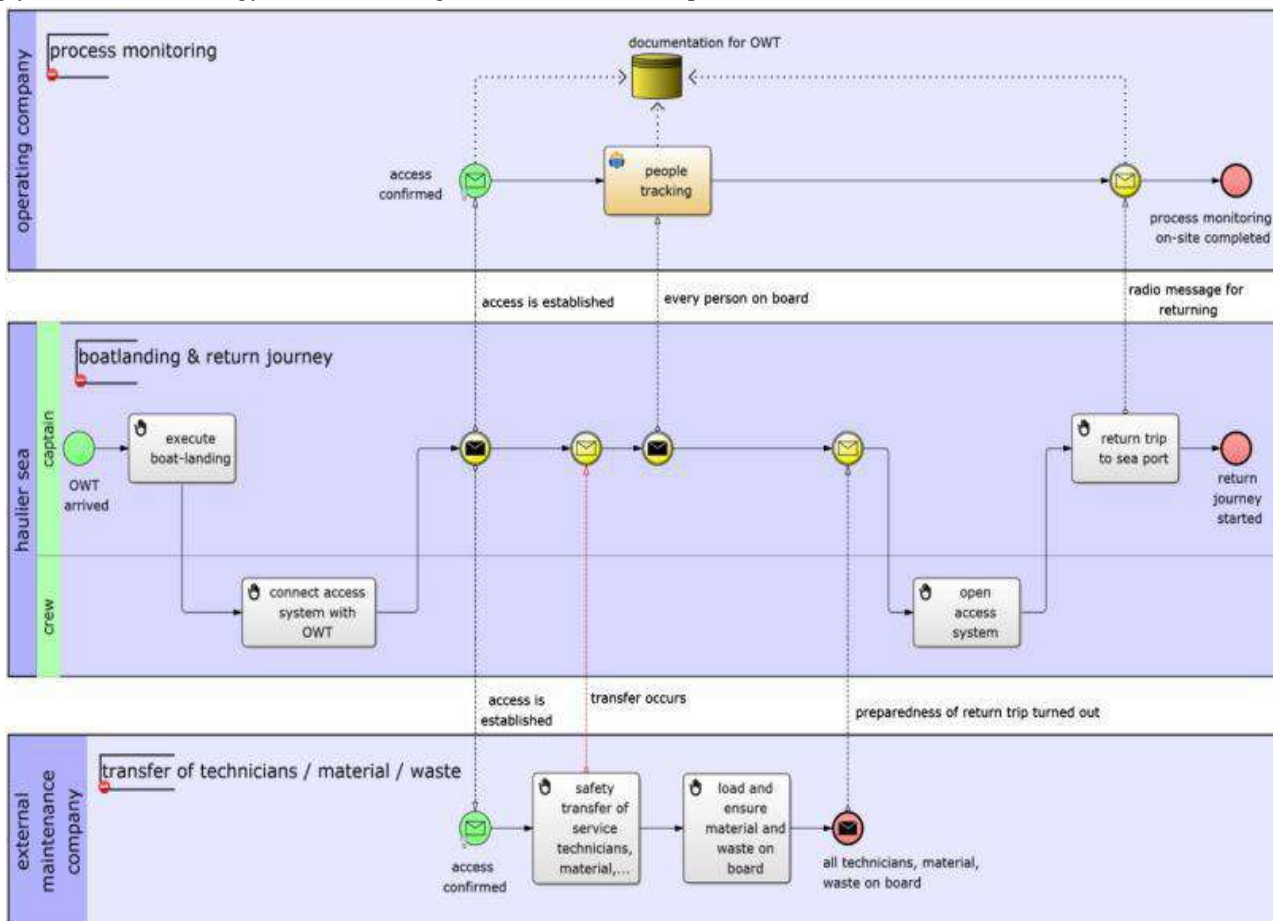
Fig. 4: Modeling of return journey process by personnel transfer vessel
Source: Joschko et al. (2015)

Strîmbei et al. (2016) provided a new view on corporate modeling in the context of BPMN and the university area. This study reveals a specific BPMN approach in the context of university information systems, based on a comparative analysis of some representative universities in the United States and Central Europe. The authors present 4 realistic and complex systems: curriculum and study programs, student admission, student routing, student exchange. Figure 5 shows BPMN modeling for the student exchange process.
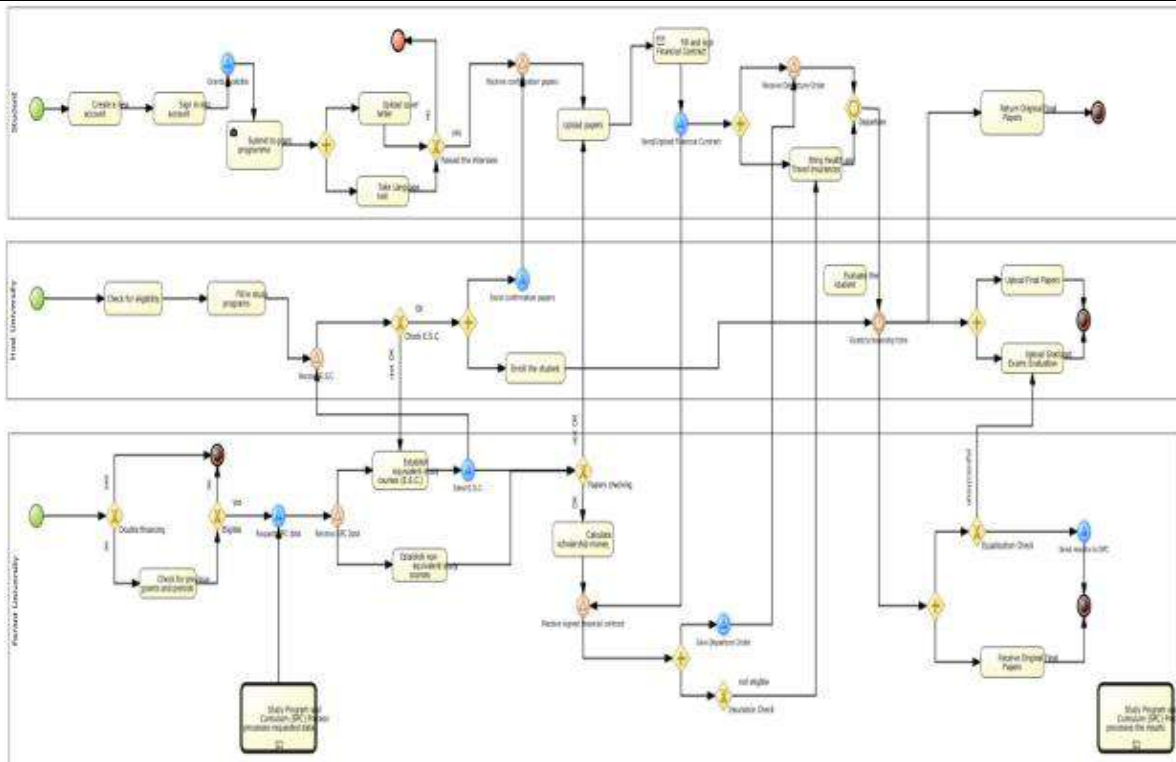
Fig. 5: BPMN modeling for the student exchange process
Source: Strîmbei et al. (2016)

4.2 Unified Modeling Language (UML)

According to Torres (2011), the UML arose from the union of three modeling methodologies: The Booch's method, the Object Modeling Technique method - Jacobson's OMT and the Object-Oriented Software Engineering method - Rumbaugh's.

This technique was developed with the purpose of being a graphical notation for the analysis, specification, construction and documentation of software development support. The main challenge in the development phase of this notation was to create a standardized language with a unique semantics to be able to represent systems of different levels of complexity (Geambasu, 2012). For Booch, Rumbaugh, and Jacobson (2006), the UML is sufficiently expressive to model non-software systems such as workflow, structure and behavior of hardware systems and projects. The success of this methodology has contributed to the adoption of UML models in several systems development initiatives, which include requirements approaches that use business process information often represented in adapted UML diagrams (Torres, 2011). Among the recent publications on the UML methodology, the works with applications in education (De Lope& Medina-Medina, 2016), health (Ferrante, Bonacina& Pinciroli, 2013), industry (Latif, Nadeem& Lee, 2011), services (Zheng, Feng & Zhao, 2014), e-commerce (Maman, Sugiarti & Kumaladewi, 2017), etc stand out.

Ferrante et al. (2013) performed the post-stroke rehabilitation process modeling. In healthcare organizations where rehabilitation procedures are provided for stroke patients, It becomes necessary greater detail in relation to the workflow. The proposed model, implemented in UML, is based on international guidelines and has been refined following the clinical pathway adopted locally by a specialized rehabilitation center. This model describes the organization of delivery of rehabilitation and facilitates the monitoring of recovery during the process. The flexibility of the model guarantees an easy update after the evolution of the process. Figure 6 discusses the class diagram of the rehabilitation process of the study in question.
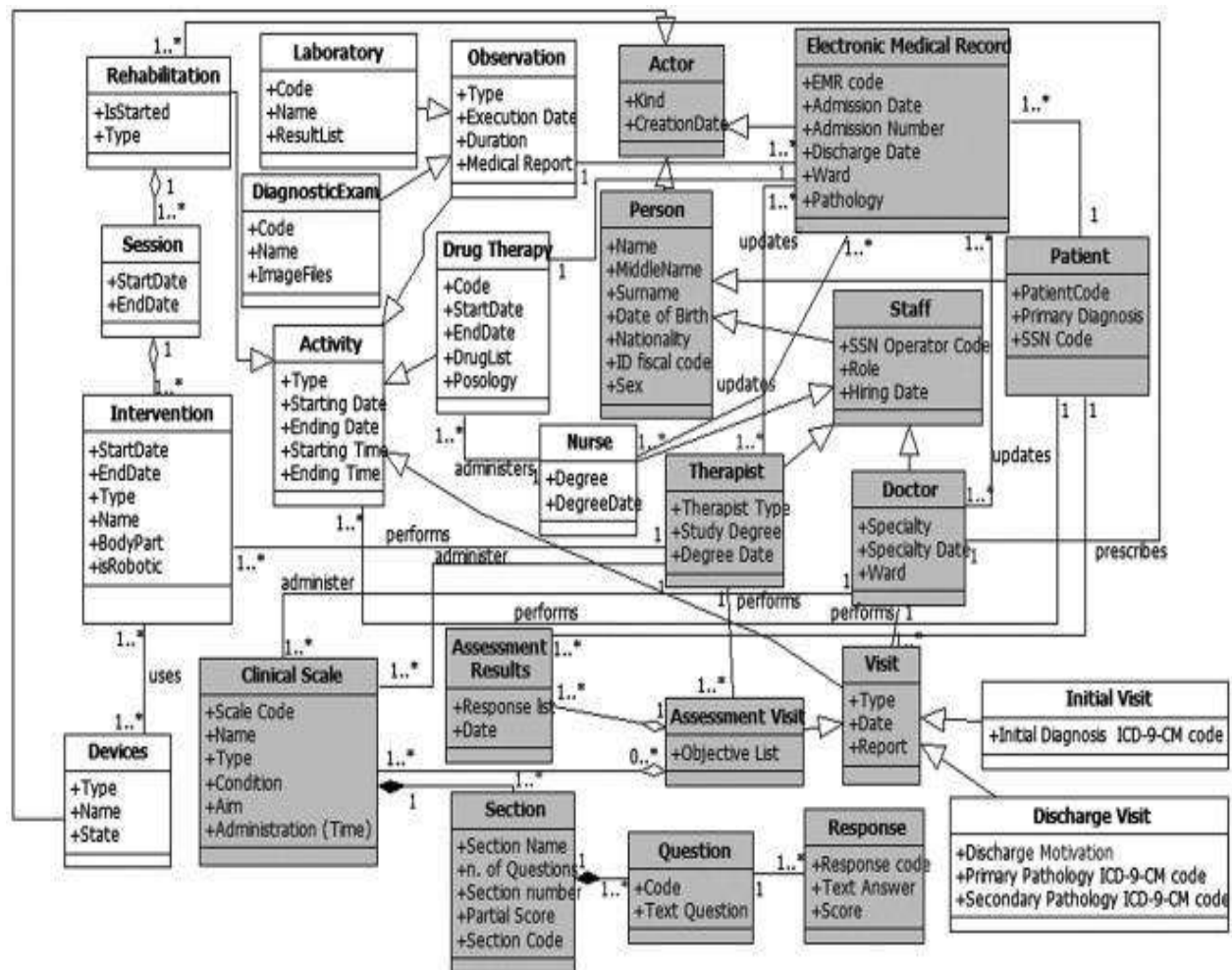
Fig. 6: Process modeling in UML - class diagram of the post-stroke rehabilitation process
Source: Ferrante et al. (2013)

Zheng et al. (2014) developed and designed a library management system based on the UML modeling mechanism to analyze a simple library management system. The authors state that UML can convey information among users, developers, designers and managers efficiently, which enhances their collaboration capabilities and increases the degree of industrialization in software development projects. The design process indicates that, as a software engineering modeling language, UML has a very good application perspective. Figure 7 discusses the UML design classes diagram of book lending management.
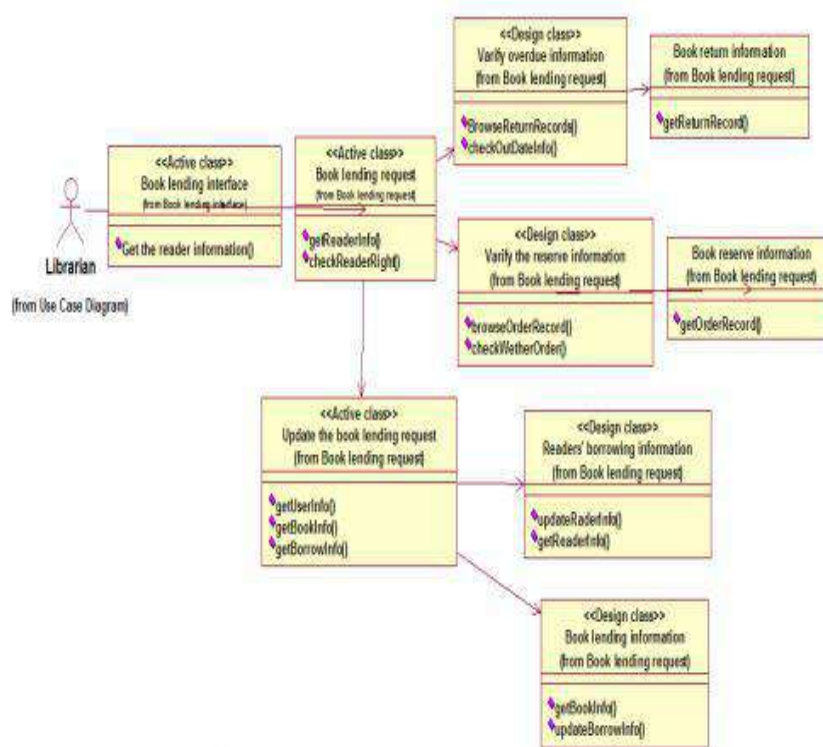
Fig. 7: Diagram of design classes for book lending management
Source: Zheng et al. (2014)

4.3 Event-driven Process Chain (EPC)

The EPC methodology is also one of the most widely used business process modeling languages worldwide (Devillers 2011). It is a notation that was developed in 1992 by researchers from the University of Saarland in partnership with SAP, one of the largest world powers in the production of integrated management software (Mili et al., 2010). Like most notations for process modeling, the EPC also resembles in its structure the flowcharts for representing logical and temporal dependencies between activities in the construction of business processes (Keletso, Chioasca & (Keletso, Chioasca & Zaho, 2014). The main focus of EPC notation is to provide users with a graphical representation of organizational processes in an intuitive way that is quick and easy to understand for both process analysts and business people (Van Wel, 2013). In addition, the EPC is the main language for the representation of business processes of the ARIS methodology (*Architecture of Integrated Information Systems*), which aggregates resources related to the business and organizes them to ensure the development of sequences of activities and tasks that produce value (Davis & Brabander, 2007). Pavani e Scucuglia (2011) consider the EPC a simple and easy to understand

methodology, very similar to flowcharts. The authors point out that the basic difference is that the EPC uses the concepts of logical operators.

Among the works based on a literature review that use the EPC methodology, the publications with applicability in the following areas stand out: services (Giviani & Argourd, 2015), *supply chain*(Mohammadi & Mukhtar, 2012), education (Rostanski,2013), *marketing* (Fleacă, Fleacă & Maiduc, 2016), health (Zarabzadeh*et al.*, 2012), among others.

Giviani and Argourd (2015) mapped the processes of the technical treatment division of the Integrated Library System of São Carlos, São Paulo, Brazil, from its acquisition to its availability to the user, who is responsible for receiving works, classification and indexing, tipping, availability in the collection and inventory of all bibliographic material of the libraries integrating the system. For this, the authors made use of business process modeling through the EPC methodology.

Figure 8 shows the macro processing detail of the library inventory activity.
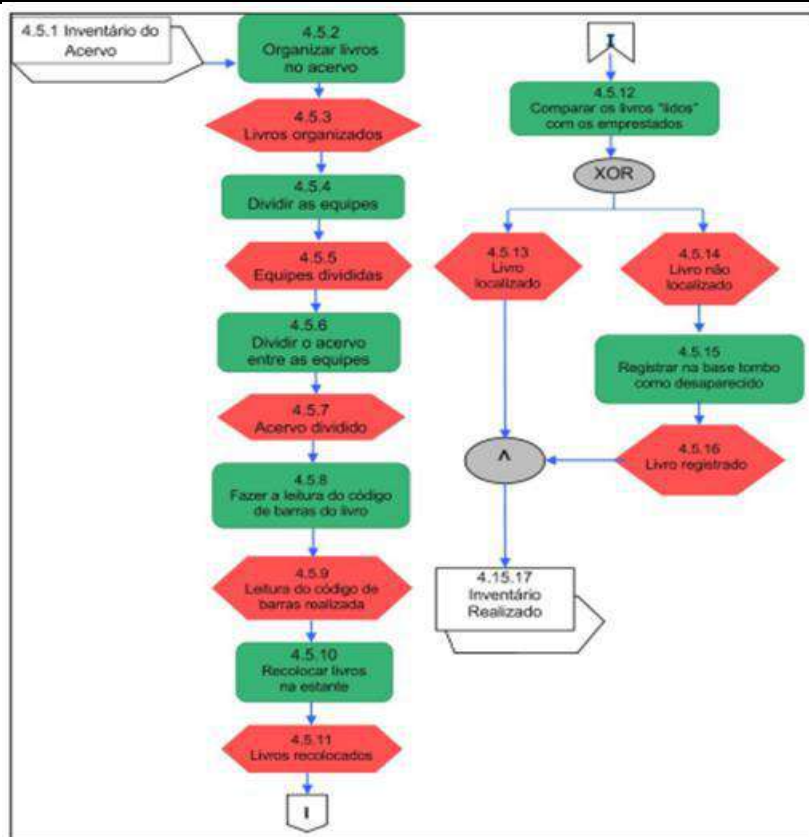
Fig. 8: Modeling of the macroprocess of library inventory activities
Source: Givianie Argourd (2015)

Fleacă, Fleacă and Maiduc (2016) applied the EPC methodology to model the variables of the marketing research process of an organization. The results highlight the benefits of the marketing research workflow that increases the value of market information while lowering the costs of obtaining it in a consistent manner. The authors also highlight the high impact on stakeholder satisfaction.

This work aimed to decipher modern trends in innovation and business process management as well as business process management and provide a useful diagram of marketing research process using the BPMN graphical vocabulary EPC tool (Figure 9).
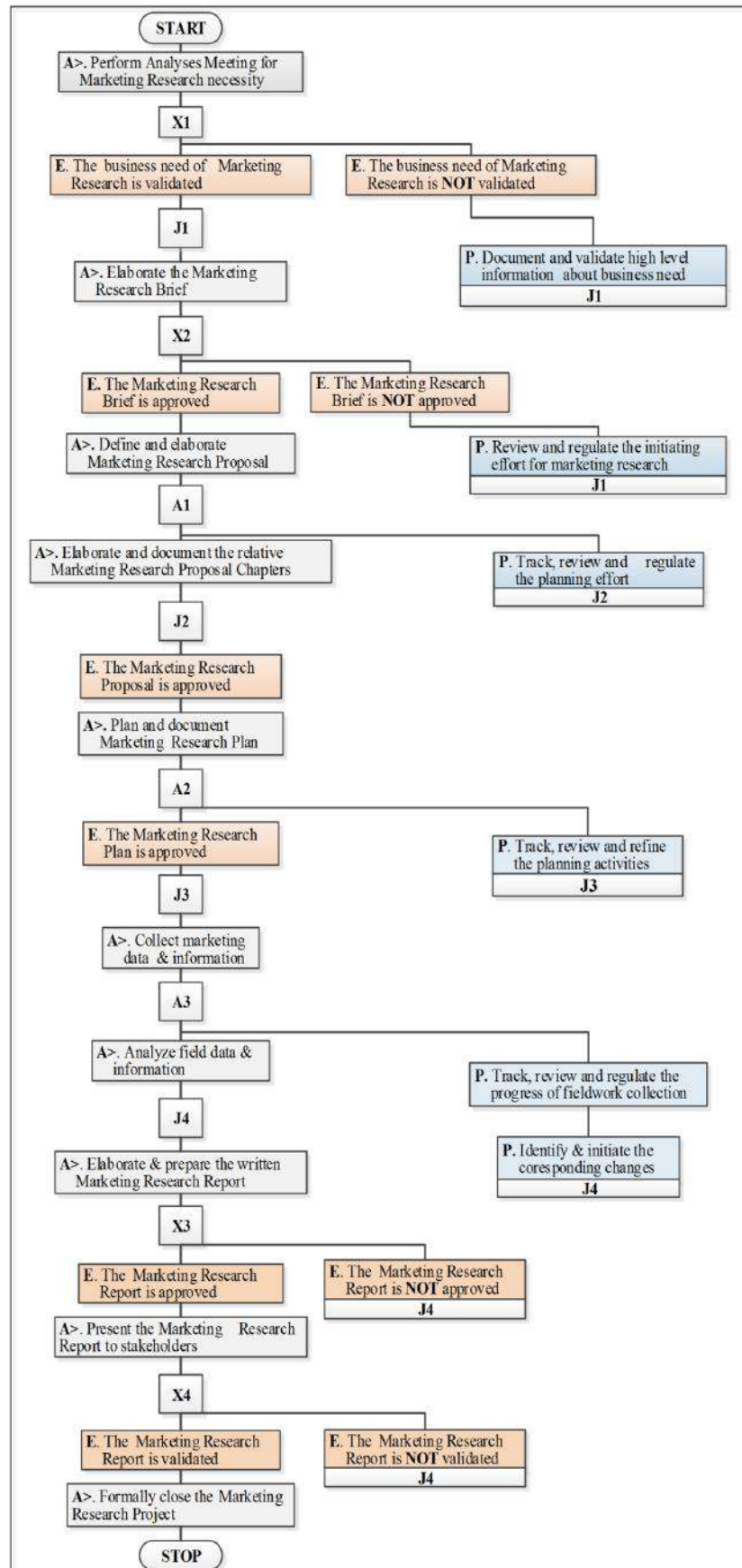
Fig. 9: EPC modeling of the BPMN graphic vocabulary - Diagram of the marketing research process
Source: Fleacă et al. (2016)

4.4 Integration DEFinition (IDEF)

The IDEF technique originated from an initiative of the United States Department of Defense aiming at the creation of a method that would allow the modeling of requirements for systems. Its initial use was in the 70's, and later standardized by the National Institute of Standards and Technology. This methodology allows to analyze processes by means of the construction of models that reflect their current functionality to design the ideal situation of business operation (Almeida, 2009).

The IDEF methodology is composed by 16 techniques for the modeling and analysis of systems, initially designed to be used in the scope of Software Engineering. Each of these techniques is used in different fields of application, however the IDEF0, more directed to modeling business functions, and IDEF3, to concretely model business processes, are in fact the two most and that can be complemented in the modeling of processes, although each of them can also perform individually, in particular the IDEF3 (Costin & Fox 2004).

The IDEF0 technique is capable of representing a set of actions that are supported by ICOMs (Input Control Output Mechanism). ICOM is a graphical representation of one or more activities, which in addition to data and information is able to describe the various elements that are associated with a process (Mykolayczky & Júnior, 2001). The IDEF3 technique was developed specifically to describe the dynamic aspect of the business processes and with the objective of facilitating the survey and description of information systems (Miliet al., 2010).

Among the publications on the UML methodology, the works with applications in manufacturing, (Pınarbaşı, Sel, Alağaş & Yüzükirmizi, 2013), industrial, (Kuo, Hsu, Ku, Chen&Lin, 2013), *supply chain* (Kuo, Hsu, Huang&Gong, 2014), civil construction etc (Tas, Yaman&Tanacan, 2008) are highlighted.

Pınarbaşı et al. (2013) studied flexible manufacturing systems (FMS). The authors proposed an FMS design approach using the IDEF methodology. A systematic layout scheme and a performance evaluation scheme are presented and detailed using this modeling framework. Next, the proposed approach was carried out with a case study of an aeronautical industry to convert an existing traditional production system into FMS. The objective was to find the machine and the mix of products that reach the maximum use, minimizing the cycle time. From the IDEF model, it was observed that the performance of the FMS system was greatly improved when determining the most advantageous level of the system components. Figure 10 shows the IDEF context diagram layout design and performance evaluation.
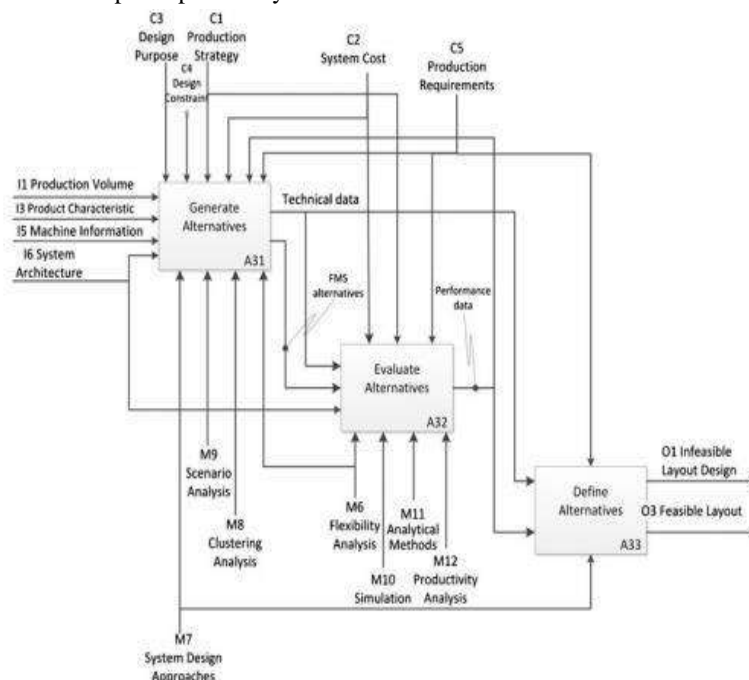
Fig. 10: Modeling in IDEF: Context diagram layout design and performance evaluation
Source: Pinarbaşi et al. (2013)

Ciuriana, Garcia-RomeuaI, Ferrerb and Casadesús (2008) developed a model that can be applied later to the development of an integrated planning and programming tool using an IDEF methodology to design an activity model that integrates process planning and production in metal removal processes.

An activity model was used to develop a system that allows the user to plan the process and the production at

the same time in collaborative engineering work. To design the activity model, a wide variety of parts were evaluated and processed in a real workshop factory. Several activities have been developed in detail to be tested in real cases.

Figure 11 shows the level of process planning in the IDEF model.
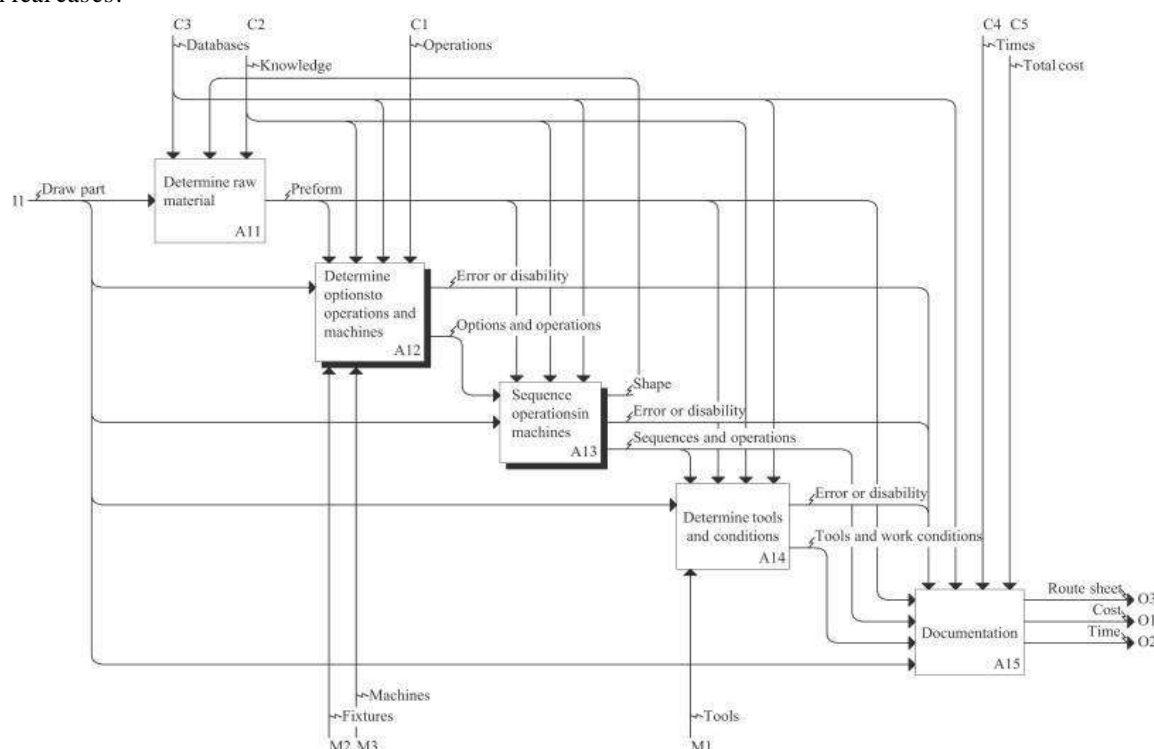
Fig. 11: Process planning level in the IDEF model
Source: Ciuriana et al. (2008)

In the next section, a comparative analysis of the main methodologies of business process modeling raised in this paper- BPMN, UML, EPC and IDEF - is approached, based on the study done by Silva (2015).

V. COMPARATIVE ANALYSIS OF METHODOLOGIES

The business process modeling methodologies succinctly presented in the previous sections have different characteristics, strong points and limitations.Therefore, it is important to find a means of comparing them in order to systematize their differences and similarities. For this purpose, a broad review of the relevant literature was carried out, which deals with the characterization of business process modeling methodologies. Different authors use different criteria to evaluate methodologies of process modeling, although some criteria tend to be more or less universal (Silva, 2015), which are:

- **Expressivity**: it tries to evaluate the language as to its capacity of representation, being for this reason a criterion specially focused on the elements of each notation in order to verify if these elements serve all the purposes and needs

of the most varied models, from the simplest to the more complex;

- **Formalism:** associated with the existence of a description and formal definition of each notation. That is, whether or not each notation has a formal definition of all its elements, as well as clear rules on the use of each one;

- **Usability:** aims to measure how difficult it is to understand and use process modeling notation for both analysts and modelers. It is a criterion that promotes the evaluation of the ease of use of the notations**;**

- **Amiability:** this criterion is concerned with the importance of the graphic aspect of the notation used, that is, one should look for a notation that is not very complex in relation to the elements and relations between them**;**

- **Legibility:** it is understood as the ease of interpreting processes by all stakeholders, such as business analysts, technical and non-technical modelers of these processes, as well as the organization's own management**;**

- **Flexibility:** the presence of graphical elements that allow a high level of flexibility and give several modeling alternatives is a privileged factor for some modelers;
- **Support Tools:** verifies that the chosen language has a variety of solutions to support its implementation;
- **Universality**: in choosing a particular process modeling notation, it analyzes whether the notation is sufficiently recognized in a comprehensive universe, presuming some benefits such as greater support from a community of active use or greater proximity to the user and the developer;
- **Purpose:** In a study of the choice of modeling notation to adopt, it is very important to understand what is intended to be done with the final models, it is necessary for the language to allow the automation and execution of the processes or only to perform analyzes and manipulations on the processes, for example.

Based on systematic analytical studies by authors of the reading of the specialty of business process modeling, Silva (2015) listed such works in each of the comparative criteria mentioned above, in order to highlight the characterization of business process modeling methodologies. Figure 12 shows an adapted version of Silva (2015) of the characteristics of each one of the methodologies raised in this study.

Criterion	BPMN	UML	EPC	IDEF
Expressivity	x	x	x	x
Formalism	x	x	x	x
Usability	x	x	x	x
Amiability	x			
Legibility	x	x	x	x
Flexibility	x			
Support Tools	x	x	x	
Universality	x	x	x	
Purpose	x	x	x	x

Fig. 12: Evaluation criteria of business process modeling methodologies.
Source: Elaborated by the author (2019)

Based on the study of systematization of the analysis of the comparative criteria mentioned, performed by Silva

(2015) in the specific literature, the criterion of "Expressivity of languages" is the one that has received the most attention by the authors. In this way, it is verified that the capacities of the methodologies raised allow to represent the most diverse organizational situations, whether in behavioral, functional, structural or informational terms.

The criteria "Formalism", "Usability", "Readability" and "Purpose" were also related to the functionalities of the four methodologies raised in this study.

The criteria "Formalism", "Usability", "Readability" and "Purpose" were also related to the functionalities of the four methodologies raised in this study.

The BPMN stood out as the only methodology to present the criteria "Friendliness" and "Flexibility". Thus, it is observed that such methodology presents a graphically pleasant notation that can help the work of the users, facilitating the identification of the desired and necessary elements to face the expected result for the final model; and allows a high level of flexibility and offers various modeling alternatives for users.

Finally, it should be noted that the BPMN, UML and EPC methodologies present the criteria "Supporting tools" and "Universality", according to the literature (Silva, 2015) on business process modeling methodologies. Thus these three notations present a multiplicity of solutions to support their implementation and have several widely used software packages that allow the business process analyst to have a professional tool and tested by the most varied organizations; and are also sufficiently recognized in the business community, academic and in terms of market disclosure.

VI. FINAL CONSIDERATIONS

The main objective of this paper was to present, based on theoretical references, a review regarding the main methodologies of business process modeling, from the systematic bibliographic survey in this area of study and the discussion of the comparative analysis of such methodologies.

It is worth highlighting that the use of a process modeling methodology for the documentation of business processes has many advantages, generally related to techniques and standards, created exclusively to support business process design and aimed at optimizing the modeling task processes. For a better performance in this area of process modeling it was clear that the use of a specific methodology for this purpose is crucial.

Thus, according to bibliometric research, BPMN, UML, EPC and IDEF are highlighted as the most portrayed business process modeling methodologies in the papers surveyed: Among the articles in the Scopus database, it was verified that BPMN stands out for being

present in most of these published works, and these results are corroborated by Kocbek et al. (2015), which point out that BPMN is the default language in the process modeling field. Unlike other techniques, BPMN is a standard developed to offer a notation more easily understood and used by all involved in the business processes, besides being a comprehensive technique and offering resources for modeling the most varied types of processes, from the most generic to the most specific.

Through a selection of the most important modeling methodologies in this area, it was possible to verify, from examples of analyzed applications, that, although they share the same objective, each methodology has its specific characteristics. Thus, a comparative analysis of business process modeling methodologies proposed by Silva (2015) was presented, based on a comprehensive review of the relevant literature that deals with the characterization of methodologies, based on the selection of different criteria of evaluation.

Finally, it is concluded that the main purpose in the construction of a consistent overview that, before a given organizational context or BPM project, allows the comparative analysis of methodologies of process modeling, in order to select the one that best suits its specificities. This solution will allow a more informed selection of the notation to serve certain designs by the project team without the need to carry out a large study of the various existing languages. In this way, it is enough to indicate among the several criteria identified, those that seem to be more important to the project or organizational context, attributing them the corresponding valorization. Additionally, these results are configured as a theoretical reference for application in papers, dissertations and theses.

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Abrasive Flow Machining using Abrasive Paste with Oiticica Oil

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Abstract — *This paper presents the use of Abrasive Flow Machining (AFM) and development of abrasive paste using oiticica oil, a typical plant in the northeast region of Brazil, are presented as a necessity in the face of the problems related to the surface finishing process parts employing existing comercial paste. Proper surface finishing and polishing improves the quality and performance efficiency of the work. With this, the main objective of this work is to use an equipment and an alternative paste for the machining of aluminum 6061-T6 and SAE 1045 steel parts. A prepared formulation of abrasive paste with oiticica oil and solid particles of silicon carbide was proposed and compared with a conventional paste in the machining of the two metals in question. The mass and the internal diameter of the parts were analyzed before and after the machining. It was established the variation of the number of cycles in Abrasive Flow Machining, keeping constant the concentration and size of the metal particles in the paste considered. The paste formulation with oiticica oil showed a new commercial paste option under development that may contribute to a better performance in the micro-machining of metal parts.*

Keywords — *Abrasive Flow Machining, Oiticica Oil, Aluminum 6061-T6, SAE 1045 Steel.*

I. INTRODUCTION

The dimensional precision and alignment, as well as the quality of surface finish, are considered by processes such as machining, polishing, sharpening, that is, traditional methods of surface finishing. These finishing operations represent a critical phase and high cost for global production processes [1, 2].

With this, there is a need to develop a finishing process with broader limits of application areas, better quality performance, increased productivity and the possibility of automating the operation. The Abrasive Flow Machining (AFM) is a process that meets these requirements.

Studies have shown that in the Abrasive Flow Machining, after a few initial cycles, material removals and improvement in surface roughness of the work part surface [3, 4, 5, 6].

Therefore, it proposes in this work the construction and use of the equipment for the Abrasive Flow Machining and the development of an alternative abrasive paste with oiticica oil.

II. OITICICA OIL

The Licânia rigid Benth, vegetation known regionally as oiticica, it belongs to the Crysobalanaceae family, typical of riparian forests of the caatinga, grows in deep alluvial watersheds of rivers and streams that are in the regions of northeast states of Brazil (Piauí, Ceará, Rio Grande do Norte and Paraíba), mainly in the backwoods [7]. It is from the nut that the highest oil content is extracted, used in large scale by the industries producing automotive paints, printers, varnishes, fine glaze and tarpaulins [8].

The oiticica has its potential underutilized, being often employed only in the soap industry, is a species that presents high yield relative to others in the production of oil. The nut occupies about 70% of the composition of the fruit and 60% to 63% of oil content [9].

III. ABRASIVE FLOW MACHINING

The Abrasive Flow Machining is a non-traditional machining process which removes the material from the surface of the part and produces residual compressive tension, can be worked with various metal materials such as steel, stainless steel, aluminum, zinc, brass, cast iron, titanium and nickel alloys, as well as in thermoplastic materials, which can not be machined by conventional machining processes efficiently and economically [5], [10]. The purpose of this process is to produce a nano-level finish on machined componentes, time saving, and is considered one of the best methods for finishing complex geometries not accessible by conventional finishing tools. In Abrasive Flow Machining a semi-solid and flexible abrasive compound ("paste") is charged and

forced through, by an extrusion process, on the surface to be machined of one or more parts, removing small amounts of material with each pass. The paste is composed of the semi-solid carrier and the abrasive grains, that is, it functions as a sandpaper and its particles act as cutting tools. The abrasive action during the process depends on the extrusion pressure, volume and flow rate of the paste, determined by machine configuration (equipment) and the paste passage área, considering the type of paste to be used, its formulation includes the viscosity, the type and size of abrasives [11]. However, the influence of three controllable variables (extrusion pressure, concentration and abrasive grain size) are responses to the removal of material and consequently internal diameter increase.

Abrasive Flow Machining can produce surface finishes of up to 0.05 µm, to thin out small holes with diameters of 0.2 mm, generate curved surfaces with radii ranging from 0.025 mm to 1.5 mm [12].

The abrasive paste is the main component of the Abrasive Flow Machining process. The paste consists of a viscoelastic polymer reinforced with the abrasive particles. This viscoelastic polymer acts as a carrier medium and the abrasive particles act as a cutting tool that removes the material from the work part. The polymer pastes used are Polybiosiloxane and Silicone Rubber, the commonly used abrasives are silicon carbides, aluminum oxide, boron carbide and polycrystalline Diamond [13].

In this work it is proposed the use of an abrasive paste using oiticica oil.

IV. MATERIALS AND METHODS

The tests were carried out using a hydraulic press and a Abrasive Flow Machining device also developed, as shown in Figure 1.

The hydraulic press was used to perform the compression movement, where the piston compresses the abrasive paste downwards inside the cylinder, forcing it to pass through the internal diameter of the parts fixed in the working support. As a result, the abrasive paste abrades the tested parts. After the initial linear movement of 25 mm, the cylinders are manually inverted.

Fig. 1: Abrasive Flow Machining Equipment

In the opposite direction, the 25 mm stroke is again completed and the work part wears. This combination of movements in both opposing directions compose a cycle in the Abrasive Flow Machining process [14].

The applied pressure was 50 bar (725.189 Psi). The tested aluminum and steel parts are machined for a number of pre-determined cycles. For the aluminum and steel parts for both the conventional pastes, commercial use and the developed paste, 720 compression cycles were carried out.

After the Abrasive Flow Machining procedure, the parts were removed from the equipment and underwent a cleaning process, to start the measurements of mass and diameter of the machined parts.

To measure the masses of the work parts a balance of the mark Bel Engineering Mark was used, model M214A, with resolution of 0.0001 g, under the room temperature of 33°C and ambient air relative humidity of 44%. The amount of material removed from each part was estimated by the difference between its masses, respectively before and after each machining operation.

The machining tests were performed with two types of working materials 6061-T6 aluminum and SAE 1045 steel, this is because aluminum has a greater lightness in transportation and higher resistance to corrosion and steel is currently the most used metal alloy, being used intensively in numerous applications such as machines, tools and construction.

After that, the parts were prepared and transformed in the formats established, as shown in Figures 2 and 3, so as to be fixed by threading in the holes of the working support.

Fig. 2: Aluminum parts 6061-T6

Fig. 3: Steel parts SAE1045

The paste developed for the tests is a mixture of plaster powder (2.400 grams), abrasive particles of silicon carbide (500 grams), oiticica oil (600 grams) and linseed oil (5 grams).

The plaster powder, oiticica oil and linseed oil were mixed with the abrasive particles in a defined ratio (0.685: 0.171: 0.001: 0.143) respectively, under the conditions of room temperature of 27°C and humidity of 79% to achieve the desired percentage concentration of particles by weight [weight of abrasive particles x 100 / (weight of developed paste)]. However, the common definition of the percentage of abrasive particle concentration is given by: weight of the abrasive particles x 100 / (weight of the abrasive paste). The homogenization of the abrasive paste was performed manually. Before starting the actual tests, a preliminary one was performed with 2 machining cycles for every 5 work parts, in order to obtaining a homogeneous mixture inside the equipment cylinders [14].

V. EXPERIMENTAL RESULTS

The results obtained after the accomplishment of the machining tests related to the removal of material and variation of the internal diameters of the machined parts will be presented.

During the tests, the influence of the number of cycles and the type of abrasive paste employed on the amount of material removed and on the variation of the internal diameter was evaluated, while the concentration, the size of the abrasives and the paste speed remained constant. The results obtained with the developed abrasive paste were compared with those obtained in the tests carried out with a conventional (commercial) one. The dimensional analysis of the machined parts were analyzed by means of images obtained by scanning electron microscopy (SEM). The first result presents the values of material removal in grams, according to the variation of the number of cycles, which were 20, 60 and 100 cycles for the aluminum and steel parts, according to Figures 2 and 3. The use of the conventional paste was compared to the paste developed

in this work for Abrasive Flow Machining. Each experiment was realized in a set of 5 parts for each cycle. Table 1 shows the material removal for aluminum and Table 2 shows the removal for steel, both for 20 cycles and for the conventional and developed pastes. The same procedure was repeated for 60 and 100 cycles.

Table.1: Comparation of material removal for aluminum in 20 cycles

Aluminum	Conventional Paste		Developed Paste	
Parts Numbers	Mass before AFM (g)	Mass after AFM (g)	Mass before AFM (g)	Mass after AFM (g)
1	1.6833	1.6820	1.6848	1.6838
2	1.7086	1.6970	1.6920	1.6892
3	1.6995	1.6924	1.6948	1.6942
4	1.6935	1.6916	1.7075	1.7046
5	1.6922	1.6920	1.6934	1.6908

Table 2 - Comparation of material removal for steel in 20 cycles

Steel	Conventional Paste		Developed Paste	
Parts Numbers	Mass before AFM (g)	Mass after AFM (g)	Mass before AFM (g)	Mass after AFM (g)
1	5.1641	5.1605	5.3942	5.3892
2	5.6866	5.6798	5.6877	5.6757
3	5.2633	5.2546	5.4449	5.4389
4	4.8252	4.8214	5.3759	5.3691
5	5.7983	5.7934	5.3327	5.3234

Removal of material occurred in the 6 conditions tested, resulting from the combination of 3 cycle numbers and 2 types of materials and are shown in Tables 3 and 4. Where **D** represents the developed paste, **C** is the conventional paste and **n** is the number of cycles.

Table 3 - Average removal of material: Aluminum (g)

D(n100)	C(n100)	C(n20)	C(n60)	D(n20)	D(n60)
0.0331>	0.0241>	0.0221>	0.0157>	0.0153>	0.0139

Table 4 - Average removal of material: Steel (g)

D(n20)	D(n100)	D(n60)	C(n20)	C(n60)	C(n100)
0.0391>	0.0353>	0.0352>	0.0278>	0.0253>	0.0223

Removal of material from steel parts resulted higher than aluminum, although this material offers greater resistance to abrasion in relation to aluminum, due to the fact that in the primary machining the surface finish of the steel parts was inferior compared to that of the aluminum parts.

The second result presents the effect of the parameters of Abrasive Flow Machining on the variation of the internal diameter of the parts and the difference between the initial and final values for the aluminum and steel parts. Table 5 shows the comparison of the diameter before and after the AFM process for the aluminum parts tested in 20 cycles and Table 6 compares the steel parts under the same conditions, for both abrasive pastes.

Table 5 - Comparison of the internal diameters for the aluminum parts in 20 cycles

Aluminum	Conventional Paste		Developed Paste	
Parts Numbers	Diameter before AFM (mm)	Diameter after AFM (mm)	Diameter before AFM (mm)	Diameter after AFM (mm)
1	**7.631**	**7.780**	**7.682**	**7.747**
2	7.872	7.874	7.689	7.800
3	7.746	8.000	7.706	7.885
4	7.998	8.101	7.710	7.928
5	8.325	8.342	7.758	7.873

Table 6 - Comparison of the internal diameters for steel parts in 20 cycles

Steel	Conventional Paste		Developed Paste	
Parts Numbers	Diameter before AFM (mm)	Diameter after AFM (mm)	Diameter before AFM (mm)	Diameter after AFM (mm)
1	**8.208**	**8.295**	**7.585**	**8.071**
2	7.683	8.330	7.288	8.102
3	7.564	8.443	7.288	7.550
4	7.689	8.253	7.552	8.117
5	7.334	8.232	7.766	8.181

The Tables 7 and 8 present the results of increasing diameters for all the cycles tested, comparing the conventional paste with the developed one for the aluminum and steel parts.

Table 7 - Average diameter of parts: Aluminum (mm)

D(n100)	C(n60)	C(n100)	D(n60)	D(n20)	C(n20)
0.649>	0.437>	0.422>	0.272>	0.138>	0.105

Table 8 - Average diameter of parts: Steel (mm)

D(n100)	D(n60)	C(n20)	C(n60)	D(n20)	C(n100)
0.672>	0.628>	0.615>	0.524>	0.508>	0.382

The highest average diameter variation occurred for both aluminum and steel with 100 cycles with the developed paste **D**. However, in all cycles and both materials occurred the increase of the diameter of all the parts. In order to verify the dimensions of the diameters and the effect of the number of cycles, it was used Scanning Electron Microscopy in all the parts tested.

Figures 4 and 5 shows the internal diameter variation of an aluminum part, respectively before and after 20 cycles with the conventional paste.
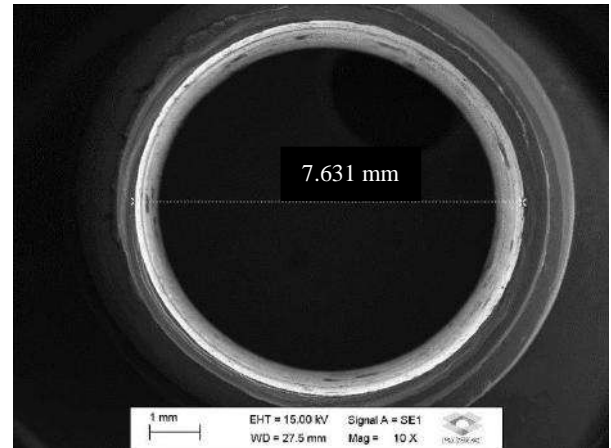
Fig. 4: Aluminum part before the AFM for 20 cycles with the conventional paste
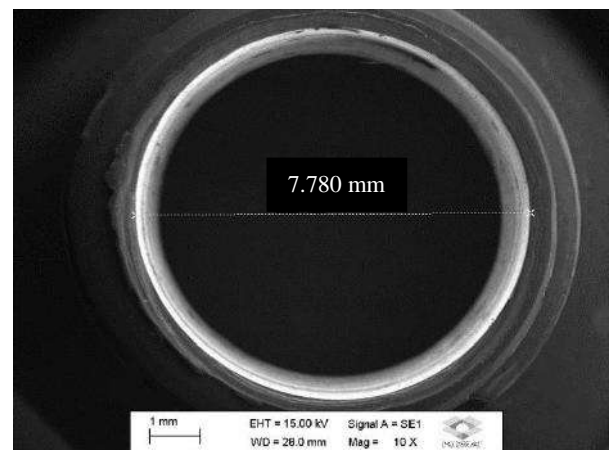
Fig. 5: Aluminum part after the AFM for 20 cycles with the conventional paste

The Figure 6 shows the aluminum part to be tested with the developed paste and the Figure 7 shows the variation of the internal diameter after 20 cycles of the Abrasive Flow Machining process with the developed paste.
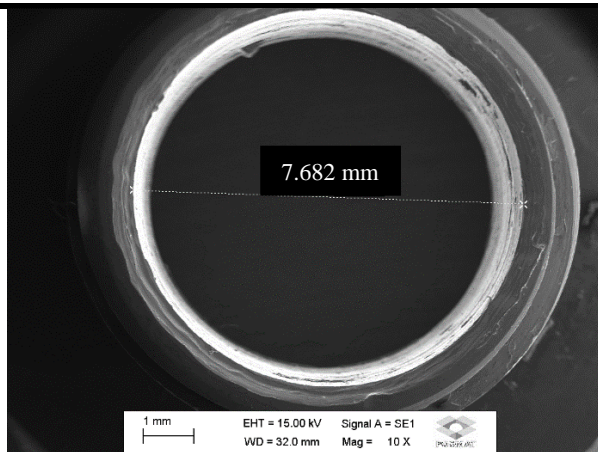
Fig. 6: Aluminum part before AFM for 20 cycles with developed paste
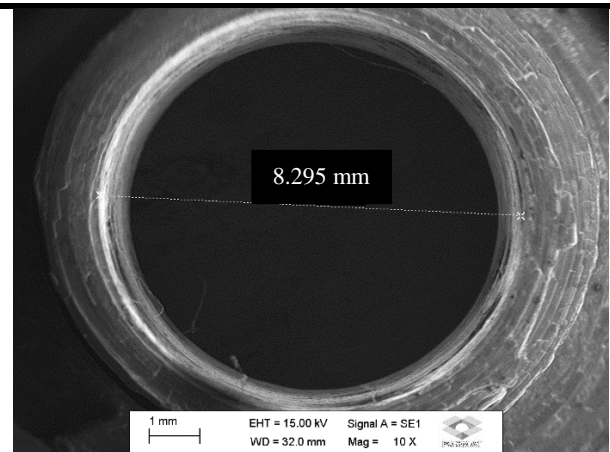
Fig. 9: Steel part after the AFM for 20 cycles with the conventional paste
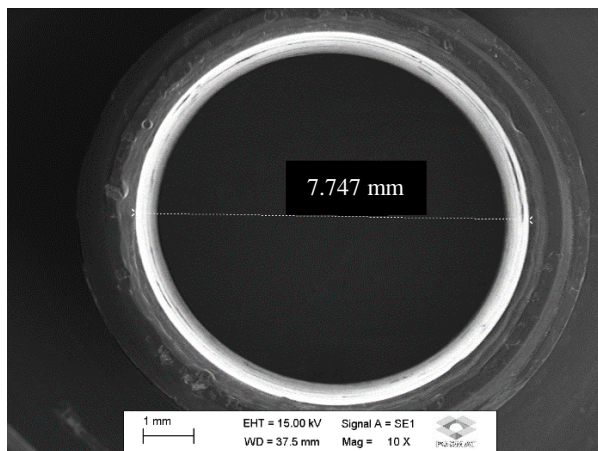
Fig. 7: Aluminum part after the AFM for 20 cycles with the developed paste
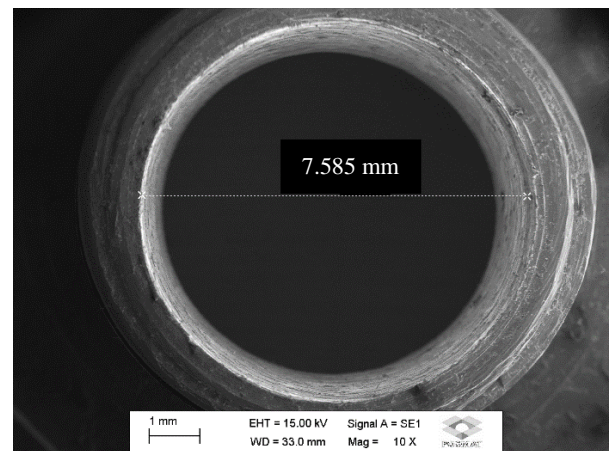
Fig. 10: Steel part before the AFM for 20 cycles with the developed paste

The same procedures was performed with the steel parts. The Figure 8 shows the steel part before the Abrasive Flow Machining procedure; the Figure 9 shows the variation in internal diameter for 20 cycles with the conventional paste.

The Figure 10 shows the steel part before the Abrasive Flow Machining procedure; the Figure 11 shows the variation of the internal diameter for 20 cycles with the paste developed.
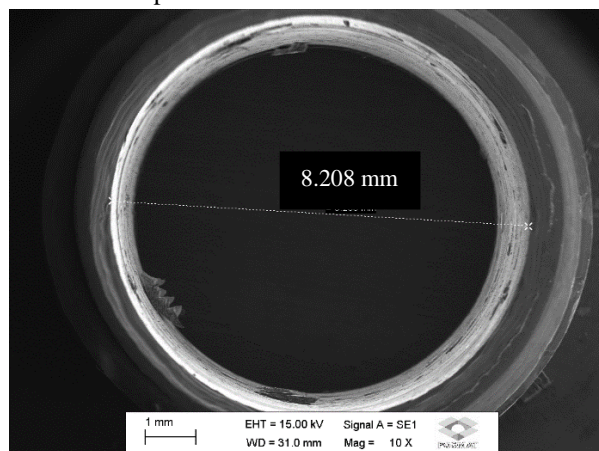
Fig. 8: Steel part before the AFM for 20 cycles with conventional paste
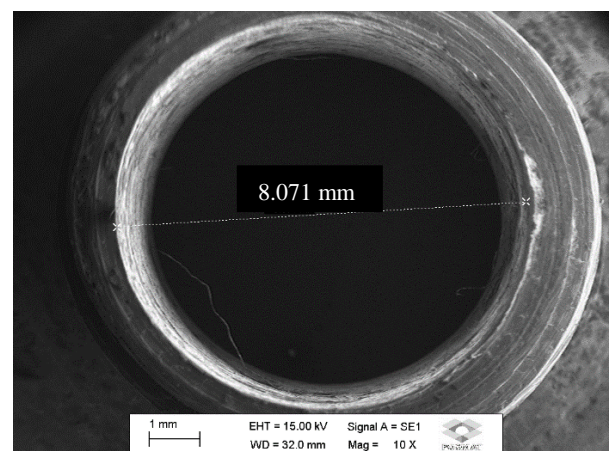
Fig. 11: Steel part after the AFM for 20 cycles with the developed paste

The Figures 4 to 11 represent the Scanning Electron Microscopy with the values of the diameters of both the aluminum and steel parts, before and after the Abrasive Flow Machining, referring to first line, parts numbers of Tables 5 and 6. However, the same procedures was performed for the other pieces tested for 60 and 100 cycles.

VI. CONCLUSION

The paste used experimentally in this work presented good results for the removal of material and for the average variation of the internal diameters of the parts, both for aluminum and steel materials. It has been observed that the removal of material is influenced by the hardness and surface finish of the parts. The highest average variation of diameters occurred in both aluminum and steel with the developed paste for the largest number of cycles D(n100). Therefore, the abrasive paste composed of oiticica oil may serve as an option for the thinning of metal parts by the process of Abrasive Flow Machining.

ACKNOWLEDGEMENTS

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A systematic Review and meta-analysis to Identify and Mitigate the Relationship with the Plasma Membrane of Plant Water Stress and Resistance to Pathogens

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Abstract— *The plasma membrane has very important functions, it is composed of a phospholipid bilayer having a non-uniform and fluid structure that controls input and output of nutrients into the cell and is a way of water transport, whose excess or deficiency affects the plant development cycle. Depending on the degree of water stress, it can also affect the plant resistance against the incidence of pathogens that cause great economic losses. Fungi and viruses mostly take advantage of this deficiency, eliminating the plant defense response producing molecules for this purpose; however, the plants employ proteins produced by resistance genes.*

Keywords— *Water stress, pathogens, plasma membrane resistance.*

I. INTRODUCTION

Recently researchers found that water stress is important and the effect of the level of stress. It is important for irrigation and soils. Also, conducting similar studies on different species and the different origins of the species determined to be resistant to drought in wider fields carries great importance in terms of identifying the species most resistant to drought and in this way preparing healthy landscaping planning in arid fields (Sevik and Cetin, 2015; Cetin, 2015; Yigit et al., 2016; Cetin et al., 2018a; Cetin et al., 2018b; Cetin et al., 2016; Cetin, 2015a).

Climatic factors are affected by temperature, wind, rain, and drought recent studies with drought stress using remote sensing show monitoring of drought stress. It is envisaged that both current land uses and potential future use will be affected by the negative consequences of possible sea-level rise. The morphological structure of low elevations suggests that the effects of elevation can easily proceed to the interior (Sevik and Cetin, 2015; Cetin, 2015; Yigit et al., 2016; Cetin et al., 2018a; Cetin et al., 2018b; Cetin et al., 2016; Cetin, 2015a).

According to Taiz et al. (2017) and Epstein and Bloom (2006), plant physiology is the study of synthesis procedures for plant biological material – e.g. vegetation growth and the functional process, and its interaction with the environment in which operates. The plant cell plasma membrane is an important structure of the cell, being composed of a phospholipid bilayer in which proteins are inserted or just attached. The most abundant lipids present in the plasma membrane are the phospholipids, followed by sterols, which provides mechanical balance on the cell membrane, making it an obstacle to the transport of large

portion of hydrophilic molecules and ions (Appezzato-da-Glória and Carmello-Guerreiro, 2006; Zhou et al., 2018).

Visually observed in the plasma membrane of the plant cell that it does not have a uniform structure, but rather a heterogeneous mosaic of small territories, where some of them have drowned in specific protein and lipid constituents, appearing to be stricter and ordered the others suffering strong interactions between different molecules, especially the lipids that constitute the membrane (Gerbeau-Pissot et al., 2014; Simon-Plas et al., 2011; Taiz et al., 2017).

The plasma membrane has important functions. The selective permeability is responsible for selecting the entry and exit of substances of the cell, allowing the maintenance of its physiological conditions (Appezzato-da-Glória and Carmello-Guerreiro, 2006). In this sense, we can mention aquaporin's proteins (AQPs) that act on the plasma membrane by increasing its permeability, allowing the transport of water and small molecules through the membrane, thereby playing an important role in water regulation of the cell and the water use efficiently(Epstein and Bloom, 2006; Lu et al., 2018).

Water stress

The plasma membrane is a phospholipid bilayer, in which various phospholipids are distributed asymmetrically between the two sheets layers of the membrane forming a primary division of the interior of the cell (protoplast), and the external space (apoplast) having a key role in the entry and exit of cell nutrients (Epstein and Bloom, 2006; Wang et al., 2018)., One of the main constraints to plant is water, whose deficit in the soil can induce water stress, causing morphological and physiological changes, with falls in productivity (Dutra, 2012). The water is the main constituent of plant tissues, corresponding in some cases with 95% of the total weight of the green mass. In this sense, it is very important for the healthy development of a plant that its tissues receive permanently an optimal water amount. The high water content is directly related to the conservation of swelling of the tissues necessary for photosynthesis, flowering, fruiting and condition of origin of products. During the development of the plant, it performs transpiration, guttation (or sweating) and exudation, processes that cause the loss of 98% of the absorbed water(Pes and Arenhardt, 2015).

The concept of water stress is controversial for a long time. Inside the agronomic context, water stress is the availability of water for the plant that generates a reduction in the economic return of cultivation. in the physiological context, the problem occurs when a specific process is affected or not. The agronomic and physiological stresses can be caused either by excess or shortage of water(Rosolem, 2014).

Plants placed in mangrove areas, wetlands or areas near rivers and lakes are subject to stress by excess water, which, depending on the intensity, can be lethal because it impairs gas exchange between the roots and soil, causing other stress, oxidative (Lopez, 2013). Drought is probably the most important factor in the agricultural branch, limiting crop yields worldwide, an example is corn: in tropical regions provides 95% of human consumption of cultivars are grown in areas subject to drought, which consequently generates a subversion from 10% to 50% of production, 80% in their cultivation areas.

It should be noted that during the drought, one of the adaptations of this plant machinery, is the accumulation of solutes in the active cell. This event is known as osmotic adjustment, a harmony in the conservation of turgor, plant growth and photosynthesis production in low water availability values on the sheet(Pimentel, 1999). Due to its complexity, drought tolerance is probably the most difficult feature for genetic improvement through conventional breeding plants. The challenge is even greater for the development of cultivars tolerant to drought for the Brazilian environment where the occurrence and severity of drought may vary each year (Petcu et al., 2013; Rosolem, 2014).

The effects of water stress

When the plant is in an environment with sufficient water availability, its cells are in the isotonic state (Figure 1), while with concentrations of solutes in the internal and external balance. However, when a low water availability, the cell before in isotonic state, performs a process called plasmolysis (Figure 2), in which, due to lack of water causes the extracellular medium has a higher solute concentration than the intracellular and due to this change in the concentration of extracellular solutes that the water was inside the vacuoles of the cell migrates to the external environment, resulting in the contraction of the vacuoles, giving an aspect contraction of the cell (Shigematsu et al., 2005).
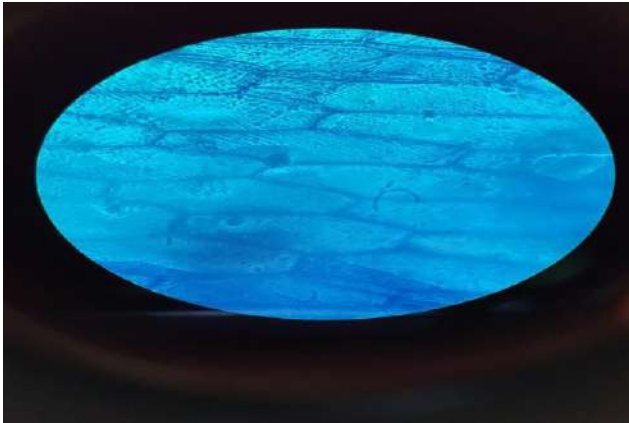
Fig.1: Plant tissue, cells in isotonic conditions, using methylene blue colored; microscopy, x400. Source: Authors, 2018.
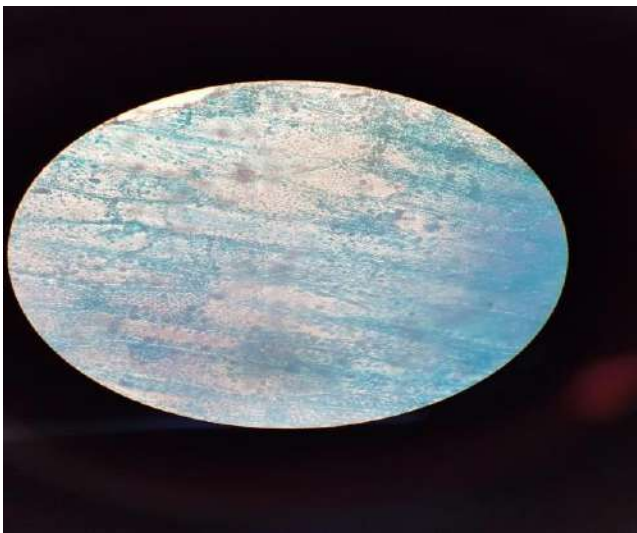
Fig.2: Plant tissue, plasmolyzed cells using colored methylene blue; microscopy, x400. Source: Authors, 2018.

According to the authors Fanti and Perez (2004), the plant when subjected to a high degree of water stress or salinity, can cause the non-viability of the germ of the seed process. In this sense, the reduction of water and osmotic potential affects the process of seed development. The absence of water may also cause the vulnerability of plants to diseases and pests and can cause the closure of stomata, thus reducing the development, resulting in the accumulation of solutes and antioxidants, reducing the development leaf area and stem. Water stress causes the synthesis of abscisic acid in the roots, where it is causing root and development and formation of secondary roots and is transported by various parts of the plant may have other responses, for example, the reduced growth of leaves and their abscission or advanced to the reproductive cycle. (Fanti and Perez, 2004; Scalon, 2011).

Losses arising by water stress in agricultural production depend on the intensity and the duration of water stress to the crops. If the stress is severe for a long period of time, the damage can be devastating to crops. If stress is moderate, with a lower water deficit, the damage may be reversible or cause less impact on production.

Losses in yield, relate much to the genetic material and adapted cultured specimen loss or lack of water (Ryan, 1990). When the plant is under water stress is the production of proteases, which are proteins related to the digestion of other proteins (Tremacoldi, 2009); at the same time is also stimulated the synthesis of protease inhibitors to control its proteolytic activity, in the event of an uncontrolled way breaks the cell membranes of the plant damage most cellular proteins and a final causes premature senescence of the plant. Studies on the plant response to drought in molecular levels show that the protease inhibitors are also compromised multivalent proteins in plant defense s against pathogens and herbivores. Inhibitors also affect the development of insects indirectly by increasing the production of digestive proteases to compensate for lower levels of amino acids available, and these amino acids would be shifted to the synthesis of more proteases to the detriment of other essential proteins (Faustino, 2015).

Pathogenic agents

According to Lopez (2013) and Righi (2012), economic loss as a result of infections in plant material caused by pathogenic agents is well documented. Fungi are the main, cause of diseases in plants in the world. A survey conducted by the Imperial College London and the University of Oxford (Fisher, 2012), demonstrates that soy crops, rice, corn, wheat, and potato have a considerable loss due to successful infection of fungicide, an exorbitant loss that could feed a population of 600 million to 4 billion people. These data reinforce the importance of phytopathological research. Viruses come in agronomic half with his percentage of losses in human cultures affecting the economies of many countries in the world. It is difficult to obtain data from the loss of crops by viral pathogens (Cavalcante et al., 2013).

Diseases caused by viruses have less conspicuous than other types of diseases caused by other pathogens. The phytopathological study of plants and viruses is important because the viruses have the ability to infect a wide variety of existing plant specimens. Economic losses caused by viral infections has already been presented since the beginning of the 90s, where in Southeast Asia rice cultivars represented annual losses estimated at one trillion dollars. In the seventeenth century, a viral infection caused frightening losses in the production of tulip flowers (Lopez, 2013; Righi, 2012).

The infection in plants by pathogens occurs when the pathogen tried to cross the cuticle, hydrophobic layer to the complex aggregate outermost cell walls of the epidermis aerial organs. This body serves as a barrier, preventing water loss and infection by pathogens; the cell wall, which serves as a physical and chemical barrier against the invasion and spread of pests and herbivores; Additionally, released cell wall oligosaccharides act as important signaling molecules, inducing defense responses against pathogens, symbionts and various other physical and chemical barriers such as the toxic secondary metabolites produced by plants themselves (Taiz et al., 2017).

Vegetables have no immune system as animals, defend cells adapting to the environment that is being submitted (Rizzardi, 2003). Generally, plants respond to infection using an innate system of two branches. The first one is constitutive, also called performed; the second is induced, also called post-training. The first group refers to structures synthesized by plants, regardless of the consequences caused by pathogens, containing various actions and functions in plant resistance in particular. It may be noted that in this group there is the presence of cuticles, stomatal and its numerous forms, conducting vessels of sap, silica pilosities layers and this group reacts molecules and common to many classes of microbes, including pathogens. The second group includes the mechanisms of resistance whose expression occurs in response to pathogen infection factors, directly or through its effects on host targets. that could be the formation of halos, buds, lignification or cellular barriers or layers of cork, abscission layers, Tylose, and gel deposition hesperidin, histological and these barriers (Jones and Dangl, 2006).

According to Stangarlin (2011), pathogens produce molecules which eliminate the defense response, however, employ vegetable protein produced by the resistance genes, this intense activity of plant defense and recognized as resistance gene-by-gene. The secondary metabolites with antimicrobial action that have a low molecular weight are known as phytoalexins, they are synthesized by plants in response to physical stress, chemical or biological. They are able to reduce or guard activities of pathogens, conditioned genotype of the host or pathogen. The operation mode of phytoalexins on fungi covers the cytoplasmic disintegration, disorder of cellular substances, protrusion of the plasma membrane, and enzymatic reduction of fungal origin (Gerbeau-Pissot et al., 2014; Simon-Plas et al., 2011; Stangarlin, 2011).

The main pathogens invasion routes are the stomata (Figure 3), and recent research has proven regulatory action is closing and opening of this structure

and the major route of contagion by pathogens. This indicates that the closure of the stomata is a functional output of pathogens and immune effector. Stomata respond to abiotic and biotic signals, and the pathogens perform the use of abiotic environmental biological conditions with a high humidity creating active virulence factors causing the closure of the activities of the stomata, as a method of its infectious process (Gudesblat et al., 2009).
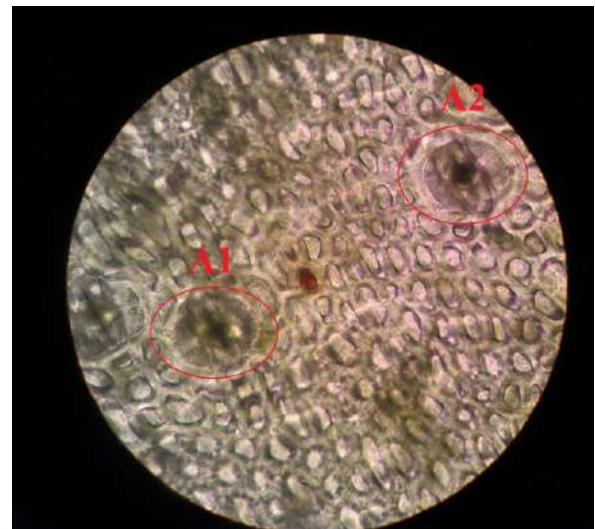
Fig.3: Plant tissue. A1: stomata; A2: stoma; x400 microscopy. Source: Authors, 2018.

Viruses can seep into plant cells by foliar lesions, physical impact or insects. They can also be spread by vegetative propagation or by contaminated seeds. Since fungi secrete hydrolytic enzymes such as cutinases, pectinases, hemicellulases, among others to degrade the cell wall and into the plant cells (Lopez, 2013; Gerbeau-Pissot et al., 2014; Simon-Plas et al., 2011; Taiz et al., 2017.).

These results suggest that the perception of the plasma membrane signal can direct the cellular response, depending on how the membrane reacts and changes its inner structure. However, still, need to be explored by which mechanisms these structural changes in the membrane are translated into defensive reactions (Gerbeau-Pissot et al., 2014; Simon-Plas et al., 2011; Taiz et al., 2017; Wang et al., 2018).

In general, it is assumed that resistance to stress is cost expensive, mainly due to the need for allocation of metabolites for defense end hindering or interrupting other physiological processes of the plant, having a negative impact on its development (Bacete et al., 2018).

II. MATERIAL AND METHODS

The methodology was based on Oliveira, (2018).

To identify articles on the subject was held search in the databases PubMed, ScienceDirect, Sciullo, Google Scholar, Dialnet, WorldWideScience.org, Tandfonline, Dialnet, Microsoft Academic. The following filters have been added to search on ScienceDirect: only journals; title, abstract; key-words: *"Water stress" "pathogens" "plasma membrane resistance"*.

After consultation, the application databases and search strategy between different studies repeated searches were identified. Inclusion criteria for articles were original research articles and conceptualize the research related to the plasma membrane of the plant cell, giving greater emphasis on their role in resistance to incoming interrelated in pathogens during water stress, in different fields of research, including research completed in Portuguese, English, and French.

The grouped articles were excluded in order: repeated irrelevant review, other publishing formats (notice, short communications, perspectives, letters), and other languages. In addition, manual searches were made in reference lists of review articles found with the predetermined keywords.

After removal of the articles repeated between the different searches, the exclusion criteria were applied, as shown in Figure 4. Of the 111 remaining articles were retrieved 35 original research articles related to the plasma membrane and plant water stress and resistance to pathogens. Through manual search were recovered 2 more items.
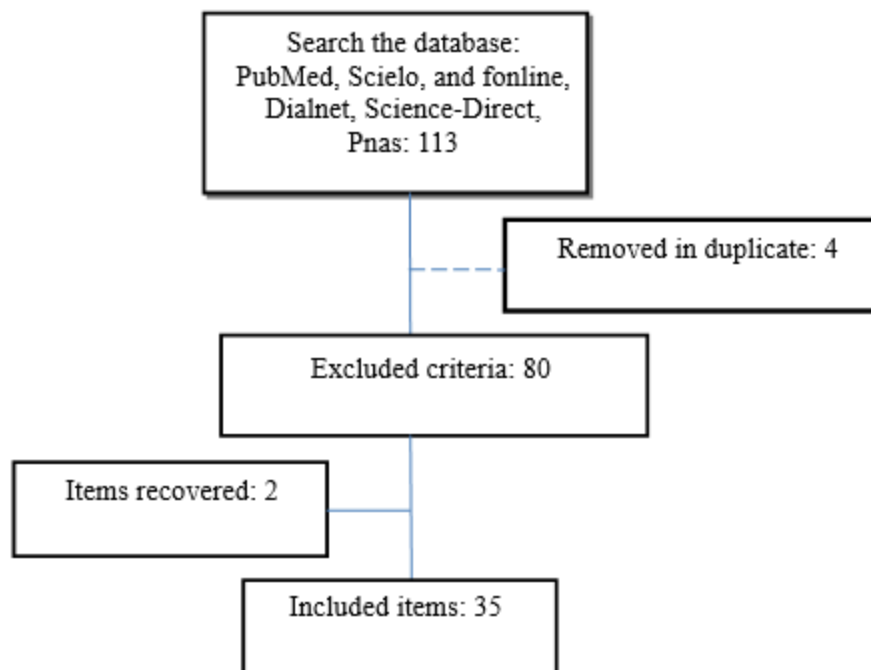
Fig.4: Flowchart of identification and selection of items. Source: Authors, 2018.

III. RESULTS AND DISCUSSIONS

This work focuses on the issue of the operation of the plasma membrane of plant cells, giving greater emphasis on their role in resistance to drought stress and the entry of pathogens. Based on the research conducted, few papers that analyzed pathologies of bacterial origin, which indicates the need to carry out further searches of bacterial pathogens in vegetable medium demonstrating a total of 5.88% of study bacteria (Figure 1). Both through the internet, as for books surveyed for this review, it became clear the lack of information on diseases caused by both bacteria and other neglected diseases.

There was also little information about the viral origin of pathogens in plants, a fact that further limited the theme of development. In this research, it was found that the papers have a relationship study of 14.71% of fungal diseases as statistical relationships demonstrate in Table 1, summarize the work of several authors. It was evident the need to develop more studies on the origin of pathologies both bacteria with other diseases, as there are many studies on fungi in the Brazilian and international agriculture. Future prospects seek the inclusion of a greater number of researches on various plant diseases.

Table.1: Correlation of articles and pathologies found during the research and its percentages.

PATHOLOGIES	REFERENCES	TOTAL	%
VIRUS	LOPEZ., 2013	5	14,71
	TAIZ ET AL. ,2017		
	BOTÂNICA NO INVERNO 2012		
	GALDEANO, KLEINGESINDS,2013		
	MOLLIER,2014		
FUNGI	JORDI LUQUE, 1997	9	26,47
	UTA FUCHS, 2006		
	MÁRIO LÚCIO, 2003		
	CAVALVANTE FLÁVIA, 2013		
	ADNE ABBUD, 2013		
	LAURA BACETE, 2017		
	BENJAMIN PETRE, 2014		
	FANTI SILMARA, 2004		
	STANGARLIN, 2010		
BACTERIUM	LAURA BACETE, 2017	2	5,88
	FERRO, M.I.T.,2006		
FEW DISEASES STUDIED	RIZZARDI MAURO, 2003	4	11,76
	RESENDE MÁRIO,2003		
	FERRO, M.I.T.,2006		
	NAT REV MOL CELL BIOL. 2008		
Total		**20**	58,82

This is the fact that fungi are the causative of larger diseases in world agriculture, viruses are also a major cause of it. There is a need to conduct further study on the pathology of the Bacteriological source and its consequences for plant use in global agronomy.

During our research for this review, the authors reported in their serious problems jobs, there is no way around them completely, since these are unpredictable because the consequences will vary on the event period, the degree of intensity and the reaction presented by plants. In many cases the damage caused by water stress and/or pathogens irreversible.

It is clear to point out that there are changes in the defense mechanisms of plants when they undergo water stress, this can result in infectious agents actions, but these are not invulnerable, there will be the moment that will hit the limit (total system loss of defense) and thus suffered major damage, such as the weakening of your metabolism or even death.

Currently, transgenic approaches have been presented as a solution in research to create an opportunity to light the production of various crops in drought conditions or water deficit. Although it has a comprehensive range study of tolerance to drought, there are challenges associated with the phenotype and identification of materials tolerant to diseases during the drought, which related to challenges of phenotyping and characterization of these, materials tolerant pathogens during stress water. In the scientific community towards the real cause of diseases during drought presents a major debate with several disagreements among researchers.

The authors mentioned that we have access to the use of technologies that can mitigate these factors, those that have provided solutions to various problems. In relation to water stress, it is possible to increase some strategies to meet the momentary need to pass the plants, such as the rational use of water dams will result in less wear of the plant, bringing benefits to the vegetation around them. Thus, it is noteworthy that the importance of studies of environmental rationing, conscious and agro-ecological, the rational use of water resources directed to agricultural production and in its different productive sectors.

We should point out that the motivating text also caveat some possible ways to partially protect plants from invading pathogens, such as the use of chemicals that can stimulate the synthesis of protease inhibitors to control their proteolytic activity, such action would help strengthen the immune system of the plant and thus generate many benefits to agriculture.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Characterization of the Production Chain of the Craft Beer Produced in Western Region of Santa Catarina and Southwest of Paraná - Brazil

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Abstract— *Beer is an age-old alcoholic drink obtained as a product of the fermentation of the wort of malted grain (barley), with the addition or not of other cereals or sources of sugars, called adjuncts, and the addition of hops, using yeast for the fermentation process. The production of special beers in microbreweries has increased significantly in recent years, making it an important business opportunity. In this context, the objective of this study was to characterize the production chain of craft beers produced in the western regions of the state of Santa Catarina and the southwest of the state of Paraná. In addition, this work sought to present the number of beer producers, grouping them by produced volume and determining the types and characteristics of the beers, the origin and the volumes of the raw material or adjuncts used in the processes and the business model. To this end, a survey instrument was developed and applied to 14 microbreweries installed in these two regions. The obtained results revealed that the production of these units vary by up to 300,000 liters of beer per month. They rely on a few partners, most exist for more than 5 years, and the owners are mostly young people of up to 44 years of age. The beer types produced are mostly Pilsen, IPA and Weiss, which rely for up to 90% on imported raw materials, making all the difference in specialty beers. As such, it can be concluded that this production chain seems to be simple, but long, starting with the purchases of raw materials and suppliers, followed by the entire production process, to then be distributed and sold to the final consumers.*
Keywords— *Drinks, inputs, production chain, beers.*

I. INTRODUCTION

Beer is an age-old alcoholic drink obtained as a product of the fermentation of the wort of malted grain (barley), with the addition or not of other cereals or sources of sugars, called adjuncts, and the addition of hops, using yeast for the fermentation process (Tschope, 2001; Rehm; Reed, 1983).

For many centuries, the production of beer on a small scale was sufficient to meet the entire demand, which resulted in a great variety of good-quality beers. However, the wide diffusion and acceptance of this drink throughout its history has led beer to become one of the most popular drinks, being consumed on all five continents in countries of different climates and cultures. Currently, the global brewing market is characterized by large-scale production to meet the high demand for the product, leading to the generation of large quantities of waste.

The brewing industry is one of the engines of the economy in several Brazilian cities, both in those where barley is grown as main activity and in those where the plants, distribution centers and the entire network are located that form this important segment of the national market. This market contributes about 1% to Brazil's GDP (Sindicerv, 2017).

In an industry characterized by market concentration, microbreweries have been emerging regionally. It is estimated that Brazil has around 200 microbreweries. Most of them are located in the South and Southeast regions, but the activity is becoming popular in other regions of the country.

Most microbreweries comply with the German Beer Purity law 111 in order to offer a beverage to the market that has been prepared with special characteristics, instead of competing on price with the brands of large companies. The increasing income of the population has been an important factor for the migration of consumers toward more expensive products. Because of their limited distribution radius, however, these manufacturers usually only meet the demand of the municipality where they are installed (Franceschini, 2006).

Santa Catarina, in particular, has a great beer producing tradition due to the German colonization, since the Germans are considered the fathers of modern beer - the beer produced with wort from barley malt and a grain basis - (Santos, 1985). And there are plenty of microbreweries having success in this ascending market in places like Blumenau, Pomerode, Indaial, Joinville, Gaspar and the western region of the state, with a concentration in the region of Chapecó, among other cities with German colonization.

The beer production chain has manufacturing as its central link, with the supply of inputs in the upstream and the consumption and/or the distribution of the finished product until the point of sale in the downstream. This segment sets a range of activities in motion, from the research, farming (barley, wheat), processing and marketing of inputs and raw materials to the delivery of the product to the consumer in the commercial establishments (Cervbrasil, 2018).

With respect to the inputs used in the manufacturing of beer, it is important to highlight that Brazil has water and is one of the largest agricultural producers in the world, including of cereals. The breweries can therefore count with ample supply of raw materials, with the large firms being able to negotiate prices and payment deadlines. However, part of the ingredients used in the processing of beer is imported, including the barley, yeast and hops, which are *commodities* with prices determined in the international markets. Exchanges rate and import tariffs are therefore of influence on the sector in the country (Tschope, 2001; Araujo, 2016).

The segment uses suppliers for packaging, i.e., aluminum cans and glass bottles. When the companies don't produce their own packages, labels and lids, however, they have bargaining power with their suppliers, making purchases through electronic bids and exclusive contracts with suppliers. The small breweries, in turn, are generally price takers (Donato, 2018).

This study therefore seeks to analyze the conditions for the competitive performance of this chain regarding the condition of the existing production structure and taking systemic assumptions as reference. Its development seeks to further understanding in the field of competitiveness. As a reference, it focuses on the production chain of craft beers, taking its strategic, structural and competitive aspects into account, characterizing, analyzing and presenting proposals for policies and actions that contribute to improving its competitive performance.

II. MATERIALS AND METHODS

The methodology for the identification and exploration of demands by studying the production chain is founded on the systems approach, technological forecasting and market segmentation principles. The benchmarks for gauging performance are efficiency, sustainability, quality and equity (Batalha, 1997). The propositions of Farina and Zylbersztajn (1992) were adopted in this study, with the term production chain of beer representing the set of components involved in the production of raw materials and inputs, industrialization and commercialization to meet the demands of the population and ensure the survival and development of the system itself.

The first contact with the actors of the chain was made through a telephone conversation, and an interview and/or visit was scheduled with those that agreed for an interview. A questionnaire was developed and sent to a sample of companies, which were considered representative and strategic, in order to shed light on situations and processes because of the intrinsic limitations and also the closed nature of some questions and their answers.

2.1 Profile of beer producers

The profile of the beer producer was gathered through the application of a questionnaire. In order to obtain the data, a sample of 15 craft beer producers distributed in the western region of Santa Catarina and Paraná State was taken. Due to the geographical spread of the producing companies, emails and phone calls were used as strategies to apply the questionnaires. Some properties were visited and the questionnaire was then applied '*in situ*'.

2.2. Data analysis

The data analysis was composed of a qualitative and a quantitative step, in addition to a third step merging the results of the previous steps. The raw data was interpreted in the qualitative step, reaching a set of variables for each question and company. During the systematization of the work, some information was gathered on production (number and characterization of craft beer producers, number of producing units and volume produced) and marketing (channels, volumes and prices).

III. RESULTS AND DISCUSSION

3.1 Overview of the craft beer market

The craft beers from Brazilian microbreweries have gained ever more space on the shelves of supermarkets, (physical and virtual) specialized stores and in food services (bars and restaurants). According to the Brazilian Association of Beverages (*Associação Brasileira de Bebidas*, ABRABE, 2018), microbreweries are mostly characterized by the production of small quantities of beer, developed with special ingredients, a greater quantity of malt per hectometer and in family micro-industries. Consequently, the products offered by this type of business are commonly called "premium beers" or

"special beers", meeting consumer demand for special beverages. The craft beer market is growing rapidly and represents a business opportunity. Like any investment, however, caution is needed with craft brewery deployment projects.

The craft beer market is in full expansion and, gradually, a brewing revolution is taking place in Brazil. Every day, new craft beverages are created to meet a growing public thirst for new tastes. Lighter and more refreshing or with a more bitter, pure malt taste or with the use of wheat, the craft breweries are a true vocation of the state.

The state of Santa Catarina has today 50 brands of beer, which together produce more than a million liters per month, according to a survey from the Association of Craft Breweries of Santa Catarina (*Associação das Cervejarias Artesanais de Santa Catarina*, ACASC, 2018). The growth of the market of craft beers in Santa Catarina between 2013 and 2018 can also be observed through the doubling of the number of brands. 28 new businesses started during this period.

The craft beer sector has continued growing in recent years, especially in 2017 and 2018. In the past nine months, the number of independent craft breweries in operation in Brazil jumped from 679 to 835. The comparison between the data from December 2017 and September 2018 was carried out by the Ministry of Agriculture, Livestock and Food Supply (MAPA). The growth of the period is 23%. There are 169,681 registered products by these breweries.

According to MAPA (2018), the number of craft breweries in activity is uncertain. As the body authorizing the operation of these enterprises, the Ministry of Agriculture makes no distinction between the size of the companies. At the end of 2017, there were 679 breweries registered in the ministry - a number 37.7% higher than the 493 recorded in 2016. As for the regional market, the south of Brazil has the largest number of breweries with 369 companies, followed by the east (328), northeast (61), midwest (51) and north (26) of Brazil.

Among the states, Rio Grande do Sul occupies first place in both the number (179) and density of breweries. With respect to the amount of businesses of this type, São Paulo occupies second place (144), followed by Minas Gerais (112), Santa Catarina (102), Paraná (88), Rio de Janeiro (56), Goiás (25), Pernambuco (18), Espírito Santo (16) and Mato Grosso (12).

3.2 Microbreweries in Santa Catarina and Paraná

Of the 190 breweries installed in the state of Paraná and Santa Catarina, 14 are microbreweries located in the western region of Santa Catarina and in the Southwest of Paraná, with eight and six craft breweries, respectively.

These 14 companies were studied in order to characterize the production chain of this type of company.

The results obtained showed that the production of these units (Figure 3) varies between 1,000 and 300,000 liters of beer per month, with 3.6% producing up to 1,000 liters of beer, 39.45% up to 10,000, 39.50% up to 150,000, 8.6% up to 100,000, and 8.85% up to 300,000 liters. This shows that the largest volume is concentrated in breweries that produce between 50,000 to 100.00 liters per month. This data can be seen in figure 1.
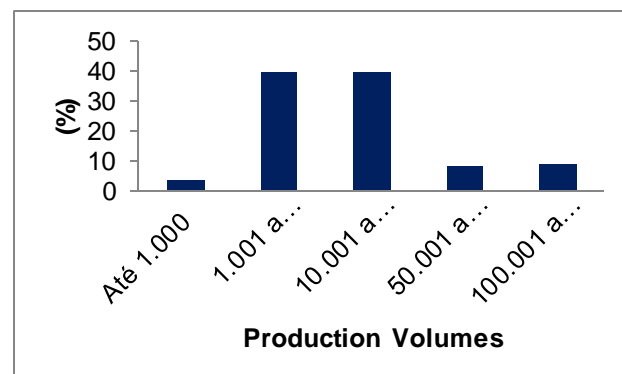
Fig. 1: Production capacity in liters of beer of the units evaluated.

These companies are managed by their owners, with 65.5% having 1 to 2 partners, 22% having 3 to 4 partners, 7% having just one partner and 2% having more than 4 partners.

Of the partners owning these companies, 57.5% have completed higher education, 17% have a graduate's degree, 3.5% have a PhD, 10.5% have a complete secondary education, 2.5% have a technical education and 8.5% have an incomplete higher education.

69% of the owners were 44 years old or younger, which makes the population investing in this type of business young. The other 31% are over 44 years of age. This characteristic may be associated to the fact of the companies being family businesses.

Despite the current growing demand for craft beers from regional microbreweries, some of them are very recent while others have been on the market for some time, with most breweries in the regions under study operating for more than 5 years, totaling 47% of the existing microbreweries. Over the years, new breweries have been established, with currently 53% of companies having up to 4 years of operations. Of these, 16% have less than 1 year of activity.

In the microbreweries where the research was conducted, it was found that the most commonly used filling containers were kegs, with 46.5%, followed by kegs and bottles, with 29%, kegs, bottles and cans, with 11%, kegs,

bottles and growlers, with 6%, and finally 7.5% using only bottles.

There are several styles of craft beers, and in general these microbreweries produce different styles in order to meet the different tastes of beer consumers.

With regard to the types of beers, one can see that the IPA style is one of the most well-known styles. It has more body with more accentuated malt and hops and a herbaceous and earthy profile, which gives it a floral aroma and fruity flavor. This style of beer is produced by 77.5% of microbreweries.

The most well-known style of beer Pilsen, which is a type of lager that follows the German Purity law, composed of only four ingredients: water, yeast, hops and barley malt. It has a golden color and is translucent and light. This beer is produced by 60% of microbreweries.

Another very well-known and appreciated style is the Weiss beer, a wheat beer that has a mild aroma of clove and banana, low quantity hops and a color ranging from a strong and lively yellow to a golden brown. This beer is produced by 55.5% of the companies.

These are the styles produced in larger numbers by the microbreweries under study, which also produce several

Table 1: Origins of the raw material used in the production chain of craft beers.

Raw Material	National (%)	Imported (%)
Hops	22.5	77.5
Malt	45.2	57.5
Yeast	24.8	75.2
Sugars	65.6	34.4
Bottles	48.9	51.1
Carboys	76.8	23.2
Kegs	21.1	78.9
Lids	64.3	35.7
Additives/Clarifiers	18.9	81.1
Flocculators	76.7	23.3
Carbonation	15.7	84.3
Beer Adjuncts	54.1	45.9

3.4 Distribution channels and marketing

In general, the companies under study have similar distribution structures. 49.7% of the beer produced is sold by own bars maintained in annexes to the production units, 18.6% is sold in supermarkets, 12.5% in convenience stores or, according to Araujo (2016), in self-service establishments, and 13% in parties and events. This data can be seen in table 2.

According to the methodology used by Nielsen (2018), beer sales channels can be classified into three groups:

1. Bar (local consumption): commercial establishments equipped for the supply of beer to be consumed at the

other styles, some resembling those already cited with respect to flavor and others being very distinct.

3.3 Acquisition of raw material

The raw material used (Table 1) in the production process of beers by the microbreweries have basically two sources: domestic and imported. Standing out among the national supplies are the packaging for filling, the sugars, the lids of the packaging and the flocculators.

Among the imported raw materials, we find additives and clarifiers, with 81.1%, the priming/carbonation, with 84.3%, the kegs, with 78.9%, the hops, with 77.5%, the yeast, with 75.2%, and the malt, with 57.5%. It should be stressed that the malt is the main raw material used in the production of beer with the greatest impact on the its cost of production. In Brazil, only a small part of demand is produced internally by local malt houses, the remainder is imported from countries that have surplus production.

The raw material is the great differential of special beers and also a great challenge, because big industries absorb national barley production and small businesses need to import it. Almost 90% of the raw material for special beers is imported.

point of sale, such as bars, snack bars, restaurants and nightclubs. In these places, the beer is chilled for immediate consumption (cold market);

Table 2: Main distribution and sales channels of the produced beer

Location	(%)
Own bar	49.7
Supermarkets	18.6
Convenience stores	12.5
Parties	8.0
Events	5.0
Other	6.2

2. Traditional: points of sale, such as bakeries, grocery stores and markets, where there is the presence of a vendor to assist in the purchase and the product is not consumed on the spot;

3. Self-service: establishments that have at least one cash register and that allow the consumer to serve himself without the presence of the seller (basically, supermarkets and hypermarkets).

3.5 Representation of the craft beer production chain

Figure 2 shows the production chain of the craft beer produced by the microbreweries with their organizational and institutional environments and their main components and flows.
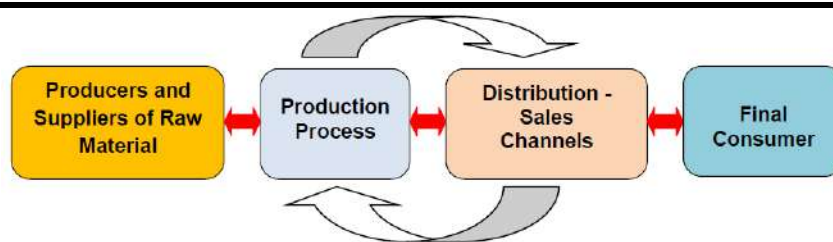
Fig. 2: Characteristics of the Craft Beer Production Chain

The starting point in the identification of the beer production chain, in its linear form, is established by the links with the suppliers of raw materials, which are: barley, hops, yeast, glass packaging, aluminum cans, among other items described in item 3.3.

The intermediate and final components of the chain are characterized by the beer producers, with their production process, passing through the distribution channels, as described in items 3.2, 3.3 and 3.4, and ending up with the final consumers.

IV. CONCLUSIONS

With this study, the conclusion can be drawn that the regions under study have 14 companies with microbrewery characteristics that can be classified as craft beer producers. These breweries have few partners, most between 1 and 2, and these partner-owners are mostly young with up to 44 years of age, with most of them having concluded higher education.

One can also conclude that 50% of the surveyed breweries already exist for more than 5 years and also that new breweries are increasingly emerging to meet the demand of a public that appreciates this world of craft beers. The most-produced styles are the popular Pilsen, the IPA, which is very appreciated by the brewers, the Weiss (wheat beers), the APA and the lagers.

The supplies for production are of national and international origin, with the imports generally being additives and clarifiers; this raw material makes all the difference for the specialty beers. The distribution and sales is done mostly in own bars, but also goes through supermarkets and parties.

Finally, this production chain seems to be simple, but long, starting with the purchases of raw materials and suppliers, followed by the entire production process, to then be distributed and sold to the final consumers.

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Numerical Evaluation of Formation Damage Models for Application in Niger Delta Oil Reservoirs

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Abstract—The frequent random application of formation damage models in the assessment of oil well deliverability has prompted the critical evaluation of these models to streamline their applicability in specific reservoir types. Coupled with the unconsolidated nature of the Niger Delta Agbada formation, the establishment of a unique damage model which will take into account, the textural and structural configuration of the formation sand in its damage estimation is most paramount. In this work, four formation damage models were numerically evaluated and matched to the conventional pressure buildup skin model using reservoir and well production data from five (5) different Niger Delta locations assigned ND-1, ND-2, ND-3, ND4 and ND-5. Result showed that the Frick & Economides model, if adopted within the region can be dreadful for all reservoir cases as it tends to underestimate formation damage implications as well as skin magnitudes since it is primarily a function of the altered permeability and damaged radius only, recording an average skin of 1.30 as against 3.36 for the reference model. The models of Behr & Raflee, Ozkan and Furui et al with reference to the buildup skin model showed promising results in skin magnitude estimation. Further damage analysis revealed that the Furui et al model was most appropriate as it yielded an average Flow Efficiency of 69.40%, an average skin induced pressure drop of 193.98 psi and an average damage factor of 0.3

Keywords— Evaluation, Formation, Model, Niger Delta, Skin.

I. INTRODUCTION

The Niger Delta, proven to have an estimated reserve of about 37.2 billion barrels of oil is branded as one of the major oil and gas province within the Gulf of Guinea. Averaging an estimated daily withdrawal of 1.6 million barrels of oil per day, though greatly attributed to quite a number of socio- economic and political reasons, a good percentage of this reduction in daily production within the province can also be ascribed to a wide range of factors. These factors may be natural or incurred owing to high degree of uncertainties associated with oil and gas exploration. Uncertainties in petro-physical evaluation, reserve estimation, poor evaluation of target recovery mechanisms peculiar to specific reservoirs and many more may retard production benchmarks. Characterized by an unconsolidated sandstone formation, the Niger Delta oil bearing rocks have been thought and proven to suffer some reservoir rock-related productivity problems. These problems span from sand production as a result of the unconsolidated nature of the reservoir rocks to formation damage or permeability impairment, possibly as a result of fines migration and other sources. Formation damage in plain terms refers to the reduction of the permeability of the formation as a result of drilling, completion, production and injection operations. It is a peculiar problem in petroleum reservoirs, occurring in different stages of reservoir development from drilling to production and fluid re-injection. Over the years, quite a number of drilling and production practices have recorded significant losses in millions of recoverable barrels of oil and billions of cubic feet of gas. This invariably implies that formation damage phenomenon is absolutely unnatural to the reservoir flow channels within the wellbore vicinity which may impair the productivity of hydrocarbons from that reservoir.

It is convenient to say that all producing formations are depth filters, varying in shapes sizes and may contain constrictions where bridging of migrated particles can restrict flow. Also in highly reactive formations like shale with high percentage of clay mineral, heaving may contribute to formation damage when contacted with water molecules. The economic importance of formation damage phenomenon has prompted the evaluation of numerous mitigation methods by several scholars, who seek by experimental and mathematical methods, preventive techniques to mitigate these occurrences.

Traditionally, experimental studies in this regard have been for special case studies, peculiar to a particular environment without conjoining mathematical correlations which will provide a research springboard for future investigators.

Despite the vast number of theoretical, experimental, and numerical studies on formation damage, a robust and comprehensively outstanding model capable of predicting the degree to which formation damage occur, especially within regions of poorly sorted petroleum formation such as the Niger Delta is paramount. The existence of such models is essential for successful development and design of damage mitigation processes. Most models have their validity based on experimentally obtained parameters from reservoir core samples under specific laboratory conditions. In this vain, their application is rather limited to field adaptations and as such, some sound level of model assumptions to adequately adopts these models to various reservoir types are requisite.

This damage phenomenon occurs not primarily by drilling and completion operations alone, but also occurs as a result of several complicated reservoir processes. Damage intensity can also be traceable to the flowing fluid properties and the geological orientation of the porous media i.e., the rock-fluid interaction. On this ground it is imperative that formation damage modeling must incorporate fluid-rock compatibilities, precipitation reactions, particulate processes in pore throats, swelling in reactive formations like clay, wettability, adsorption, absorption, net stress and compressive variations.

According to He *et al.,* 2002; Brandford *et al.,* 2010, subsurface fluids often contain in them suspended particles that may affect both flow and mechanical properties of the resident formation with time. Drilling mud infiltration into the near wellbore region, migration of fines, propant from hydraulic fractures, and contaminants from underground water are all a means by which formation damage can be quantified in a porous media.

In a bid to realize optimum recovery in oil and gas investments, it essential that all maximum well productivity techniques be explored. For this reason, identification and evaluation of effective formation damage models is paramount. Formation damage can occur at any point in the life of a reservoir from drilling, completion, work-over operations, well interventions and total depletion of the reservoir. This formation damage may be as a result of scaling and fine migration. (Schaible, *et al*., 1986; Mirabolghasemi, 2017).

Formation damage in petroleum reservoirs occurs as a consequence of the combined effects of several complicated processes. The extent of damage depends on the properties of the fluids and the geological configuration of the porous media, and the nature of fluid-fluid and rock-fluid interactions (Schaible, *et al,*. 1986). Therefore, formation

damage modeling should account for fluid-fluid and rock-fluid incompatibilities, dissolution and precipitation reactions, pore deformation and collapse and sand production phenomena, particulate processes in porous structure, swelling of porous matrix and clay particles, effects of adsorption, (Civan, 2007; Ozkan and Raghavan, 1997; Mansoori, 1997).

The effect of skin can considerably reduce the production performance of any reservoir, be it sandstones, carbonates or shale. The skin phenomenon occurs when migrated fines are accumulated in and around the wellbore region as a result of production operations, drilling, workover, completion operations or even fluid injection operations. This phenomenon creates a distinction in the transmissibility of fluid in the reservoir, altering the permeability of the affected region.
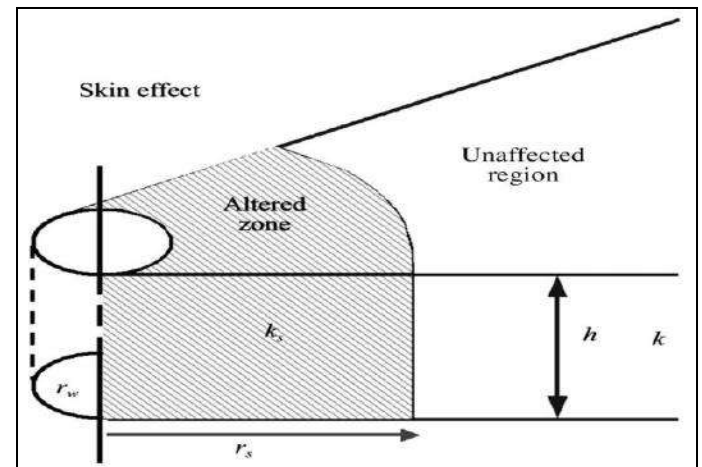
Fig.1: The 2-Region Reservoir Model Showing the Altered and Unaltered Zones

The 2-region reservoir model shown in Figure 1 is a convenient representation of a damaged wellbore region. Here, the altered zone is assumed to be of a uniform permeability k_s out to a radius r_s, beyond which the formation permeability, k is unaltered.

Using the 2-region model, the skin magnitude can be mathematically deduced with the following equation

$$s = \left(\frac{k}{k_s} - 1\right)\left(\frac{r_s}{r_w}\right) \tag{1.1}$$

Rearranging the above equation to resolve for the permeability of the altered zone, we obtain

$$\backslash k_s = \frac{k}{1+\frac{s}{\ln(r_s/r_w)}} \tag{1.2}$$

Having deduced the skin magnitude, it will be required to determine the additional pressure drop due to skin. This can be mathematically presented as;

$$\Delta p_s = \frac{141.2\, qB\mu}{kh} s \tag{1.3}$$

Flow efficiency, E_f, in plain terms is defined as the ratio of the actual productivity index of the well (including skin) to the ideal productivity index if the skin factor were zero. since productivity index, J is the ratio of a stabilized flow rate to pressure drop required to sustain that stabilized rate, then

$$J_{ideal} = \frac{q}{\overline{p} - p_{wf}} \qquad (1.4)$$

And

$$J_{actual} = \frac{q}{\overline{p} - p_{wf} - \Delta p_s} \qquad (1.5)$$

The flow efficiency for such a system now becomes;

$$FE = \frac{J_{actual}}{J_{ideal}} = \frac{\overline{p} - p_{wf} - \Delta p_s}{\overline{p} - p_{wf}} \qquad (1.6)$$

For a well with neither damage nor stimulation, *FE*= 1; for a damaged well, *FE*< 1; and for a stimulated well, FE > 1.

Rege and Scott-Fogler, in 2007 in an attempt to develop a radial model for formation damage in porous media, the authors observed that a continuous change in velocities in radial geometry have a significant effect on process characteristics, making it an intellectually challenging problem. In practical injection operations, fluids are injected down-hole and travel radially in the outward direction. They presented case studies for constant flow rate and constant pressure injections for which comparisons are made between linear and radial systems. Simulating this radial system with linear models was the primary target for their study. A radial network model, covering an angle of about 120º was developed to simulate formation damage due to deep bed filtration (DBF) of injected suspensions. The model when validated drew a previously developed concept of "wave-front movement" and "flow-biased probability" for linear systems using monodispersed and polydispersed suspensions. Results from their analysis showed that parameters so obtained from linear models were conventional when compared to results obtained from other radial models. He *et al.*, (2013) developed a fluid-solid coupling finite element model to simulate and quantitatively analyze the pressure evolution in the reservoir as well as damage and permeability change in the formation during long-term water flooding process. Their obtained results provided a theoretical comprehension of the benefits (pore pressure increase in the simulation domain), rock damage, permeability change of long-term water flooding, and offered an in-depth knowledge on how to detect and prevent wellbore failure and collapse due to formation damage during water flooding.

Regardless of the numerous experimental studies on formation damage of oil and gas bearing formations, only very few attempts to adequately mathematically model the process have been done. The application of these models in actual reservoir analysis and management has been rather limited because of the difficulties in the understanding and implementation of these models. (Byrne and Rojas, 2013; Carpenter, 2017). Organic deposition both in and around the wellbore is perhaps the most prominent form of damage problem reported in the mature oil-producing reservoirs worldwide. These organic deposits fall into two broad categories, paraffins and asphaltenes. Paraffins and asphaltenes can deposit both in tubing and in the pores of the reservoir rock, significantly limiting well productivity (Petrowiki, 2015). The plugging of reservoir-rock pore throats can be caused by the fine solids found in mud filtrate or in solid particles dislodged by a filtrate within the rock matrix. In order to reduce this, it is often a common practice to encourage using nano sized solid particles in mud preparation when designing to counteract fluid losses (Zain, and Sharma, 2000). Buildup of fine particles being transported, particularly in sandstone reservoirs, can significantly reduce well productivity due to the mobile nature of particles, particularly in unconsolidated system. Direct evidence of migrated fines-induced formation damage in production wells are usually difficult to be encountered (Aristov *et al.,* 2015). While other mechanisms of formation damage have obvious indicators of the phenomenon, field indications of fines migration are much more elusive. Indirect evidence such as declining productivity over a period of several weeks or months is the most common symptom. This reduction in productivity can usually be reversed by mud-acid treatments. A large number of wells around the world follow these patterns of reduction of productivity followed by significant improvements when subjected to a mud-acid treatment. This behavior most often suggests a buildup of fines in the near-wellbore region over a period of time (Nguyen *et al.*, 2013; Olivera *et al.*, 2014). Field studies and laboratory experiments have indicated that the fines causing the permeability reduction include clays, feldspars, micas, and plagioclase. Because the mobile fines are made up of a wide variety of minerals, the clay content of the reservoir may not always be a good indicator of the water sensitivity of the formation (Gray and Rex, 1996). Owing to the fact that reservoir rock property classification vary from place to place possibly as a result of several geological and stratigraphic configuration, it may be convenient to conclude that the adaptation of petro-physical properties of reservoir rocks for formation damage modeling should be exclusive to a particular model that can accurately mimic the candidate reservoir system. Over the years, there have

been quite a number of formation damage reviews but none in recent time, pertinent to its applicability within the Niger Delta formations has yet been established. It is therefore important that that the establishment of suitable formation damage models via sound engineering evaluations be implemented, putting in to consideration, the petro-physical properties peculiar to the region. Several Mathematical models in conjunction laboratory evaluations have provided some degree of comprehension into the spatial development and quantification of formation damage. For example if suspended colloidal particles /or formation grains carry electrostatic charges, particles might attach to the grains' surface and get entrapped. This phenomenon has classically been modeled by the \single collector model (Zamani and Maini, 2009).

A variety of studies have been done to quantify formation damage and formulate it in terms of permeability impairment as a function of time and properties of flow, suspended particles, and porous media. Moreover, industrial standard measures pertinent to reservoirs are in place, many of which are only applicable under limited circumstances. For example, a common rule of thumb is if particles been are greater than 33% of the median pore throat diameter, they will form stable bridges which can cause permeability reduction. While this is only valid for turbulent flow, particles as small as 7% of the median pore throat size have the ability to plug the pores in laminar flow cases (Blyton *et al.,* 2017). This, however, lack of a global criterion for particulate bridging implies that a thorough comprehension of the phenomenon of formation damage entails a comprehensive study of all of the contributing factors and mechanisms (Mirabolghasemi, 2017)

Fallah and Sheydai, (2013),revealed that, near wellbore mud the resulting formation damage considered one of most encountered problems involving the petroleum reservoir exploitation. They assumed suspension concentration which was based on the fact that for each flow velocity there does exist the maximum amount of retention particles that electric-molecular forces can keep. The dimensionless erosion number, which is ratio between the cross flow drag force and the total of normal forces, is proportional to flow velocity. The stabilization phenomenon was characterized by so called storage capacity which is the maximum retention concentration versus erosion number. Nmegbu, (2014) in an attempt to model for quantitative formation damage in oil the reservoir during microbial enhanced oil recovery shows that for a continuous microbial injection operation, the total pore area of the formation decreases in an equivalent percentage via the microbial plugging and

biomass accumulation mechanisms within the reservoir. The prevailing effects of formation damage due to these microbes were also presented with residual fluid flow rates and corresponding velocities decreasing in magnitude fter several days of microbial injection. The author presented a second order PDE which was resolved using the Explicit Finite Difference Approximation method. The model was to estimate the pore area reduction in the reservoir due to biomass accumulation.

II. MATERIALS AND METHODS

The fundamental principles upon which the formation damage (skin) models will be evaluated will include the damaged zone permeability assessment, analytical evaluation of formation permeability via well test analysis (particularly for pressure buildup transient test), flow efficiency analysis, skin induced pressure models and damage intensity. Field parameters were collected form five reservoirs at different locations within the Niger Delta. The selection process was influenced by the research scope which as earlier stated, will consider and limit this analysis to oil reservoirs only within the region. These parameters comprised of data obtained from four onshore operators and an offshore operator. With each field producing at a desired optimum production constraint and with adequate sand control measures in place, sand production data was also obtained. The nomenclature assigned to each location is ND-1, ND-2, NG-3, ND-4 and ND-5, with ND-5 being the only offshore field amongst all five operators.

2.1 Damage (Skin) Models to be Evaluated
2.2.1. Frick and Economides Model

In the estimation of equivalent skin factor, assuming both conically and cylindrically shaped damaged zone and putting into consideration the net pay thickness of the reservoir pay interval, the magnitude of formation damage will be estimated using that presented by Yildiz, (2008);

$$S_{FE} = \left(\frac{k}{k_d} - 1\right) \ln\left(\frac{1}{3}\sqrt{\frac{r_{dh}^2}{r_w^2} + \frac{r_{dh}}{r_w} + 1}\right) \qquad (2.1)$$

Where;

S_{FE} Dimensionless Frick and Economides skin factor.

k   is the average undamaged reservoir permeability, mD

k_d is thedamaged reservoir permeability, mD

r_{dh} is the damaged radius for the payzone, (ft)

r_w is the wellbore radius, (ft)

2.2.2 Furui *et al.,* Model

$$S_{(x)} = \left[\frac{k}{k_{d(x)}} - 1\right] \ln\left[\frac{1}{I_{ani}+1}\left(\frac{r_{d(x)}}{r_w}\right.\right.$$

$$\left.\left. + \sqrt{\left(\frac{r_{d(x)}}{r_w}\right)^2 + I_{ani}^2 - 1}\right)\right] \quad (2.2)$$

$$I_{ani} = \sqrt{\frac{k_H}{k_V}}$$

Where;

$S_{(x)}$ Dimensionless skin factor at damaged radius x

k   is the average undamaged reservoir permeability, mD

k_d is the damaged reservoir permeability, mD

I_{ani} is the anisotropic index, Dimensionless

$r_{d(x)}$ is the damaged radius, (ft)

r_w is the wellbore radius (ft)

k_H is the horizontal permeability of the reservoir, mD

k_V is the vertical permeability of the reservoir, mD

Accounting for the effect of formation damage on well productivity, the ratio of the productivity index for a damaged well to that of an undamaged well can be deduced using;

$$\frac{J_d}{J} = \frac{\ln\left[\frac{h\,I_{ani}}{r_w(I_{ani}+1)}\right] + \frac{\pi\,y_b}{h\,I_{ani}} - 1.224}{\ln\left[\frac{h\,I_{ani}}{r_w(I_{ani}+1)}\right] + \frac{\pi\,y_b}{hI_{ani}} - 1.224 + S_{(x)}} \quad (2.3)$$

2.2.3. Behr and Raflee Model

In the assessment of reservoir pressure support induced formation damage, the Behr and Raflee particle induced skin account is presented in equation (3.04) below;

$$S_p = S_i\left(\eta_w\frac{r_w}{r_R}\right)^{1-n} + \frac{1}{1-n}\left[\left(\frac{r_e^{1-n}}{r_R} - \frac{r_p^{1-n}}{r_R}\right)\right] +$$

$$\omega^{1-n}\frac{r_p^{(\beta+1)(1-n)} - r_w^{(\beta+1)(1-n)}}{(\beta)(1-n)r_R^{1-n}} - \ln\left(\frac{r_e}{r_w}\right)$$

$$\quad (2.4)$$

$$\omega = \frac{1}{r_p^{\beta}} = \frac{\eta_w}{r_w^{\beta}} \quad (2.5)$$

$$\beta = \frac{\ln(\eta_w)}{\ln\left(\frac{r_w}{r_p}\right)} \quad (2.6)$$

$$r_R = \sqrt{r_w\,r_a} \quad (2.7)$$

Where;

S_p is the Dimensionless particle induced skin factor

S_i is the Hawkins deduced skin factor

η_w is the Dimensionless coefficient of completion for an oil well (0.50)

r_R is the equivalent radius, ft

r_w is the wellbore radius, ft

r_e is the reservoir radius, ft

r_a is the aquifer radius, ft

r_p is the radius of the sandstone particle, ft

n is the dimensionless tortuosity index for porosity range. Though Equation (2.4) was originally modelled for a polymer injection process, with power law index of injected fluid *n*, this study replaces the power law index with the tortuosity parameter for each case study. The adaptation of the model to this study is validated since the value of the power law index in the study of Behr and Raflee falls within the tortuosity range of the various case studies to the analyzed.

Therefore, the tortuosity of each reservoir sand foran overlapping circular-shaped sandstone formation as approximated in 1989 by Comiti *et al.*(Comiti *et al.,* 1989) will be deduced using Equation (2.8) below;

$$\tau = 1 + \text{p}ln\emptyset \quad (2.8)$$

Where;

τ is the dimensionless tortuosity magnitude.

p   is the formation packing factor for sandstone

$\emptyset$ is the formation porosity

2.2.4. Ozkan Model

The derived expression for the determination of formation damage magnitude and additional pressure drop caused by the region of altered permeability around the wellbore as presented by Ozkan, (1997) at time, t and distance, r is given by;

$$S_{Om} = \frac{P_{wf_{r,x,t}} - P_{s_{r,x,t}}}{\frac{L\,k_{\tilde{r}}}{h\,k}\left(\tilde{r}\frac{\partial p}{\partial r}\right)_{(r,x,t)}} = \frac{\frac{k\,h}{141.2\,q\,\mu\,B}\Delta P_s}{q_D} \quad (2.9)$$

$$q_D = \frac{q_{sc(r,t)}L}{q} = \frac{L\,k_{\tilde{r}}}{141.2\,q\,\mu\,B}\left(\tilde{r}\frac{\partial p}{\partial r}\right)_{(r,x,t)} \quad (2.10)$$

Where

$$k_{\tilde{r}} = \sqrt{k_y k_x} \quad (2.11)$$

$P_{wf_{(r,x,t)}}$ is the wellbore flowing pressure at time t, psi

$P_{ws_{(r,x,t)}}$ is the pressure of the radial damaged interval r, at time t, psi

L is the length of the well, ft

q_d is a dimensionless flux quantity

q_{sc} flux at the well surface, bbl/day/ft

$k_{\tilde{r}}$ is the equivalent permeability of the x-y plane.

$\frac{\partial p}{\partial r}$ is the defined pressure derivative obtained from a transient test plot

2.2.5. The Conventional Transient Test skin Model

Evaluating the above models, deductions form each model will be compared to a pressure buildup transient test skin model. This is because available field data is made up of

pressure buildup parameters among others. The pressure buildup skin model is thus given as;

$$s = 1.151 \left[\frac{P_{1hr} - P_{wf}}{m} - \log \frac{k}{\emptyset \mu c_t r_w^2} + 3.227 \right] \quad (2.12)$$

Where;

$\emptyset$ is the porosity of the reservoir

μ is the oil viscosity (cp)

c_t is the total compressibility of the reservoir system, (psi^{-1})

r_w is the radius of the wellbore, (ft)

P_{1hr} pressure interpolation on the Horner's plot at dt=1, (psi)

P_{wf} is the wellbore flowing pressure before shut-in, (Psi)

m is the slope of the Horner's plot, (psi/cycle).

One of the ways in which the productivity of a nonzero skin or non-zero formation damage is quantified is by the Flow Efficiency deduction. Denoted by the symbol F.E, it will be obtained through taking a ratio of the actual productivity index of each well (including skin) to the ideal productivity index if the skin factor were zero. Because the productivity index is the ratio of stabilized flow rate to pressure drop required to sustain that stabilized rate, the productivity indexes is presented in Equations (2.13) and (2.14) respectively.

$$PI_{actual} = \frac{q}{(\bar{P} - P_{wf})} \quad (2.13)$$

$$PI_{ideal} = \frac{q}{(\bar{P} - P_{wf} - (\Delta P_s))} \quad (2.14)$$

Consequently, the flow efficiency can be presented as;

$$F.E = \frac{PI_{actual}}{PI_{ideal}} = \frac{(\bar{P} - P_{wf} - (\Delta P_s))}{(\bar{P} - P_{wf})} \quad (2.15)$$

For a well with neither damage nor stimulation, F.E = 1; for a damaged well, F.E < 1; and for a stimulated well, F.E > 1. Again, it is important to note that for this study, the wells of interest from the various locations have no records of well stimulation(matrix acidizing or hydraulic fracturing) performed on them for the past 10 years. This is a desired analytical constraint because accurate flow efficiency estimation for ND will be distorted and results may truncate model choice of model establishment on completion of study.

Equation (2.15) will be adopted for the efficiency of flow of the well in a damaged subjected scenario for all 5 selected models

Damage intensity of models will be evaluated in terms of Damage factor and Damage ratio. Damage factor is a dimensionless quantity used to evaluate the fractional percentage of production performance as a function of the damaged or altered permeability around the wellbore. Mathematically, it is presented as;

$$DR = 1 - F.E \quad (2.19)$$

Damageratio will be used to evaluate the magnitude of the skin induced productivity for each model. It will be calculated using Equation (2.20) below

$$DR = \frac{1}{F.E} \quad (2.20)$$

III. RESULTS AND DISCUSSION

Having computed reservoir rock and fluid data, production data, well parameters and other requisite parameters from five different Niger Delta reservoirs, a Matlab R2007 a program was written to generate a series of formation damage (skin) magnitudes for all five (4) models (Frick and Ecomindes model, Furui *et al.,* model Behr & Raflee model and Ozkan model) with the nomenclatures; s_FE, s_F, s_BR and s_O and that of the buildup obtained skin being s_i.

The four models were however matched and compared to the skin equation for a buildup pressure transient test. Permeability function for each model was also deduced from the transient test plot. These results were obtained for all five Niger Delta reservoirs (ND-1, ND-2, ND-3, ND-4 and ND-5). Graphical representation of these variations in skin magnitudes for each model is presented in Figure 2, 3, 4, 5 and 6 for all five reservoirs ND-1, ND-2, ND-3, ND-4 and ND-5 respectively.
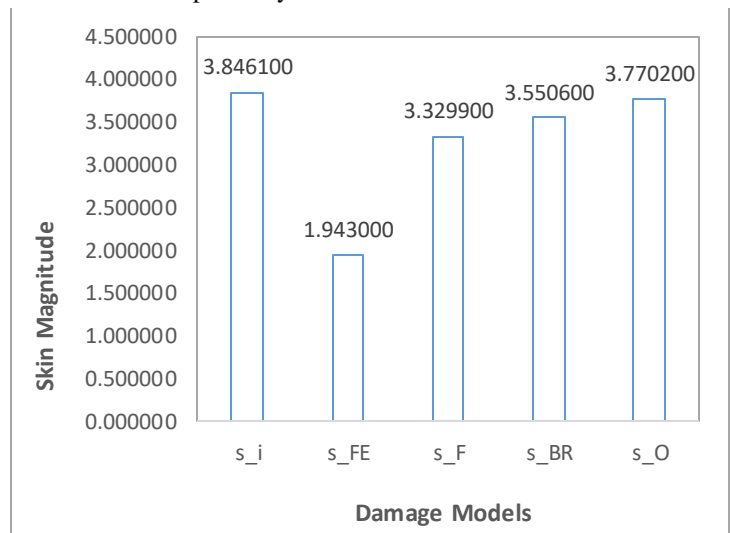
Fig.2: Formation Damage Magnitude (Skin) for Each Damage Model for ND-1
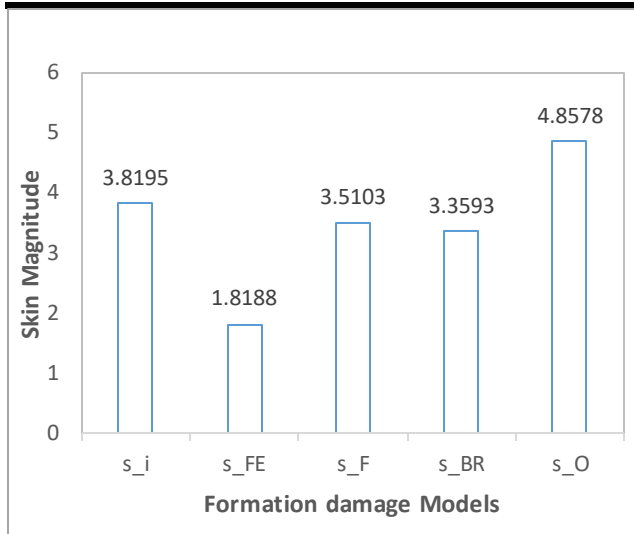
Fig.3: Formation Damage Magnitude (Skin) for Each Damage Model for ND-2

With the buildup obtained skin (s_i) being the reference for the evaluation of all others for the ND-1 reservoir, it can be inferred from Figure 2 that Ozkan's skin model, (s_O) recorded the closest to the buildup obtained skin (s_i), recording about 3.77 as against the buildup obtained skin of 3.85. Frick and Economides model under estimated the skin magnitude, recording about 1.94 damage to the formation.
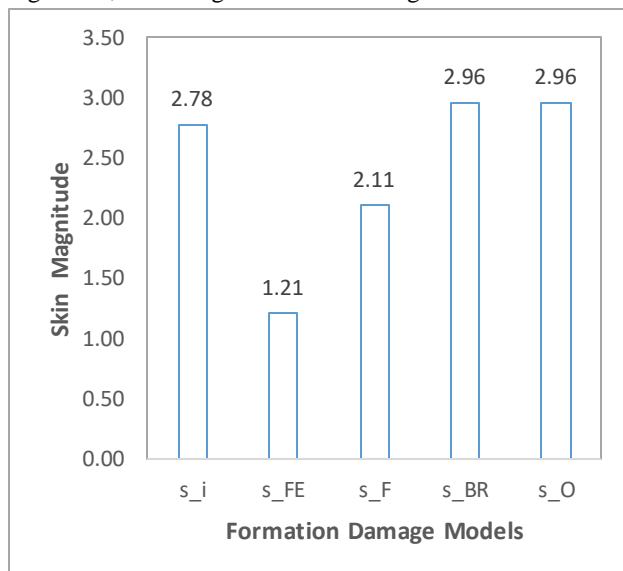
Fig.4: Formation Damage Magnitude (Skin) for Each Damage Model for ND-3

For ND-2 reservoir, the Frick & Economides skin model, (s_FE) also under estimated the formation damage magnitude by recording 1.82 as against the buildup obtained skin (s_i) which was 3.51. as shown in Figure 4.2. The closest to the buildup skin (s_i) was that of the Furui et

al, (s_F) which was 3.81 and that of Ozkan overestimated the skin magnitude, recording about 4.86 which when used for future reservoir performance forecast may prove erroneous in some flow and productivity analyses.

Figure 4 above shows that for the ND-3 reservoir, the damage models for Oskan and that of Behr and Raflee can be used to estimate skin magnitude as it tends to have a closer reading to that of the reference skin model. Both having 2.96 as against 2.78 for that of the Buildup obtained skin magnitude, shows a considerable level of applicability. Again, for this reservoir, the skin estimation obtained from Frick and Economides model cannot be adopted as it shows an underestimation of formation damage in the magnitude 1.21.
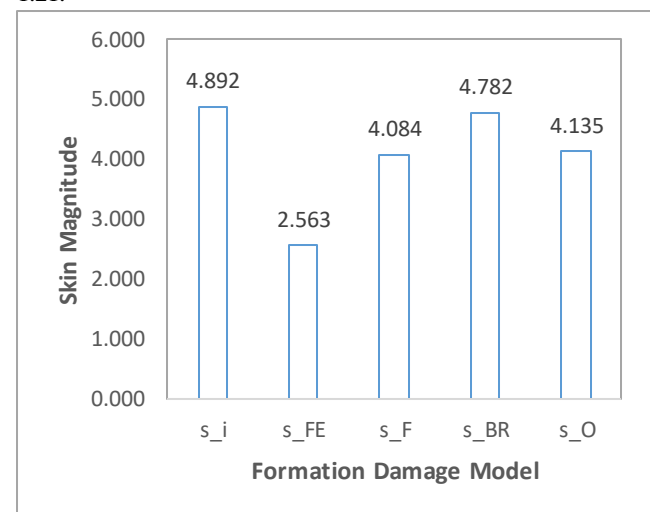
Fig.5: Formation Damage Magnitude (Skin) for Each Damage Model for ND-4

The ND-3 reservoir, having computed all reservoir rock and fluid parameters for skin estimation saw to the adaptation of the s_BR model as it recorded a damage magnitude of 4.78 as against the buildup damage estimation of 4.89. The Ozkan and Furui *et al* model slightly underestimated the damage magnitude as they both recorded 4.14 and 4.08 respectively. At this point it is convenient to ascertain that the skin estimation form Frick and Economides cannot be used for damage analysis as it has proven to underestimate four reservoir skin magnitudes as shown in Figure 5 above.
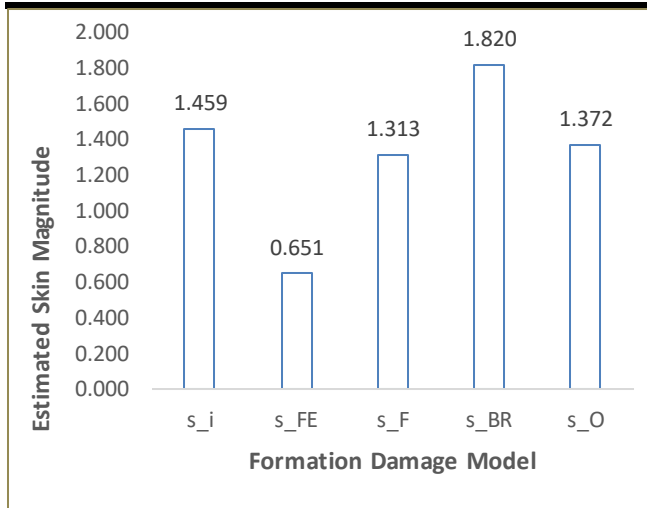
Fig.6: Formation Damage Magnitude (Skin) for Each Damage Model for ND-5
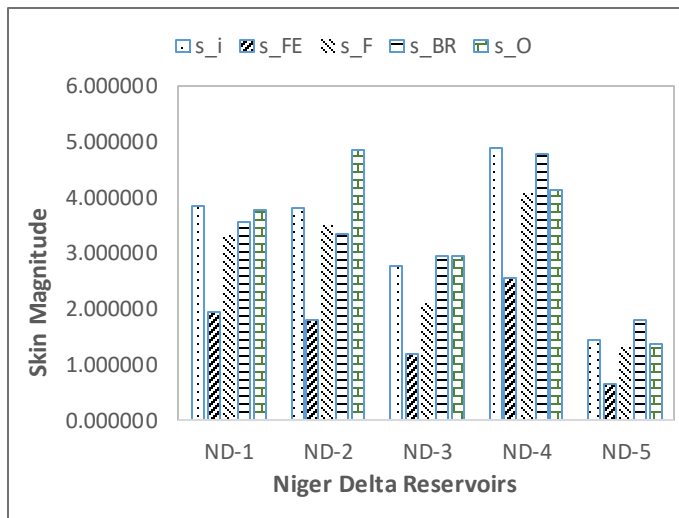
Fig.7: Summary of Skin Magnitudes for Models for all five oil Reservoirs

The model for Ozkan and Furui *et al* showed an encouraging applicability in the offshore reservoir, ND-5 as shown in Figure 6 above. The Behr and Raflee model was observed to have overestimated the formation damage magnitude by 20% recording about 1.820 in skin magnitude as against the 1.459 skin magnitude from buildup skin estimation. The 55.4% underestimation of formation damage by the Frick and Economides model shows that sound engineering of reservoirs in offshore locations cannot be achieved using it as it tends not to proffer proximate skin values, It can be inferred from Figure 7 that the recurrent underestimation of formation damage from the Frick and Economides model is traceable to the fact that it does not incorporate certain intricate reservoir parameters that can

influence formation damage. It seemed to be the simplest expression, having only damage radius and damaged permeability considerations, tending to ignore other relevant parameters such as sand grain sizes, anisotropy of the system, tortuosity and other relevant parameters, especially for a Niger Delta oil bearing formation that is characterized to the well sorted but poorly unconsolidated.

3.1 Pressure Drop Evaluation
3.1.1 Skin Induced Pressure Drop
The additional pressure drop due to skin ΔP_s was calculated for each model using the Hawkins expression for all five reservoirs. Simulation results showed that the skin induced pressure drop for all models had an equivalent weighted average to their corresponding formation damage magnitudes. Figure 8 below shows the variation in formation damage magnitude and the corresponding skin induced pressure drop, ΔP_s for all five damage models in ND-1.
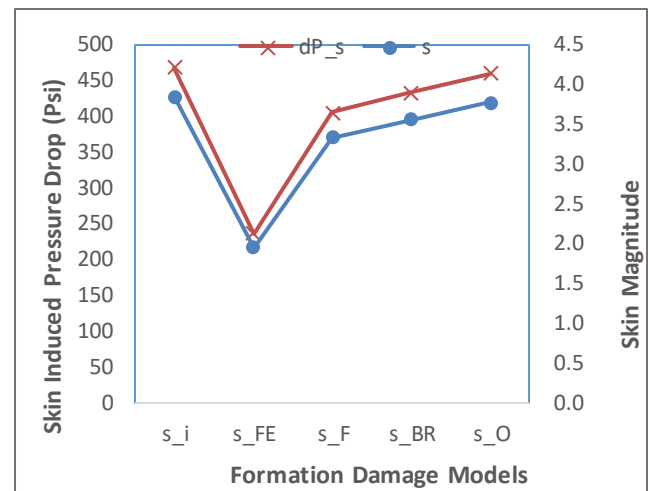
Fig.8: Variation in Formation Damage Magnitude for all Damage Models with their Corresponding Skin Induced Pressure Drop, (ΔP_s) for ND-1.

Here, it is observed that a skin magnitude of 3.8 yielded a corresponding pressure drop in the magnitude of 467.92 psi for the buildup obtained model. The closed to this model as earlier stated and observed in Figure 4.1 is that of the Ozkan model, recording an equivalent pressure drop of 458.67 psi for a skin magnitude of 3.77.
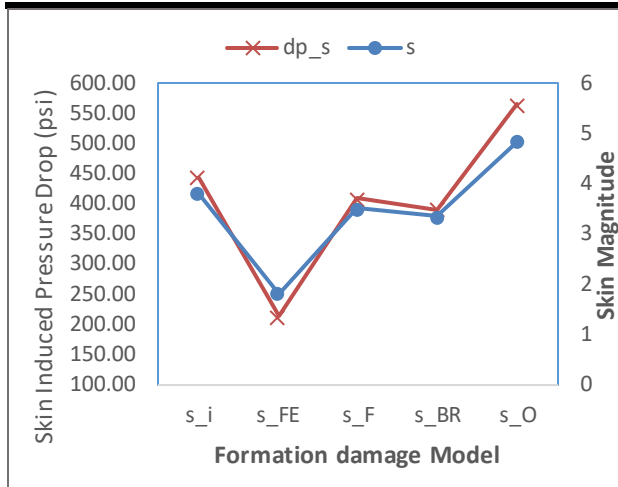
Fig.9: Variation in Formation Damage Magnitude for all Damage Models with their Corresponding Skin Induced Pressure Drop, (ΔP_s) for ND-2.

As shown in Figure 9 the Buildup skin model and the Furui *et al* model with skin magnitudes of 3.82 and 3.51 respectively was observed to be slightly similar in skin estimation for the ND-2 reservoir. Both yielding an average pressure drop due to skin in the magnitude of 444.77 psi and 408.76 for the Buildup model and that of Furui *et al* respectively. This 9% variation in pressure drop analysis between both models makes it imperative that the Furui *et al* model, compared to all others proves a better option for the ND-2 field.
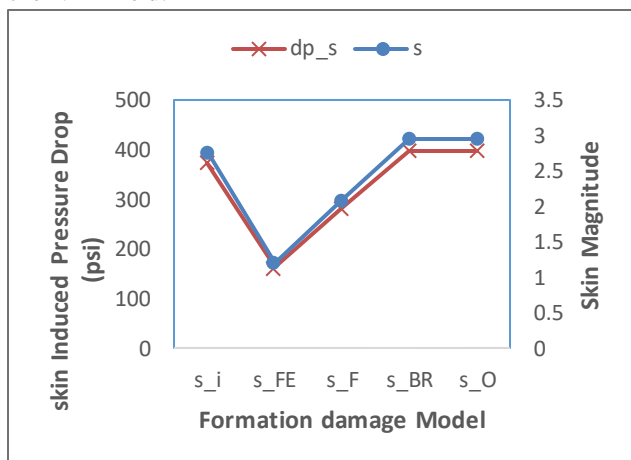
Fig.10: Variation in Formation Damage Magnitude for all Damage Models with their Corresponding Skin Induced Pressure Drop, (ΔP_s) for ND-3.

Skin induced pressure drop **(ΔP_s)** analysis for the ND-3 reservoir revealed that since both the Ozkan and BR models had a close prediction of formation damage in the magnitude of 2.96 for both models as compared to 2.78 skin

magnitude for the buildup model, it can be inferred that for reservoirs producing within a rate of 800 stb/day range, both models can be adopted . With a 0.06% deviation from the reference model for both damage models with respect to pressure from due to skin, we can conclude that s_{BR} and s_O can be adopted for intermediate production reservoirs within the Niger Delta.
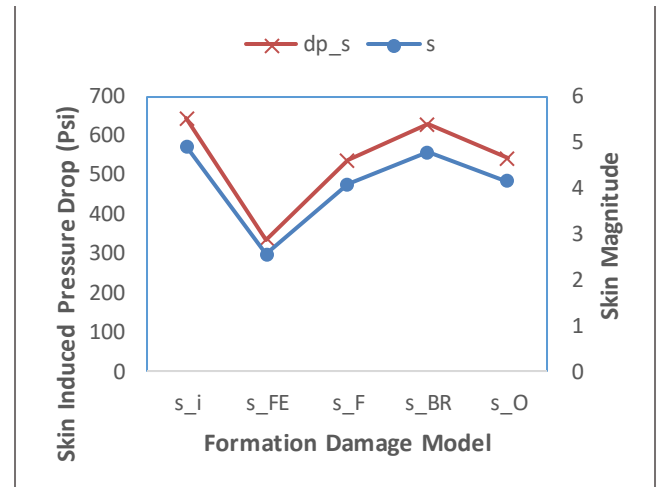
Fig.11: Variation in Formation Damage Magnitude for all Damage Models with their Corresponding Skin Induced Pressure Drop, (ΔP_s) for ND-4.

The parameters from the offshore field showed a perfect superimposition for both formation damage magnitude and its equivalent pressure drop due to skin for all five models as presented in Figure 12 below. This is to say that a skin estimation of any magnitude, regardless of the authenticity or applicability of the model in the environment can yield a perfect and optimum pressure drop with its corresponding formation damage degree.
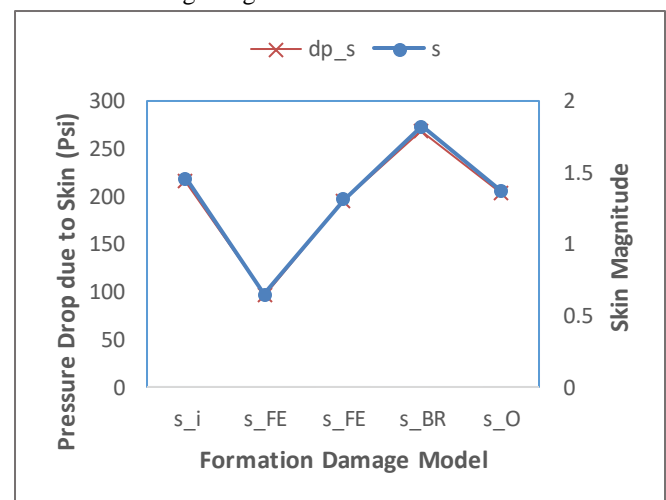
Fig.12: Variation in Formation Damage Magnitude for all Damage Models with their Corresponding Skin Induced Pressure Drop, (ΔP_s) for ND-5.

The underestimation of skin and formation damage losses in pressure for the Frick and Economides model (s_FE) in all five distinct reservoirs goes a long way to confirm that skin magnitude estimation within the Niger Delta is not just a function of the damaged radius and damaged permeability, but also a function of certain petro physical properties peculiar to the Niger Delta region.

3.2. Reservoir Flow Performance

3.2.1 Flow Efficiency Analysis

A unique method for the examination of formation damage translation to a physically meaningful characterization of our candidate Niger Delta reservoirs is by using the Flow Efficiency, (F.E) analysis. The adoption of Equation (2.15) and accurate simulation via Matlab R2007b with reservoir parameters for all five reservoirs and deductions from pressure transient analysis is represented in figure 18 to 22.
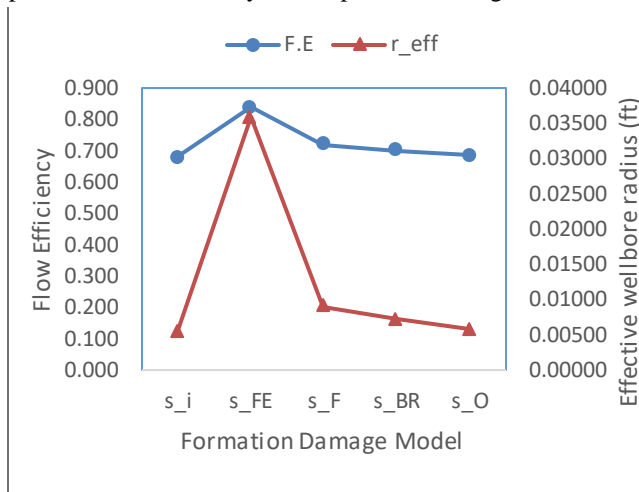
Fig.13: Variation in Flow Efficiency and Effective Wellbore Radius for all Evaluated Damage Models in ND-1

The 83.7% prediction of Flow Efficiency by the Frick and Economides model on the ND-1 reservoir may seem convincing and may influence the choice of model adaptation to reservoirs of such like properties. However, the non-incorporation of skin dependent parameters besides damaged permeability and damaged radius in the model has prompted this model to ignore certain intricate formation damage functions and thus tends to predict a high flow efficiency of 83.7%. This is as a result of the underestimation of the pressure drop due to skin, (ΔP_s) by the model which records just about 236.39 psi.

With the reference model recording a 67.7% flow efficiency prediction for this reservoir at a pressure drop due to skin, (ΔP_s) of 467.92 psi, parameter and simulation studies revealed that the Ozkan model had a closer prediction of Flow Efficiency to the reference, recording a Flow Efficiency of 68.36% at a corresponding pressure drop due to skin of about 458.68 psi. The Furui *et al* and BR models had a higher flow efficiency estimation of 72.1% and 70.2% at their corresponding pressure drops due to skin (ΔP_s) of 405.12 psi and 431.97 psi respectively.

Figure 14 shows a 59.5% flow efficiency from pressure buildup skin model for reservoir ND-2 at a corresponding pressure drop, (ΔP_s) of 444.77 psi. Here, the Furui *et al* model shows a better result in terms of similitude to the reference model, having a 408.76 psi skin induced pressure drop and a corresponding flow efficiency estimation of 62.77 %
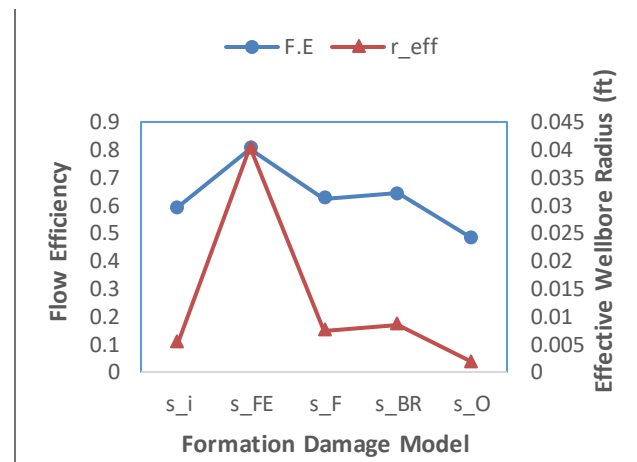
Fig.14: Variation in Flow Efficiency and Effective Wellbore Radius for all Evaluated Damage Models in ND-2

Closer to the Furui *et al* model was that of the Behr and Raflee model, having a pressure drop of 391.98 psi and a 64.37% flow efficiency performance. The Ozkan model showed a larger percentage difference from the reference with a 21.37% deviation in skin induced pressure drop magnitude and a 9.3% variation in flow efficiency for the ND-2 reservoir.

For the ND-3 reservoir shown in Figure 15, the model Behr & Raflee and that of Ozkan predicted a closely related flow efficiency percentage of 64.39 and 64.45 respectively, both with a 4% deviation from our reference model irrespective of their skin induced pressure drop.
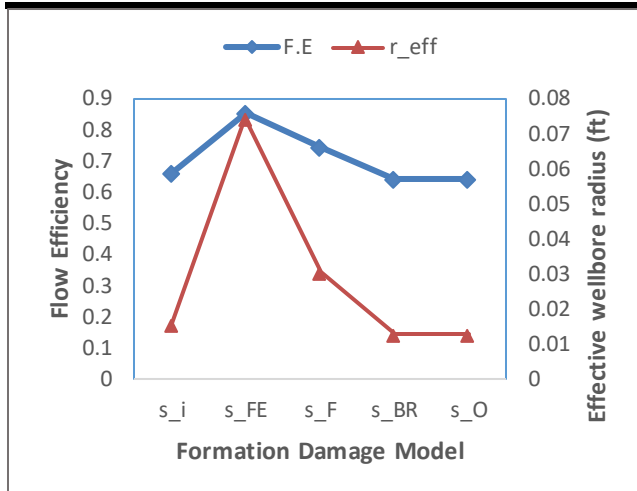
Fig.15: Variation in Flow Efficiency and Effective Wellbore Radius for all Evaluated Damage Models in ND-3

The 74.71% estimation of flow efficiency for the Furui *et al* model still falls within a 9.5% deviation range from that of the buildup formation damage model. The Furui *et al* model may be adopted for this reservoir when all requirements and reservoir parameters available can accurately be simulated, provided there is a less impact on anisotropy in the candidate reservoir as the model emphasizes the importance of anisotropy in formation damage evaluation.

The Behr & Raflee model also shows a good application in the ND-4 reservoir in terms of well flow efficiency as it records a 49.76% F.E as against 48.61% for that of the reference model as shown in Figure 16
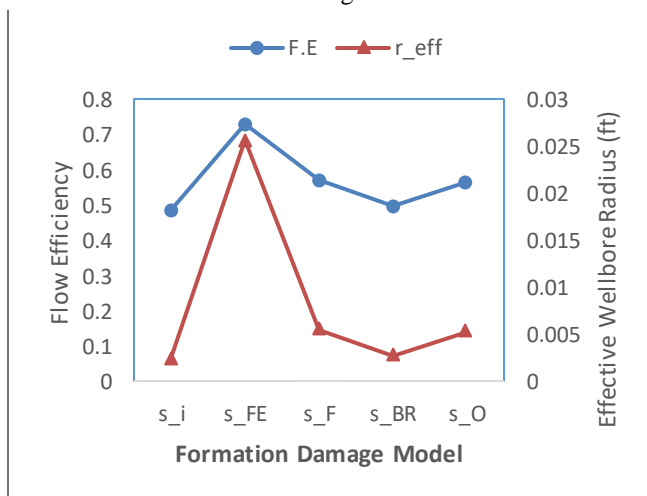
Fig.16: Variation in Flow Efficiency and Effective Wellbore Radius for all Evaluated Damage Models in ND-4.

The models for Ozkan and Furui *et al* also showed proximal flow efficiency predictions but were rather than that of the B-R model, with both having 56.56% and 57.09% flow

efficiency estimations. This is as a result of their low formation damage prediction which naturally tends to overestimate the reservoir production performance and efficiency.

In the analysis of the offshore reservoir of ND-5, the Furui et al model once again showed a good applicability in terms of flow efficiency analysis. Figure 4.16 reveals that a Furui *et al* obtained flow efficiency of 82.24% can match up to an 80.26% flow efficiency for that of the reference buildup damage model. The ozkan model can also be applied as it showed a closer flow efficiency estimation of about 81.43% with a corresponding pressure drop due to skin of 202.75 psi as against the 215.58 psi drop in pressure from the reference model.
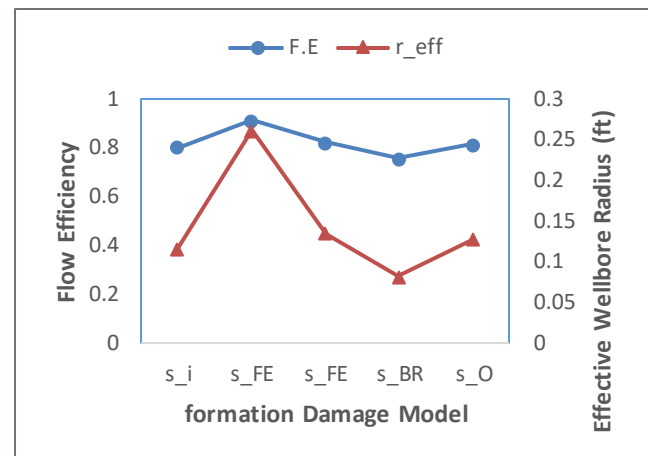
Fig.17: Variation in Flow Efficiency and Effective Wellbore Radius for all Evaluated Damage Models in ND-5

As usual, the Frick and Economides model as presented by Yildiz in 2008 on evaluation via reservoir parameter simulation with Matlab continuously underestimated formation damage magnitudes, predicted a lower pressure drop in an actual case scenario and overestimated well productivity performance by recording very high flow efficiencies for all five (5) reservoirs that have been investigated.

3.3 Damage Intensity Analysis
3.3.1 Damage Factor – Flow Efficiency Relationship

The damage factor expression from Equation (3.13) yielded a series of deductions from all 5 models for the five (5) Niger Delta reservoirs. The result translates that a higher flow efficiency will result in a lower damage factor, while a lower flow efficiency will incur a higher damage factor. This also applies to the damage ratio analysis relative to flow efficiency. The higher the flow efficiency, the lower the damage ratio and vice versa.
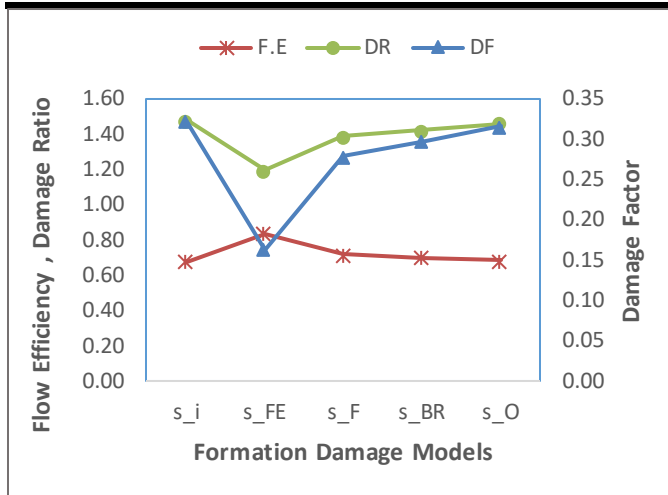
Fig.18: Variation in Flow Efficiency, Damage Ratio and Damage Factor for all Evaluated Damage Models in ND-1.

Figure 4.17 above shows that for reservoir ND-1, the buildup obtained reference skin model with a 67.73% flow efficiency had a corresponding damage factor and damage ratio of about 0.323 and 1.48 respectively. These values were close to that obtained from the Ozkan model which had damage factor and damage ratio o of 0.316 and 1.46 respectively with a corresponding flow efficiency of 68.37%. The B-R and Furui *et al* models followed successively in terms of DF and DR analysis.

Figure 4.18 shows that the Furui et al model proves a better alternative to the others in terms of Damage Factor and Damage ratio analysis as it tends to record a lesser deviation for the reference model for ND-2 reservoir. Having a damage factor of 0.373 and a damage ratio of 1.59 as against 0.405 damage ratio and 1.68 damage ratio for the buildup reference skin model.
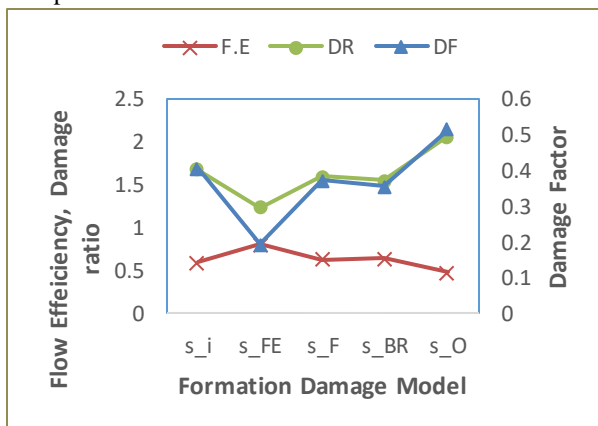
Fig.19: Variation in Flow Efficiency, Damage Ratio and Damage Factor with for all Evaluated Damage Models in ND-2.

A higher production rate of 800stb/day for the ND-3 reservoir revealed that the Ozkan and B-R models are a good alternative for formation damage magnitude evaluation in terms of damage intensity (damage factor and damage ratio) analysis.
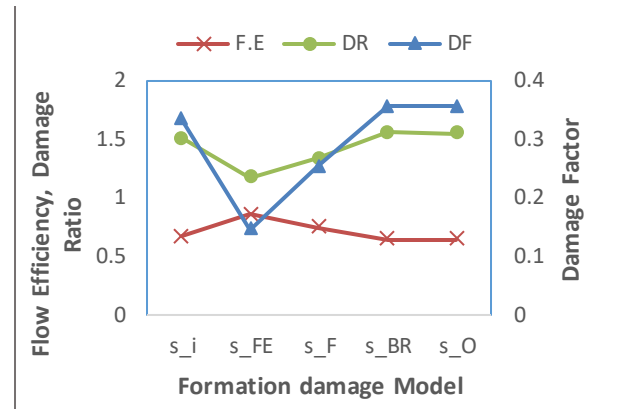
Fig.20: Variation in Flow Efficiency, Damage Ratio and Damage Factor for all Evaluated Damage Models in ND-3.

As shown in Figure 20 above, a damage factor of 0.36 and damage ratio 1.55 for both models could be said to match a 0.33 damage factor and a 1.50 damage factor deduction from the reference model. This goes a long way to ascertain than that at higher production rates, the Ozkan and B-R models mat be applicable provided parameter requirements are met for adequate simulation.
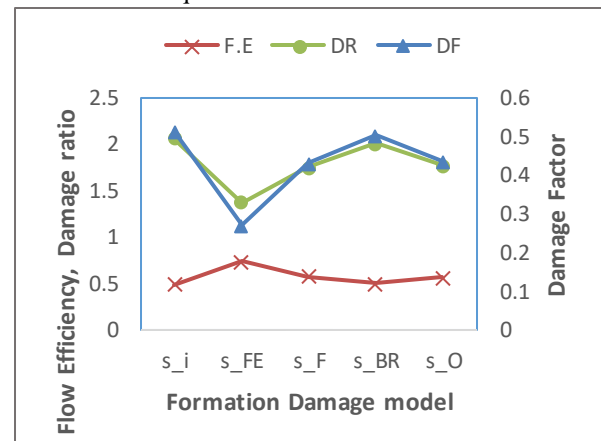
Fig.21: Variation in Flow Efficiency, Damage Ratio and Damage Factor for all Evaluated Damage Models in ND-4.
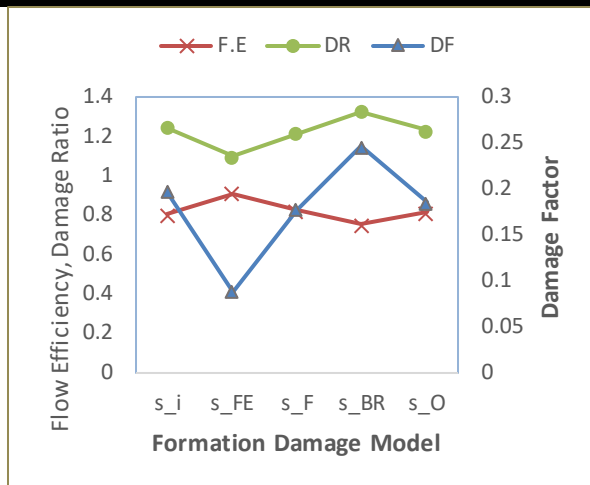
Fig.22: Variation in Flow Efficiency, Damage Ratio and Damage Factor withfor all Evaluated Damage Models in ND-5.

The low production rate reservoir of ND-4 revealed that the B-R model suites best for these reservoir conditions (petro physical, well and pressure transient properties) in terms of damage intensity as shown in Figure 21. Following the Behr & Raflee model in terms of applicability was that of Ozkan and then that of Furui *et al*.

The Offshore field having the highest production rate of 950 stb/day maintained that the models of Ozkan and Furui *et al* can the most applicable in terms of damage factor and damage ratio on parameter simulation. Both models having a lower deviation from the standard skin model.

IV. CONCLUSION

The models presented in this work provide predictive tools for quantitative evaluation of formation damage estimates in Niger Delta reservoirs. The theoretical agreement obtained between predictions by the evaluated models for this study and formation damage prediction from the empirical pressure buildup skin model has been thoroughly analyzed.

Skin usually referred to as formation damage is one of the major factors that influence a well or reservoir productivity. It tends to either promote or hamper production rates; it contributes greatly to pressure drop analysis in the entire production system, it influences well and reservoir deliverability and to some considerable extent, influences investment decisions and economic evaluation for candidate oil reservoirs particularly for unconsolidated sand reservoir systems like those of the Niger Delta.

In this work, one can clearly state that a comprehensive research and development study on the possible establishment of a unique formation damage model in Niger

Delta area has been carried out. The numerical evaluation of these empirical models having incorporated their dependent variables yielded several series of damage responses. Critical evaluation on damage factor, damage ratio, flow efficiency, effective wellbore radius, and skin induced pressure drop analysis proved to be reliable analytical tools for the establishment of the unique model for the Niger Delta region.

Judging from the skin magnitude estimation standpoint, with reference to the buildup estimated skin model, the models were streamlined to only three during the selection procedure as the Frick and Ecionomides model having skin as a function of only damaged radius, damaged permeability, wellbore radius and reservoir absolute permeability continuously underestimate skin values. This trend was observed for all five (5) reservoir cases leaving the models of Furui *et al*, Behr & Raflee and that of Ozkan to contend for the most suitable. The skin induced pressure drop analysis also translated the above mentioned case as the pressure drop due to skin is a function of the degree of damage to the formation around the wellbore vicinity. Flow efficiency and damage factor investigation translated the application of all streamlined three (Furui *et al*, Behr & Raflee and that of Ozkan) in a decreasing magnitude in the manner in which they appear for all five reservoirs.

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Ice cream Made of Brazilian Native Fruits: Sustainable Development to Depressed and Biodiversity Areas

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Abstract—*This paper presents a case of food production, especially ice cream producing made of Brazilian native fruits, and the engagement of the poor population and women in the production of healthier products and a more sustainable production. It is about of accessing native fruits in the Brazilian savanna and, therefore, in the base of production, that it is necessary to recognize the role of small and medium producers in the social and environmental transformation of poor or depressed areas. Especially since small and medium producers still have areas of native forests on their land, while large areas of production are generally destined for commodity production. The Frutos do Brasil company is therefore analyzed for its performance in the face of more sustainable forms of production, because it invests in the production of healthier foods, in stimulating small and medium producers of food, in stimulating the maintenance of native vegetation, and inserting more poor and women in the productive process.*
Keywords—*healthy food, sustainable production, SMEs, environmental development.*

I. INTRODUCTION

This paper has the objective of studying the initial formation of a cluster involving the extraction of Brazilian native fruits and the production of low fat and low calories ice cream. The main actor of the study is the company *Frutos do Brasil* that produces ice cream out of native fruits. The firm is in the center of a web of producers, public and private non-profit entities, which includes universities, government and research centers. There is an important participation of the poorer population of Goias (Map 01) that is a dynamic state especially in high valued agriculture activities but that still has many impoverished areas. Also, should be mentioned another important participation: women from small underdeveloped communities that are perceiving this economic movement to access market, generate jobs and promote social improvement.

Although the world market of ice cream is expanding, especially in emerging countries like China, Brazil and Turkey, the traditional fattening format is losing space for healthier alternatives like frozen yogurts and low fat and calories nutritious ice cream. So, there is a growing marketing niche formed by consumers worried not only about health but also with the sustainability of the planet. This is where native fruits come to play: as much as they are rich in fibers, vitamins, minerals and antioxidants, their cultivation can be done without any harm to the surrounding environment.

Considering this scenario, the company *Frutos do Brasil* envisioned a good business opportunity to be explored: the production and selling of ice cream made of native Brazilian fruits. The firm is at this moment trying to organize its production chain which involves the development of native fruit suppliers, the setup of the assembly line of pulp extraction, the production of ice cream, and all management functions like marketing, distribution, sales and governance.

To carry on the proposed objective, the article is structured in four parts: (a) contextualization of the state of Goias with the economic potential of a sustainable native fruits exploration; (b) the recent scenario of the ice cream market worldwide and in Brazil, considering the most recent trends towards healthier products; (c) the fruit business with some insights about the native fruits marketing niche; and (d) the challenges of the management of a new company inserted in a web of participants each of them playing an important role in the development of a possible new cluster around native Brazilian fruits and the production of derived healthier products.

II. GOIAS STATE AND ITS POTENTIALITIES

Located in Central Brazil, Center West region, the state of Goias is part of a rich biodiversity area with low demographic density; population density is around 19 (inhabitants per square km), very low when compared to the 177 of the richer and more developed state of São

Paulo. Its most important Biome, a woodland savanna, known as the "Cerrado" is the second largest in South America. In the limits of the Cerrado are the springs of the biggest hydrological basin of the Continent, including rivers like the Amazon, San Francisco and Plata. So, the hydrological potential of the area is very high. This Cerrado Biome is home of more than six thousand species of cataloged plants which includes a great diversity of fruit trees. The tropical climate, with temperatures varying from 72° to 79° F along the year is adequate for cultivating fruits according to the Brazilian Agriculture Research Corporation (Embrapa, 2006) (Maps 02, 03, 04 and Figure 01).

In the last decades, Goias state has experienced an intense economic development. Agriculture has been the motto of this growing since the 1970's when the state company Embrapa with its applied research transformed the then poor aluminum-based soil of the Cerrado into fertile fields of today where soybean, sugarcane and corn are cultivated with state-of-the-art technology. It also should be mentioned the long-time mining activities (mainly iron, nickel, manganese, calcareous and phosphate) explored in the state by multinational companies like Anglo American and others. Besides agriculture and mining, the state has also developed an important industrial base in sectors like automobile, pharmaceutical, food and beverage. Also, in the 1970's the regional government started fiscal incentive programs that were successful in attracting global companies from the more developed Southeast part of the country (Gomes, 2005).

Although Goias holds the ninth grade in the national economic ranking with a GDP of U$ 50 billion, and despite the fact that the human development index (HDI) has grown from 0,487 in 1990 to 0,735 in 2010 (UNDP, 2010), there are poor and underdeveloped areas in the state. In the public policy "Plano Nacional de Desenvolvimento Regional", the state is divided into a rich and dynamic area versus stagnant and poor areas. According to Santos (2011), there are many poor municipalities spreading across the state; in some of these small towns there is not even a single formal company. They are dependent upon eventual government support and its population suffers the odds of poor regions lacking access to health, education and jobs (Map 05).

The state and municipal governments articulate public policies to stimulate these poorer areas through fiscal transference programs. Despite that people from these depressed areas also try to create possibilities for their own development. They are natural entrepreneurs with lots of knowledge of the local potentialities.

As mentioned before, Goias has important economic high valued activities, such as agribusiness, especially commodities like sugarcane, corn and soybean, mineral exploitation, automobile, harvest equipment and pharmaceutical production – centered in the middle of the state (IMB, 2015). Nevertheless, there are also less economically important activities, such as artisan ice cream production. Although in small scale, it seems an interesting business to be analyzed because it is a growing market with some important elements to consider: the low-fat fruit-based ice cream is gaining international exposure due to the increasing consumer demand for healthier products. Besides that, the cultivation of native fruits, the basic input of artisan ice cream, helps to preserve the more important Biome of Central Brazil and it employs small and medium producers, mostly from the poor local population, uncovering new possibilities of business for a biodiversity area such as the Cerrado.

III. WORLDWIDE CONSUMPTION OF ICE CREAM

The global market of traditional ice cream is still growing: from 2010 to 2015, the worldwide business grew 31%, rising from US$ 54 to US$ 71 billion (Forbes, 2016). It is worth mentioning that it is as much a profitable market with margins around 23%, higher than snacks, candy, cereal and sugar. It is not a market dominated by a single brand. Unilever, the most important player accounts for approximately 23% of the world market, followed by Nestlé with share of 10%, General Mills, with 3% and Lotte Group with 2%. Around sixty-two percent remains with small local brands.

The growing of the market in the last years is credited mostly to emerging countries like China and Brazil with expansions of 50% and 100% respectively in the period considered from 2010 to 2015 (Euromonitor, 2015). The explanation for that is based on the up surging in these nations of a lower middle class now able to afford the consumption of indulgences like ice cream, candies, chocolate bars and other amenities. The mentioned growth is centered in products with traditional format, that is, containing high doses of fat in its elaboration which is the original formula of ice cream.

The up surging middle class is not yet as demanding as their peers in the developed world about nutrition facts. In developed countries there has been a decline in the consumption of traditional ice cream due to worries about the intake of sugary and fattening food. In the United States, for instance, in 1989, an average American used to consume ice cream 41,3 times a year; in 2014, this frequency dropped to 28,5 times a year (Fortune, 2014a).

The preference in wealthier markets of the globe is veering towards frozen yogurt (froyo) and fruit-and-vegetables flavors, considered healthier products

opposing to indulgent traditional fattening ice cream. The frozen yogurt market gained room in the 1980's and peaked in sales at the beginning of the 1990's and has born again in the last five years, with revenues increasing by 23%, from 2010 to 2015, according to Guidant Financial data (2015).

IV. ICE CREAM CONSUMPTION IN BRAZIL

The ice cream market in Brazil has been growing steadily since the turn of the twenty-first century and has not stopped despite the current economic crisis the country is facing since 2013. According to the Brazilian Association of Ice Cream Producers (ABIS, 2016), from 2003 to 2014, the volume produced varied from 685 to 1.300 million liters, an increase of 89.7% (Figure 1). The 12% drop from 2014 to 2015 reflected the beforehand mentioned macroeconomic problems. Different sources show different numbers but one way or another the market is growing intensively.
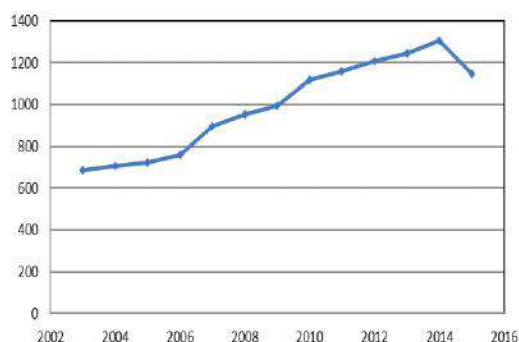
Fig.1 – Evolution of consumption of Ice Cream in Brazil in millions of liters

Source: ABIS (2016)

The most prominent companies in operation are the internationally renowned Unilever and Nestlé, but together the two big giants accounts for only 10% of the internal market (Datamark, 2016). There can be listed some small successful players showing double digit increases in their businesses just in the middle of a strong political and economic turmoil: in 2015, Sorvetes Rochinha, a famous ice cream house in the North shore of the state of São Paulo grew as much as 30%; Bacio di Latte also located in São Paulo in the same year had sales increase of 60% (Datamark, 2016).

As mentioned before, a plausible explanation for the intense growing in the Brazilian ice cream market is the up surging of a lower middle class since the beginning of the years 2000. It is what Marcelo Neri (Neri, 2011) calls "the new middle class". According to this author, it cannot be compared to the affluence of the North American middle class for instance, but it has

discretionary purchasing power, that is, the new middle class can consume beyond those very basic expenses related to surviving like food and shelter.

From 2001 to 2011 the 10% poorer in Brazil had an income growth of 91.2% while the 10% richer had an increase of only 16.6% (IPEA, 2012). In poorer regions like Northeast the increase in income was 72% against only 46% of the wealthier Southeast. This rising in purchasing power allowed this once excluded strata of population to afford air travels, new car financings, home appliances and electronics in general, including the so popular mobile phone, accessible today for practically the whole Brazilian population. On the rise of income rising, lower middle class is now able to consume outdoor foodstuffs. The consumption of eatables outside home is usually associated with higher standard of living (Kamakura & Mazzon, 2013).

Although evidences are supporting that there is, on one hand, a rising lower middle class now able to consume what in the recent past was out of reach, on the other hand, there is an upper middle class in Brazil with consumption standards very close to developing countries wealthier social strata. In the case of ice cream consumption, just like in the developing world, the upper middle class prefers low fat and healthier choices like frozen yogurt and natural fruits options (ABIS, 2016).

This situation uncovers a complex market reality showing social classes composed of quite different family structures, with some of them on the top of the social pyramid, demanding sophisticated products while others, on the base of this pyramid, celebrating the very fact that they now can afford to buy indulgences like a tasteful (and incidentally fattening) ice cream.

The potential for growth is reflected in the numbers: per capita consumption of ice cream in Brazil is only 6,4 liters/year, way behind the United States with 20 liters/year; and lagging as much South American neighbors like Argentine and Chile both with 9 liters/year (Datamark, 2016).

V. THE MARKET OF NATIVE FRUITS

Fruits are the second most popular consumed item by Americans, taking over the spot once occupied by soft drinks. Growth conscience is partly responsible for the fruit ascent. Grocery stores are dedicating more shelf space to produce (fruits and vegetables). The most consumed fruits are berries, apples, bananas, grapes and citrus (Fortune, 2014b). The fruit industry is in the mature stage of life cycle. The market shows strong signs of competition, minimal technological change, industry product category well defined and demand increasing with the rising of middle classes (IBIS, 2016).

Due to consumer health consciousness fresh fruits and vegetables are expected to replace industrial formats. In many parts of the world, the growing demand for fresh fruits is expected. This growth is positively associated with urbanization and with the rising of middle classes (IBIS, 2016).

The fruit market in Brazil, according to the Ministry of Agriculture, Livestock and Food Supply (MAPA, 2014) exported as much as U$ 878 million in 2013. The consumption of fruits in the country occurs during the whole year long due to good weather conditions.

When interviewed in 2012, the president of the Brazilian Association of Ice Cream Producers expressed: "let's stop exporting mangoes and start exporting ice cream" (Marques, 2016). It is worth to mention that the fruits export values (US$) are very close to the fruits import values. Therefore, to aggregate value to native fruits products could improve the exportation figures and enhance the trade balance (Graphic 01).

The fruits are consumed in many different forms like juices, jellies, sweets, ice creams and popsicles. Fruits and vegetables grew as much as 52% from 2010 to 2013. The sector represents 10% of Brazilian GDP and the country is one of the largest players in the world. There are 32,000 companies involved in the production of fruits and vegetables – the sector employs 19% of the working population and is highly concentrated: 1% of the companies accounts for 50% of the production gross value (EMIS, 2014).

The consumption of food is concentrated on three main species: corn, wheat and rice; together they account for 60% of all food consumed. Thirty species accounts for 95% from a universe of 12,650 species, evidencing that in practice native species are not demanded or consumed (Hortibrasil, 2016).

Native fruits could be classified in the "specialty" categories, that in the definition of the Specialty Food Resource (Roberts, 2016) are those differentiated items not available in the mass market. Specialty fruits remained representing only 2% of the sales but the increase was 38% from 2009 to 2013 (Fortune, 2014b).

There are alleged benefits in the consumption of native fruits. They are said to be rich in fibers, vitamins, minerals and antioxidants. They are also believed to prevent diseases like cancer, cardiovascular problems, rheumatism and amaurosis. Native fruits in Brazil are used for consumption in natura or to produce jellies, juices, liquor, sweets and others. They are adapted to the soil and do not need any chemical treatment. Also, the fruit trees are used successfully to recover degraded and eroded areas (Embrapa, 2006), that is, the cultivation of native fruits can contribute significantly to the sustainability of the Biome where they are inserted in.

It is a fact that the Cerrado is having environmental problems. The same agricultural treatment that transformed the once poor soil into fertile lands brought troubles in reason of the use of chemical corrections, causing pollution to the soil, subsoil, rivers and streams. Besides that, innovation in agriculture also introduced invasive species that compete with native ones, fragmenting the habitats. Adding to that the greenhouse effect caused by industries and the natural fires, the flora and fauna of the Cerrado is under constant threat (Fernandez, 2011).

The Center West region has 71 kinds of native fruits. The ones with high potential in the short run are pequi, mangaba, cagaita, baru, araticum, maracuja, caju, buriti and gabiroba; pequi and mangaba are the two most studied species (Embrapa, 2006).

Weersma and Batista (2007) present a group of critical factors required to have success in exports of fruits in general: quality of products, quick delivery, good regularity and punctuality, adequate packaging and the correct use of irrigation. Embrapa (2006) developed a criterion to assess the native fruits business and it involves knowledge available, social importance, environmental importance, conservatism, use and handling, potential for planting (seeding) and marketing and commercialization. Additionally, Dorr and Grote (2009) argue that certificates and quality requirement – involving safety and traceability of the products are increasingly a prerequisite to producers interested in exportation.

The production of native fruits in Brazil is explored by small farmers with labor force from local communities. Usually they are underpaid, and the business is poorly rewarded financially (Embrapa, 2006).

Braga (2014) conducted a research assessing the acceptance of consumers when tasting the nectar of exotic Brazilian fruits in the format of lactose free diet ice cream. The results showed that respondents perceived positively the taste of some native fruits, especially graviola and taperobá. It was also detected an important positive influence of the previous information about healthy components of the fruits and its alleged potential to prevent diseases. To a suggested extent, taste and health should be combined. This point is quite interesting because it exposes the problem the frozen yogurt (substitute of ice cream) has had since the beginning of its launch in the 1980's; there has been a lot of complain about weak flavor; according to Hillard (2015), there is a stigma among consumers that the taste of frozen yogurt is not good.

Native fruits are becoming target of producers due to the business potential they represent. According to the researcher of Embrapa interviewed, the commercial

possibilities of cultivating native fruits are considerable (Globo Rural, 2013). Native fruits are the main raw material used in the production of artisan ice cream. The forecasts about the market of specialty fruits and artisan ice cream indicate a good potential to be explored (Marketing Indicator Report, 2014, Fortune, 2014b).

An interesting possibility is to offer the native fruit ice cream not only to middle class consumers but also to low income population due to its nutritious characteristics. An inspiring example of that was articulated by Muhammad Yunus (1999) between the Grameen Bank and the French company Danone producing low cost yogurt. This partnership provided a nutritional enrichment of the food for poorer population in Bangladesh, and it was especially good for the children. The renowned economist emphasized that the production of low-cost nutritious food is an important step to help people for poor areas once it has the potential of improving the quality of life and health of the population.

VI. FRUTOS DO BRASIL – THE MANAGEMENT OF THE COMPANY

In the 1990's two companies owned by the same family were launched: Frutos do Brasil e Frutos do Cerrado. The first located in Goiania (GO) and the former

in Uberlandia (MG). Both companies are specialized in ice creams and popsicle made of native Brazilian fruits, produced with low fat and sugar (Photo 01).

The main company, named "Frutos do Brasil" employs 32 people, produces 27.000 posicle a day, equivalent to 1,500 kg a day of ice cream. They offer 76 different flavors of products between ice cream and popsicles. In 2015 this company made about US$ 3,5 million of dollars in revenues. They have stores in nine states of Brazil, adopt a franchise model and have 16 franchisees and 22 dealers. In 2016 the company started to export to USA, especially to Florida, and they intend to export to The Netherlands in a few years.

As depicted in figure 2, Frutos do Brasil interacts with research centers, universities, and government institutions. The research centers are helping the mentioned company with logistics, strategies and marketing. The company is sending them the waste (biomass) from the producing process of the fruits – transformed into pulps – to provide for instance research about antioxidants.
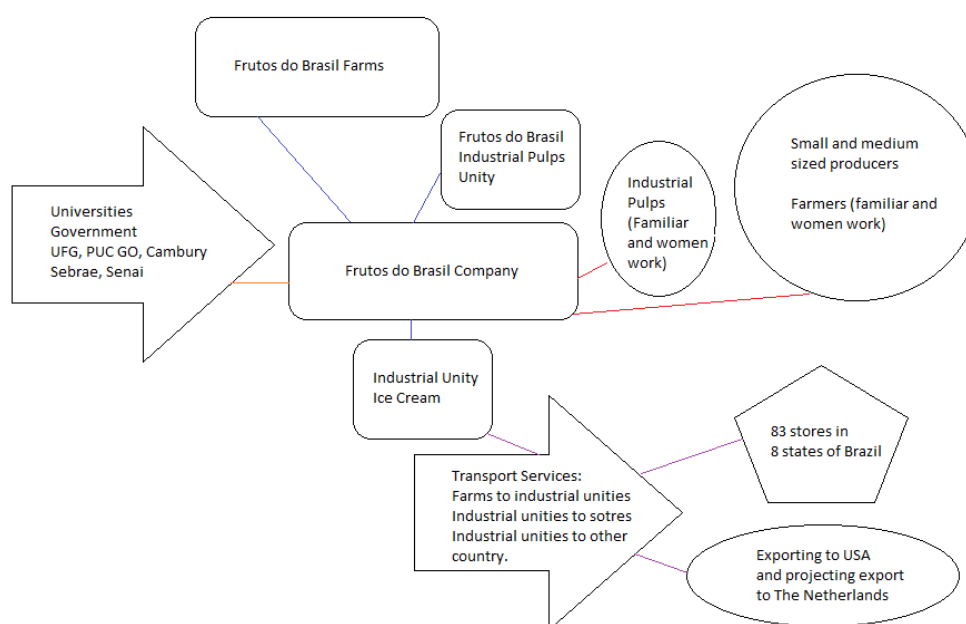
Fig.2 – Frutos do Brasil and the Web of Activities

Source: The authors.

According to figure 3, the annual production and sales had a steady growing period from 2002 until 2011, from 43 thousand liters to 864 thousand, when the effects of the economic crises came to the ice cream business. Because of the new unfavorable situation, from 2011 to 2015, there was a 25% fall in volume and value received

for every liter sold. In figure 4 one can see the evolution of the employed personnel in the operation. Since the start of the business in 1996 until 2002, there was a very small body of 3 workers. Then this number grew yearly until 25 in 2014 and 32 in 2015. This shows a certain loss of

productivity per worker due to an excess of production capacity brought by the mentioned drop in sales.
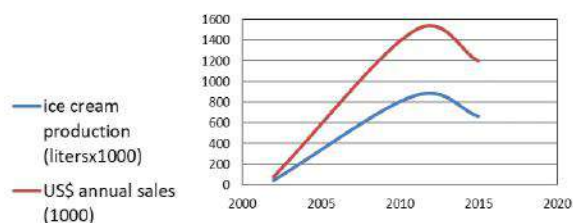
Fig.3 – Evolution of production and sales

Source: data from Frutos do Brasil
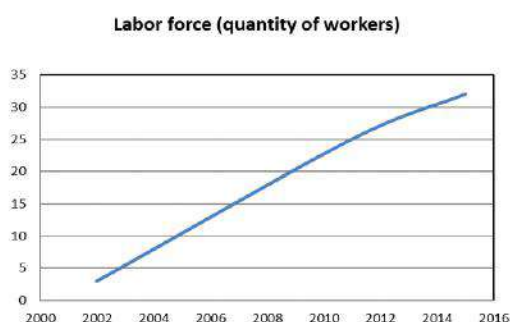
Fig.4 – Labor force employed

Source: data from Frutos do Brasil

VII.   COMPETITION

As much as Frutos do Brasil and Frutos do Cerrado, other incumbents have also entered in this specialized business of native fruits ice cream market: Delícias do Cerrado (Paraúna-GO), Frutos de Goiás (Goiânia -GO), Fruta Pura (Anápolis-GO). These companies are not formally connected but are geographically concentrated, especially in Goias and Minas Gerais. The products are similar in tastes and consumption format (cones and popsicles), the sales areas are also alike but they do not exchange information or share equipment, structures or suppliers. They are just a group of companies formed by medium and small entrepreneurs without organization among them (see teaching note 03).

From the point of view of Frutos do Brasil the competition is considered high in the following aspects: price, mix of products, access to suppliers. An important challenge is the concentration of suppliers and the improvement in the logistics strategy.

VIII.   PRODUCTION OF FRUITS

There are two ways to get to the fruits. One way is through an area of 35 hectare where the company Frutos

do Brasil cultivate 100 different species of fruit trees from the biomes Caatinga (another Biome from the Center West region). Another way is through independent small producers who sell their fruits production to the company (social data from Goiás: Map 05, Graphics 02 and 03).

To pave the way to the important supply of fruits the company stimulates the producers offering them seedlings without costs. These seedlings are germinated beforehand at Embrapa and Emater-GO and then are sent to the producers and research institutes interested in the matter.

The suppliers also have an important role supporting the product development, once they are informally acquainted with their raw materials. They also support the handling and transformation of fruits, recipes and combinations.

To transform the raw material, Frutos do Brasil has a production unit (plant) to extract the fruit pulp localized in Abadia de Goias (GO), 50 kilometers West of the state capital Goiania. This unit has a processing and storage capacity of 120,000 kilos of fruit pulp per year. It has two fixed employees and up to 30 in the high harvest season. These workers, women in majority, made the peeling of the fruits manually. After preparing the pulps, they are stored in cold chambers to be sent to the unit in Goiania to transform them in ice cream and its diverse formats – cones, popsicle, sorbets.

IX.   PACKAGING

The production is concentrated in the city of Goiania. Suppliers deliver their raw material at the unit of transformation in Abadia de Goiás, and after processing of the raw material, the pulps are transported to Goiânia where they become input in the production of the ice cream and popsicles.

The number of personnel involved from the harvest of the fruit crop until the selling of an ice cream in the retail is approximately 500. In the unit of Goiania, 12 employees work in the production line under the supervision of two food engineers that respond for the quality of the products. There are also 3 more employees in charge of the administrative support.

In the second semester of 2016 the ice cream industry operates using only 60% of its full installed capacity (Company Data collected in interview). The ice cream produced contain from 60 to 80% of fruit pulp in its composition, with low sodium, fat and sugar.

X.   DISTRIBUTION

The distribution of products happens all over the Brazilian territory and the exportation begun in June of 2016. The first country selected for testing exportation was United States, in the state of Florida.

After produced the ice creams are stored in a cold chamber of 104 square meters with temperature of 0° F. Once frozen they are packed, put into boxes and transported in appropriate trucks to the franchisee shops.

The truck fleet is proprietary; once there were situations when Frutos do Brasil needed aid from competitors to refrigerated trucks, but the partnership was denied.

The export usually happens through appropriate trucks (refrigerated); the production is sent to the port of Santos (Southeast Brazil) from where it goes abroad in refrigerated containers, United States in the case of this first external sale.

It should be mentioned that there is a dry port (exporting point through airport) very close to the company facilities in Goiania, only 60 kilometers away. But the costs to send the load of fruit by plane are prohibitively higher than the ordinary way using refrigerated truck and container.

XI. SALES AND MARKETING

Frutos do Brasil operates in seven states and in the Federal District where the federal capital Brasilia is located. There are 80 shops distributed all along the country. In the last years, the company decided to offer the franchise model to launch new shops. In 2016 the franchisees are 16 and there are 22 dealers. To be a franchisee one has to apply in a selection process, to pay fees and in case of approval the new franchisee receives a team of marketing professionals and architects to plan the building of the new shop. The marketing team is hold responsible for the promotion of the products specially in events and fairs.

In the last three years the investments made by Frutos do Brasil were proportionally distributed as follows: 60% to productive capacity, 25% to product development and 15% in marketing. The entrepreneurs are planning to change that in the next five years to: 40% in productive capacity, 30% in product development and 30% in marketing. They believe that at this point the business is in need of organizing professionally the communicating and promoting functions. The top management is confident that their products are better than the competition, attributing this superiority to a high-quality production process.

XII. GOVERNANCE AND SUPPORT INSTITUTIONS

The studied company established research and development relationship with Sebrae and Senai. Sebrae is a non-profit private entity created to promote and develop small business; they have branches in every Brazilian state directed to support the management of small companies and startups. Senai, the National Service of Industrial Learning is an education entity which mission is to form professionals in 28 areas of the industry; they operate in the 27 Brazilian states and territories. These entities, Sebrae and Senai are used by Frutos do Brasil as an important source of professional education.

There are also direct partnerships with universities and research institutes. The Federal Universities of Goias and Minas Gerais conduct studies about antioxidants with the waste (biomass) originated in the extraction of fruit pulps. The company donates the biomass to these research entities and in exchange they use it for relevant scientific investigations. The formalization of these partnerships was only documented in 2016, twenty years after the foundation of Frutos do Brasil.

Another interesting partnership was made with the Information Technology Center of the Federal University of Goias directed to support projects in logistic chain in which Frutos do Brasil is involved. Marketing specialists from the University also assist the visual planning of the company.

The company Frutos do Brasil estimates that the development of a new product consumes approximately US$ 6,000 due to the lack of interaction and governance among partners. There is a lack of programs with support to processed native fruits; this specific sector is not recognized as separate area to be considered and studied.

Due to excessive paperwork, formalities and complex procedures, the company does not participate in the fiscal incentive programs like Fomentar and Produzir, the two most famous tax exemption programs of Goias state.

To establish the new unit that processes fruit pulp in Abadia de Goias the company Frutos do Brasil could rely on public resources from the city: the mayor donated the ground on which the producing plant was constructed.

XIII. ACCESS TO CAPITAL AND FUNDING

There are some ways to access financial resources available to Brazilian industries. In the Center West region there is a popular fund denominated Constitutional Fund for Financing the Center West or just FCO (Fundo Constitucional do Centro Oeste). It aims at contributing to social and economic development of the region through the financing the productive sectors like agriculture, mining, industries in general, commerce and services. A company can obtain up to US$ 6 million to initiate, expand or modernize its business.

Frutos do Brasil does not use waivers of tax exemption nor does get credit at FCO. But they have access to an also popular source of public foment funded by the National Bank of Economic and Social Development, the BNDES. They call it the "BNDES

card", the way it is implemented and arrives in the hands of the borrower. This kind of resource is operated through ordinary public and private banks because BNDES has no operating branch; it provides the fund, but the risk analysis is conducted by the commercial banks. Entrepreneurs complain about this inter mediation because sometimes banks demand the acquisition of services to offset the odds of operating the BNDES card. This is considered unfair, but it is practiced by the Brazilian financial system.

XIV. CONCLUDING REMARKS

The production of fruits and its derivatives is an important activity due to the professionalization of the supply chain involving people from poorer local communities in the provision of healthy food. It also stimulates the valuation and awareness of the Brazilian Biomes like Caatinga and Cerrado, the ones approached in this paper. These activities are not supported specifically by public or private financing.

The producers are not articulated or organized; they only compete and have not access to international market in reason of an expensive logistic cost, among other factors. The collaboration among fruit producers should be more articulated and organized in order to build the basis to the formation and enhancing a cluster.

It might be too early to affirm that the web around the company Frutos do

Brasil can become a cluster soon. The organization of players is still in an initial stage of maturity. Although there are important signs of participation like the involvement of universities, research centers and experienced non-profit entities supporting the activities, the interaction among players has not grown strong enough.

The good news is that the demand for healthy products based on native fruits are increasing worldwide. Also to be considered is: the environmental sustainability that permeates the exploration of native fruits suggesting good possibilities of obtaining foment funding by international entities focused on the preservation of nature; the stimulus to the preservation and cultivation of native species, contributing to the conservation of the Biome, its fauna, flora; the preservation of hydrological basin and springs of the region; the support to poorer communities to solve problems like unemployment and low labor qualification; the possibility of widening the employment for women especially those from low income families. This kind of organization can be a reference for countries with economic depressed areas looking for sustainable solutions.

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ANNEXES

Teaching notes (for use in teaching cases):

1. Sustainability and innovation are themes and issues of studies and discussions about possibilities of the renovations and permanence of the capitalist productions. Sustainabilitywererepresented as a concept in Brundtland report as a possible action for the human beings that shouldn't result in damages to the future generations. Arbix (2010) argues that innovation is essential for continuity of capitalist competitive activities. Analyze relations between sustainability and innovation will be a challenge because to maintain capitalism and agents as productive its necessary innovation, but to maintain this process in long term it will be necessary sustainable actions in those innovations, and only then the concept of innovation can really mean something complete.

So in this case we want try to discuss the concepts: Innovation, Sustainability, Competition and Cooperation.

2. According to the Case Dutch Flower it is important to separate elements that are relevant to promote Competition and elements to support and stimulate Cooperation. That case wasvery important to build this one, because both are about dedicated products and process. In The Netherlands things were and are still much more organized, but it is important to think about these innovative actions as an important idea for clusters.

3. Is there a cluster of producers? In what they compete? Do they cooperate? How to stimulate the group of producers? How can they become a cluster? Students should be incentivized to define which items would be interesting to establish cooperation; which items should be stimulated to competitiveness?

Competition: production time, price, product, size, quality, quantity, reputation and variety.

Collaboration: technologies, information, suppliers, education, qualification, campaigns to preserve potential areas of supply, transportation, infrastructure, technical challenges, plagues combat, financial control, negotiation, exportation, fund raising, teamwork, marketing of products, consumer of healthy food, the participation of small farmers and local communities in the business, the preservation of native forests.

4. To know the actions that involve innovation and sustainability becomes an exercise in this study. To know the productive and sustainable activities of "Frutos do Brasil" company becomes an important theme to this analysis. It is a company created in the middle of the Brazilian territory, and their activities has to deal with small and medium farmers, that need to preserve at least part of the natural environment. All the raw material of this company comes from preserved environment. This business is about ice cream made of (most of all) endemic fruits.

5. This is an important case because it can become an interesting model of cluster to depressed areas all over the world; it might help public decision makers to deal with the challenges of poorer regions, and additionally bring reflexions about protected areas with biodiversity.

Map 01: Localization of Goias State.

Source: Atlas do Desenvolvimento Humano. Available in: http://www.atlasbrasil.org.br/2013/pt/perfil_uf/goias.

Map 02. Vegetation cover of the Cerrado in Brazil.

Source: Mapeamento de Cobertura Vegetal do Bioma Cerrado: estratégias e resultados. Available in: https://www.infoteca.cnptia.embrapa.br/bitstream/doc/570887/1/doc190.pdf. Access: July, 2018.

Map 03. Mapping vegetation of the Cerrado and states with "Frutos do Brasil" stores.

Source: Cobertura Vegetal e sítio empresa Frutos do Brasil. Organization: Godoi, C.N. Available in: http://bbeletronica.cpac.embrapa.br/2007/doc/doc_190.pdf and http://frutosdobrasil.com.br/pt/lojas. Access: August, 2016.

Map 04: Antropic action in the Cerrado. (Yellow – antropic action, green – Natural Cerrado.)
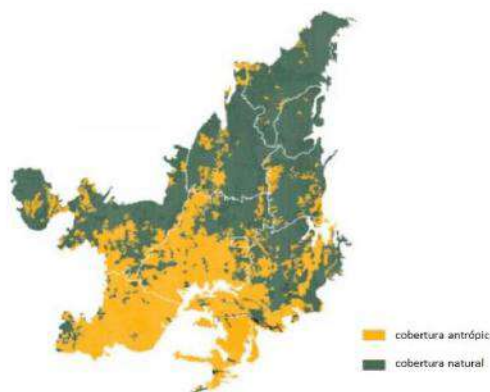
Source: Mapeamento de Cobertura Vegetal do Bioma Cerrado:estratégias e resultados.Available in:

http://bbeletronica.cpac.embrapa.br/2007/doc/doc_190.pdf. Access: August, 2016.

Estado	Porcentagem do bioma no estado (%)	Cobertura vegetal natural (ha)	Cobertura vegetal antrópica (ha)	Formação florestal (ha)	Formação savânica (%)	Formação campestre	Cobertura vegetal natural
SP	33	1.078.716	6.934.203	833.387	210.441	34.888	13
PR	2	118.692	255.565	20.558	14.048	84.085	32
MS	61	6.935.404	14.722.762	2.867.267	3.599.826	468.311	32
DF	100	213.527	362.138	44.645	162.718	6.164	37
GO	97	14.706.696	18.180.482	2.929.033	11.090.161	687.502	44
MG	57	17.794.873	15.418.690	3.279.762	11.322.147	3.192.964	53
MT	40	23.740.333	12.148.095	7.717.102	15.868.080	155.151	66
BA	27	11.209.896	3.963.095	3.333.902	7.357.605	518.389	74
TO	92	20.251.786	4.838.460	4.639.932	13.362.688	2.249.165	79
MA	65	18.753.706	2.318.028	12.337.965	6.032.951	382.790	89
PI	37	8.590.582	758.423	2.319.035	6.210.085	61.462	**91**

Fig.1: Antropicocupation in the Cerrado,in Brazil:State / Bioma in State/ Vegetation cover/ Antropic Cover/ Florestal formation / Savannas formation/ Grassland/ Natural Cover

Source: Mapeamento de Cobertura Vegetal do Bioma Cerrado:estratégias e resultados . Available in: http://bbeletronica.cpac.embrapa.br/2007/doc/doc_190.pdf. Access: August, 2016.

Photo 01: Report about the company in Brazilian magazine.

Source: Revista GOL 02.2012.Available in: http://frutosdobrasil.com.br/pt/momento-natural/clipping/revista-gol

Graphic 01: Commercial exchange of fruit in Brazil (Blue – Exports; Red – Imports)

Source: Ministério da Agricultura, Pecuária e Abastecimento.Available in: http://www.agricultura.gov.br/arq_editor/file/camaras_setoriais/Fruticultura/41RO/App_Oportunidades_41RO_Frutas.pdf.Page 04.Access: July, 2016.

Map 05: Economic dynamic regions in Goiás.
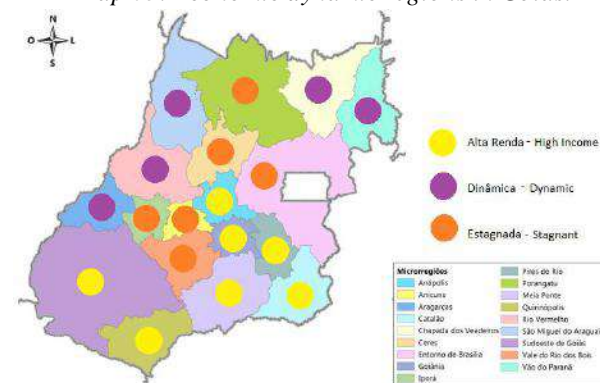
Source: Política Nacional de Desenvolvimento Regional e Instituto Mauro Borges.Org.: Godoi, C. N.Available in: http://www.mi.gov.br/microregioes_pndr and http://www.imb.go.gov.br/viewmapa.asp?mapa=Mapas%20das%20Microrregi%F5es%20de%20Goi%E1s%20-%20IBGE.

Graphic 02: Evolution of the IDMH in Goiás State:
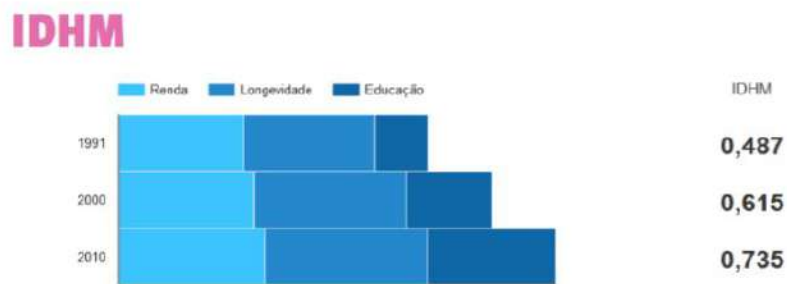
Source: PNUD, Ipea e FJP. Available in: http://www.atlasbrasil.org.br/2013/pt/perfil_uf/goias.

Graphic 03: Population, Age, and Qualification in Goias
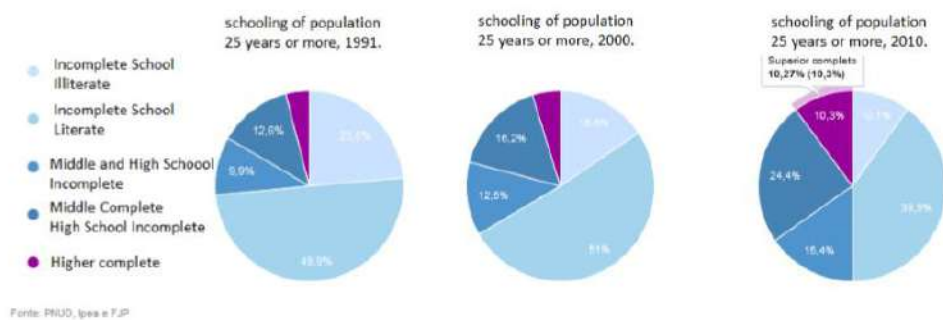
Source: PNUD, Ipea e FJP. Available in: http://www.atlasbrasil.org.br/2013/pt/perfil_uf/goias.

Perception of the Students of the Third Year of High School on GMO Foods

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Abstract—*The GMO foods are increasingly embedded in our daily diet, being frequent in your market presence. These foods have as objective the improvement of the production quality and resistance to pests and herbicides. But even though these foods are being consumed, there is no consensus in the scientific community about the safety of these foods for human health and the environment. Soon the present work aimed to go into the field to assess the knowledge and the vision of the high school students of the private network on the GMO foods, this from the application of questionnaires in schools of the municipality of Gurupi-TO and investigate whether This topic is discussed in the classroom.*

Keywords—*Education, Transgenic, Knowledge, Foods.*

I. INTRODUCTION

Genetically modified organisms (GMOs) or GM crops are those who have had your genetic material (DNA/RNA) changed in order to provide these features, such as increased productivity and greater resistance to pests. These changes are possible due to the advent of recombinant DNA technology, which allows the manipulation of the genetic material of an organism or, even, by transferring genes from one organism to another, even if they do not have any relationship Genetics [1].

Genetic engineering techniques make use of tools and innovative methodologies and, due to this, raise questions about the advantages and disadvantages linked to the use of GMOs both inside and outside the scientific community. Therefore, studies are carried out to try to clarify such points and define the weight of these in the commercialization of GM crops [2, 3].

The advantages of using GMOs can be observed in different segments of the industry, agribusiness, food sample, doctor and pharmacist. How can they be applied differently, transgenics feature several advantages, but at the same time, specific to each industrial area. The same is valid for the disadvantages linked to the use of this type of organism[4–6].

For the agribusiness area, the application of GMOs is focused on the improvement of cultivars, this can lead to food produc- tion safer, for example, enables the reduction of harmful compounds (mycotoxins, alkaloids, etc.) present in plants Convention members; reduces the use of pesticides/herbicides through the use of plants modified to be tolerant to these products, or that are resistant to pests [2, 5].

The advantages of the use of GMOs in agro-industry does not stop there, because they still allow the reproduction of plant varieties more efficiently, i.e. leads to decrease in the amount of land required for the same income that unmodified cultivars; development of plants resistant to adverse environmental conditions such as drought and salt; among other [5–7].

In the area support, the use of GM crops appears to assign functional foods/nutritional characteristics, or produce new types in order to diversify the diet of individuals that have food restriction due to allergies or intolerance. The use of GMOs in this industrial segment products originates with biofortification nutrients, beneficial to health and that may prevent disease [2]. Whereas the present study aims to analyze the level of knowledge of the non-scientific community and that the GMO foods are the most accessible to the population,

another term such as "genetically modified micro-organisms (AGMs) "will be explored later.

As for the medical and pharmacological areas, it is remarkable the positive application of transgenics in the industry, as an example have the possibility of producing edible vaccines (e.g. milk and transgenic plants containing molecules able to promote immunization of individuals); cancer research through the use of transgenic viruses as vector; use of bacteria that secrete substances against diseases such as HIV; Finally, studies on the possibility of producing biopharmaceuticals through transgenic plants [8].

In spite of the benefits arising out of the use of genetically modified organisms, there are still doubts about the harm that can be tied to the same. So widespread, the issues raised the more relevant point to possible health risks, unexpected gene interaction, cancer risk, the possible emergence of allergies, horizontal gene transfer, increasing the chances of resistance to antibiotics, environmental risks, risks to biodiversity, among others [2].

Despite being a topic discussed and controversial enough at the present time, GMOs have been produced for some time, since the experiments undertaken by Mendel in the 19 century. With the advancement of technology, the methods of transformation of bodies were being improved and it was possible to obtain specific way modified organisms and to submit only desirable characteristics [9]. Initially, GMOs produced were more related to the areas of medicine and Pharmacology, only in the year 1996 the first genetically modified food (AGMs) were introduced on the market [6, 7].

Nowadays, in the context of GMOs, we live a moment totally opposite moments experienced a few years ago. Today these foods are entered in our daily diet and criticisms with respect to these foods have ceased, well different from the years 2000, where reports of the presence of genetically modified food in industrialized Brazil axis departments public opinion campaign conducted by Greenpeace, "GMO foods: not on my plate!".

The production of AGMs if given by the fact of providing best quality, foods containing higher amounts of nutrients,   or reducing the use of chemical agents in the field, improving the resistance to environmental stress conditions food, such as droughts and flash floods. It is possible to say that the cultivation of genetically modified foods, also, the optimization of production, making it produced a greater amount of farming per hectare, so it would be a way to meet the food demand of the globe [6, 7, 10].

The use of transgenic cultivars presents some

advantages already clarified by research, such as increased resistance of plants to insecticides, droughts, disease, salt, increase in the quality and quantity of nutrients from food, reduction of land destined for Agriculture, reduction of inputs used in the cultivation, among others. Still, there are controversies regarding the consumption of AGMs, mainly in that it is tangent to the safety of these or other products containing traces of GM crops [6, 11].

Although the aggregate benefits to the use of genetically modified food are considerable, discussions about your consumption raised several controversial issues, such as the possibility of mutations, allergies, and carcinogenic effects. Concerned about the withdrawals, researchers were able to demonstrate that AGMs consumption does not cause damage to the body. However, instituted a culture of prejudice, fear and lack of information of the population about the use of transgenics [5, 6, 12].

In Brazil, GMO foods or contain traces of GMOs shall include, on the packaging, a symbol to indicate the nature of this. Despite providing essential information about the product, the symbol used for signaling is similar to others which refer to street signs, radioactive elements, and high voltage. In this way, the portion of the population that has a poor knowledge regarding AGMs understands that products containing such emblem should be carefully considered, thoughtful, or even dangerous to health products. Thus, policies of awareness and dissemination of information should be carried out so that there is acceptance
of transgenic origin food products.

II.   MATERIALS AND METHODS

The method used was the experimental study of quantitative and qualitative type. The quantitative methodology aims to work with numeric data collected during the research, by applying statistical techniques, while the qualitative method aims to evaluate and interpret aspects raised the subject researched.

The target audience for this research were students of the last year of high school or private schools of the municipality of Gurupi-TO. Data collection was performed with the application of 35 structured questionnaires according to the purpose of the research, which is to raise data to evaluate the level of knowledge of young people about the AGMs.

The questionnaire consisted of 20 questions initially contemplating the General information of the participant, where there has been focus on 9 of these issues which sought to understand the knowledge of the student interviewed   about   the   existence,   production,

consumption, and disclosure relating to GMO foods, which was set taking into account the knowledge of students about biology and genetics. In this way, the aim is to better understand the level of knowledge of young people with education about the AGMs, the myths that still are believed, prejudices, and erroneous information that is disseminated to the population. Soon, the data obtained may lead to planning methods to be addressed to enrich the knowledge of such a group, on genetically modified food.

III. RESULTS AND DISCUSSION

After the application of the questionnaires, data were evaluated and tabulated, seeking to evaluate the knowledge and degree of acceptance about genetically modified foods by high school students from the private network of Gurupi-TO. The questionnaire was answered by 35 students and contained multiple choice questions related to the definition, transgenic foods consumption and labeling. Of those surveyed, 49% were male and 51% female with ages of 17 to 18 years (Fig 1).

Most students, 40% of respondents, say make use of GMO foods, the rest is divided into 31% which doesn't make the use of GMO foods and 29% who don't know how to make use or not, just do not know the definition and do not seek to observe the presence of them on the switch shows (Fig 2). We realize that the vast majority never heard or know what the exact definition of GMO foods (Fig 2), 34% of respondents claim to know the definition of GMO foods, this percentage is lower than the 37 percent who declared themselves do not have knowledge.

Students said knowing the definition of GMO foods, responded that these foods are genetically modified to assist in the planting, while others said they are foods with high nutritional value. The percentage of students who said not knowing the definition shows us that is necessary more information on GMO foods of high school students in the schools of the town of Gurupi-TO.

Fig. 1: Sex of respondents.

Fig. 2: Use of GMO foods and knowledge of definition.

When asked about the possible human health impacts most students (32%) agree that GMO foods are safe to human health, this most 32% agree fully while 23 percent agree partly and 31% do not know about the safety of these foods, and those who disagree (14%) the

statement represent a part of who don't know about the AGMs (Fig 3). It is obvious that, when comparing the GMO foods with organic food, the students gave their opinions by the alternative of not knowing (40%) If the GMO foods are healthier or not.
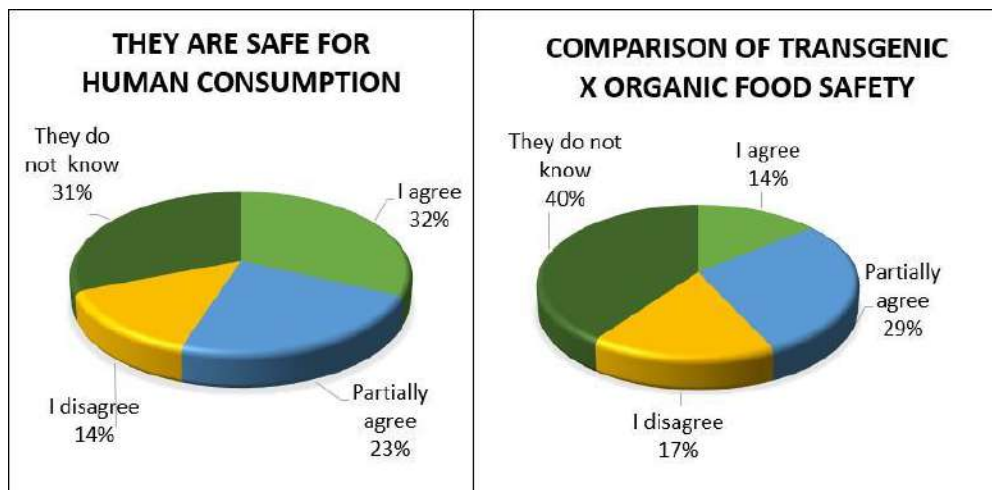
Fig.3: Security relationship of consumption of GMO foods and comparison of these with organic food.

If treating the symbolism of GMO foods about of 57% of respondents claimed to have seen or know the meaning of the symbol "T", while 56% said they had knowledge of what is the "T" symbol. Some employees showed knowledge of the meaning of the symbol of transgenics in packaging, however, most people don't

know that the meaning is related to GMO foods. With respect to the meaning of the symbol related to GMO foods, 43% claimed not to know the meaning, which was checked on the issue essay explaining what is GMO foods (Fig 4).

Fig.4: Demonstration of the issues regarding symbolism AGMs.

It is obvious that the majority of respondents chose not to express an opinion with respect to the consumption of these foods, due to little understanding about the subject, but 34% of the students are aware that people consume GM crops without knowledge of the same, as seen in the previous charts. The population lacks information on transgenics, and when they receive is because of adverse two sides both beneficial as evil in relation to the consumption of these foods, soon more

information is required.

In view of all this lack of knowledge and dissemination, the students gave their opinions about the best alternatives to the disclosure of AGMs. The values obtained showed that 32% opted for the internet and social networking, 19%, 17% in schools packs, 12% in two categories, newspaper/radio and tv, and 8% did not know to opine (Fig 5).

Taking into account the data collected in a recent

survey it can be affirmed that there should be greater dissemination of information about GMO foods since there is still little information or erroneous information regarding this type of product. The lack of information

undermines the right of consumer choice because she didn't know the product you are choosing and consuming.
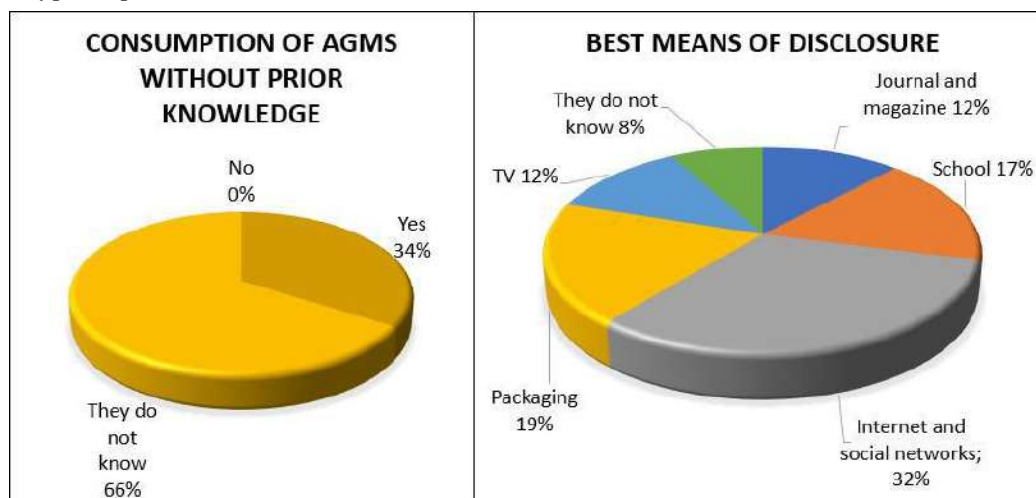
Fig. 5: GMO consumption without having knowledge and some means of disseminating AGMs.

IV. CONCLUSION

One can understand that more than 85% of high school students did not know the private network to respond to what is a transgenic food according to the descriptive issue. The results showed that there is a lack of knowledge of the students and probably about transgenic foods supermarket consumers are, however, some students know the meaning, or a brief knowledge of genetics modified. On the study of the population has been established that there is misinformation about the presence of GMO in processed products and also the meaning of the symbol "T" and the risk of consumption of AGA. Lack of information impairs the right of consumer choice because he didn't know the product is chosen and consume.

ACKNOWLEDGMENTS

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Beef Cattle Expansion in the Brazilian Legal Amazon: from Land availability to Emerging Technologies

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Abstract — *The state of Mato Grosso is part of Brazilian Legal Amazon and is one of the new frontiers in world farming facing the global demand for food. It is also one of the most important regions that have contributed to increasing the size of Brazilian cattle herds. However, a better understanding of the factors driving this expansion in area and the quantity produced is needed to support public policies and domestic production planning. Consequently, the aim of this article is to analyze and describe the historical drivers of beef cattle expansion in the state of Mato Grosso, considering the beef supply chain and state economy. Key findings included indications that this expansion was based on the availability of arable land and lower land prices but mainly resulted from the use of technologies allowing increased efficiency and competitiveness in livestock in Mato Grosso.*

Keywords** — **Livestock, Food Production, Socioeconomic Development, Agricultural Engineering Research, Land Use Change.

I. INTRODUCTION

The growing consumption of animal protein and the increasing concern regarding the exhaustion of natural resources are major challenges for food production in all the world. This demand for meat has encouraged beef production, leading to increases in herds worldwide. In Brazil, the cattle herd increased about 30% in the last 20 years, mainly in the center-western region (IDESP & ADEPARA, 2012) where land is available and the production costs are more competitive (Arima et al., 2014). In this scenario, land price is one of the major drivers and is influenced by the potential development of this region and the economic returns for commodity crops, such as soybeans (Borchers et al., 2014).

On the other hand, investments in research and technologies to intensify productivity also contributed to establishing Mato Grosso as one of the main Brazilian livestock production centers.

Moreover, Mato Grosso consists of three important biomes, Amazonia, Cerrado (*Brazilian savanna*), and Pantanal and is part of the Brazilian Legal Amazon. This diversity offers versatility to the production systems but increases the concerns regarding the expansion of food production over natural areas, causing deforestation in this region (Arima et al., 2014).

Although cattle herd in this state presented a growth of 10% from 2005 to 2012 (McManus et al., 2016), there is a clear trend toward the stabilization of this herd, probably because of the pressure from environmental legislation, which requires 80% of farms located within the Amazonian biome to be set aside as legal reserve.

Nevertheless, the drivers and socioeconomic aspects that led to beef cattle expansion in this state are unclear because public policies and other productive strategies did not consider local particularities connected to this activity.

In addition, studies dedicated to understanding the drivers influencing the occupation in Mato Grosso can support national production planning and public policies for incentives or control (Oliveira et al., 2017) because the special relocating of the production has great implications on the region to which it moves (Bowman et al., 2012).

Therefore, this research offers a descriptive analysis of the drivers that influenced the expansion of cattle production in the state of Mato Grosso.

II. MATERIAL AND METHODS

The focus of this study was the state of Mato Grosso located in the center-western region.

This state also belongs to the Brazilian Legal Amazon, a political-administrative region, created by the Brazilian Government in 1953. Brazil's third-largest state, Mato Grosso has 903,357 km2 of area and more than 3 million habitants, but only 549,153 of those reside in the rural areas (IBGE, 2010). Moreover, as mentioned in the introduction, Mato Grosso consists of three important biomes (Figure 1).
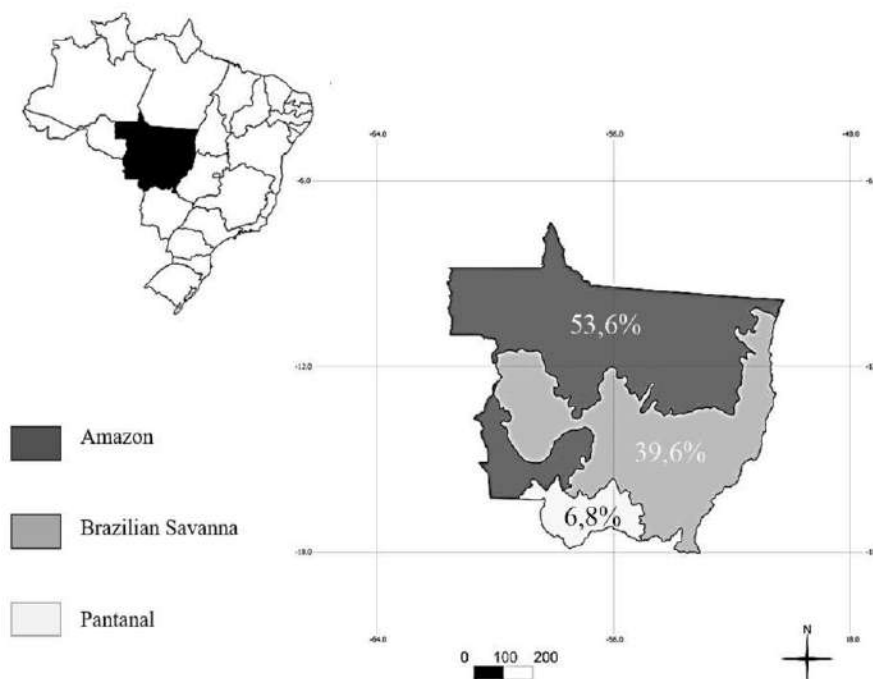
Fig. 1: Location of Mato Grosso state and local biomes, according to the distribution of Brazilian biomes Numbers in the map indicates the percentage of the state occupied by each biome

To identify the drivers of cattle expansion an exploratory analysis of the grazing areas and the cattle herd in Mato Grosso was conducted between 2000 and 2014.

Additionally, the total export volume and the number of animals slaughtered in the state during this period were compared. These comparisons were analyzed using a Spearman correlation in the SPSS 20.0 software (IBM SPSS, 2011), assuming $r^2 > 0.80$ and $P < 0.001$ to be statistically significant.

The topic was also researched in scientific publications (books, journals, proceedings, thesis, and dissertations) and in secondary data (governmental reports, universities, and research institutions).

In addition, on-site observations were conducted to identify the drivers behind technological changes in the sector and milestones of this expansion (Table 1).

To confirm the relevance of the identified drivers, interviews were conducted between 2011 and 2012 with key Brazilian stakeholders of the beef cattle supply chain (agents from government agencies, slaughterhouses and meatpacking industry, research centers, auctioneers, investors, and farmers).

Table 1: Scientific events, research group discussions, and integrating seminars discussing the expansion of beef cattle production in Brazilian Legal Amazon.

Events and discussion centers	Year
Scientific Events	
World Congress of Rural Sociology	2012
Low Carbon Agriculture Plan dissemination seminar	2011
Annual IFAMA World Forum and Symposium	2011
Sustainable Livestock Symposium	2011
NESPRO Meeting	2010/2011
International Conference on LCA in the Agri-Food Sector	2010

Sustainable Livestock Congress	2010
World Meat Congress	2010
Cong. of the Brazilian Society of Economics and Rural Sociology	2009/2010
International Pensa Conference	2009
Research discussions groups	
Center for geo-environmental studies (NUCLAMB/UFRJ)	2009/2012
Center for studies in beef production and the production chain (NESPRO/UFRGS)	2009/2012
Strategy, Competitiveness, and Development Research Group (GEComD/UNESC)	2009/2012
Integrating seminars	
CEPAN Meeting	2010/2011
PPG Animal Science Seminar	2011
NESPRO Annual Meeting	2012

Finally, the Business Process Model (BPM) was adopted (see Vanthienen et al., 2007) to elaborate the framework model (Fig. 2), for the description of and the resulting figure for the drivers of the cattle herd expansion in the state of Mato Grosso (Fig. 7)
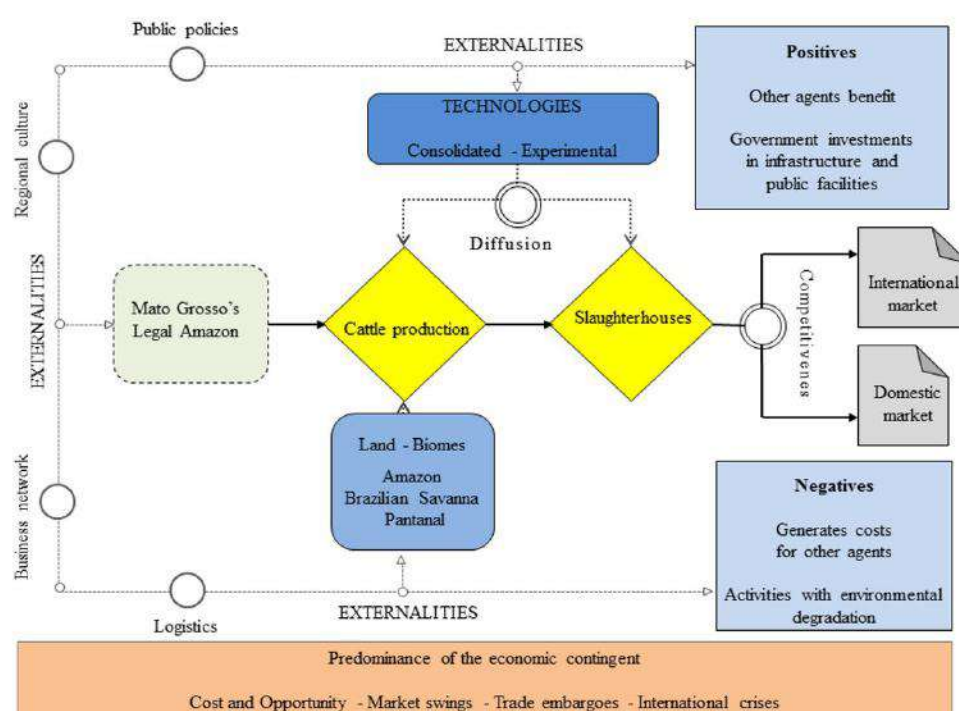
Fig. 2: Analysis Model for the cattle herd expansion in Mato Grosso, located in the Brazilian Legal Amazon

III.   RESULTS AND DISCUSSION

We identified three dimensions that directly affected the beef supply chain in the Brazilian Legal Amazon, the socioeconomic outlook, the installation of meatpacking industries, and diffusion of technologies in the region. The characteristics and main events for these dimensions in Mato Grosso were determined to identify the drivers behind the occupation of cattle production in this state.

3.1 Socio-Economic outlook and the beef supply chain in Mato Grosso

In 2010, approximately 208 farms dedicated to cattle production were placed in Mato Grosso. Although 85% have up to 300 animals (24% of the state's herd), most of the herd (52%) was concentrated in 5% of the farms (INDEA, 2010). Despite the land and herd concentrations, the state still maintains small proprieties, normally managed by rural families. Most of these families come from other Brazilian states in search of opportunities and land availability. The migration in the past decades, along with the availability of land with low prices, also contributed to the beef production growth.

Moreover, despite 35% growth in the population, Mato Grosso remains one of the least populous and settled states (INDEA, 2010). Consequently, its population is unable to absorb its own beef production, which is currently exported overseas (19%) and to other states (81%) (IMEA, 2011).

The structure and main interactions between the stakeholders were determined by the researched in scientific publications, secondary data, discussion center and in the interviews. A basic structure for the beef supply chain in Mato Grosso was elaborated according to the information and data analyzed in this research, this result was also an adaptation from the proposition of the Beef Breeders Association of Mato Grosso (ACRIMAT, 2011) (Fig. 3).
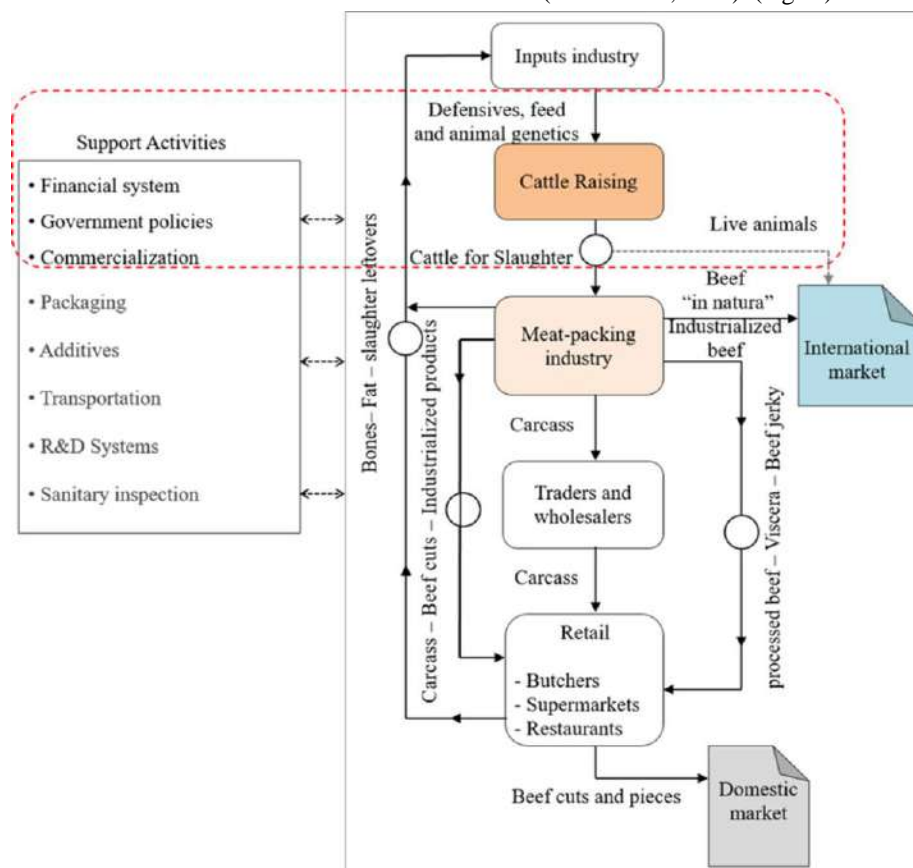
Fig. 3: Structure of the beef supply chain in the state of Mato Grosso, located in the Brazilian Legal Amazon
Source: Elaborated based on Wiazóvsky & Lírio (2003); FAMATO & FABOV (2007).

In Mato Grosso, most of cattle production systems are extensive, complemented with feed supplementation in the dry season, between April and September (Moraes, 2010). However, these systems do not provide adequate financial returns, requiring productive improvement and the adoption of new technologies to improve productivity and economic indicators. Recent technologies have introduced new relationships into the productive space, an important fact that has led the stakeholders to seek sustainable production strategies, like shortening the production cycles of the cattle.

Beef cattle integration with agriculture or forestry has contributed to grassland recovery and increased productivity and profitability. This is because, after the harvest of grains (soybeans and/or corn), these areas can be used for grazing, fattening the animals with grain-products, forage, or pasture from July to September (the end of the dry season). This integration can increase the organic matter in the soil, encouraging biomass production and allowing higher stocking rates. These integrating strategies have the potential for sustainable intensification of agricultural activities in Brazil, particularly in Mato Grosso. However, little is known regarding these systems, and few farmers have adopted it till date (Gil, 2015). This proposal has been implemented in other Brazilian states through a process of agricultural occupation associated with greater coordination to the national economic space (IBGE, 2005).

Overall, many factors influence this beef cattle supply chain, especially regarding the variation in the number o animals allocated to grasslands and send to the slaughterhouses, both fluctuate according to the management strategies of each farmer. The main results observed comprise the dynamic cycle of beef cattle activity in Brazil (Fig. 4).
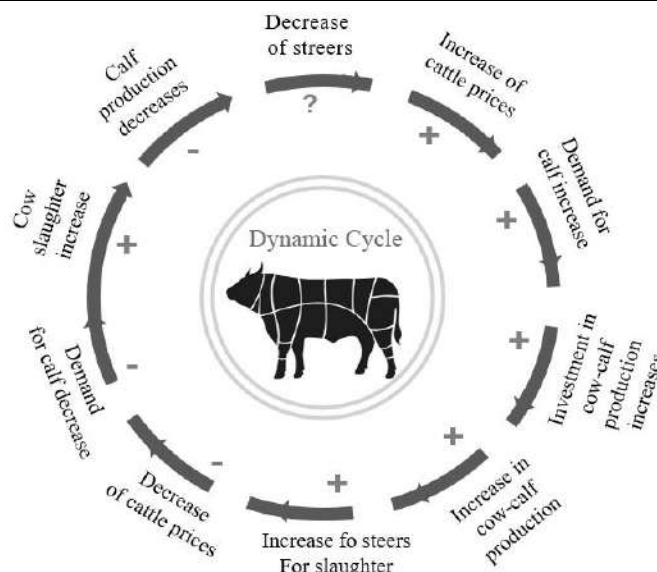
Fig. 4: Dynamic of the law of supply and demand applied to beef cattle in Brazil.

Based on the dynamic cycle of beef production (Fig. 4), the reduction in prices for farmers led to an increase in the slaughter of females, which accounted for 47% of the total herd between 2005 and 2007. This, in turn, inflated the overall supply and reduced calf production, causing a reduction in the slaughtering of steers between 2008 and 2010, raising the price of calves, and reducing the female slaughter rate to 36% (IMEA, 2011).

This dynamic resumed the growth of the state's herd, pushing farmers to increase their use of technologies and lead to a reduction in the average slaughter age of males, but also caused significant losses for the slaughterhouses and meatpacking groups.

Moreover, the quick and intense establishment of slaughterhouses in small towns, without proper strategic planning and scaling, influenced the production, particularly for cattle transport conditions and costs (Capanema et al., 2012). In this case, the movement of slaughterhouses toward Mato Grosso's Amazonia reflects a logical reduction of acquisition costs. Recently, the

international market witnessed the internationalization of Brazilian meatpacking industry, a process that stimulated the sector's growth.

However, the market dominance of this sector raised doubts to the credibility of the relationship between large companies, the government, and local farmers, indicating the importance of trust mechanisms between the parties (Fröhlich & Bluhm, 1991), because of the beef production for export targets demanding markets. Those partnerships included distribution networks and have increased since the end of the sanitary blockades, opening new export markets (Rivero, 2009).

Furthermore, an increase in grasslands was observed and was associated to the economic stability of the state, which allowed the investment in livestock production encouraged by governmental incentives and the availability of cheaper land in the 1990s (Fig. 5).
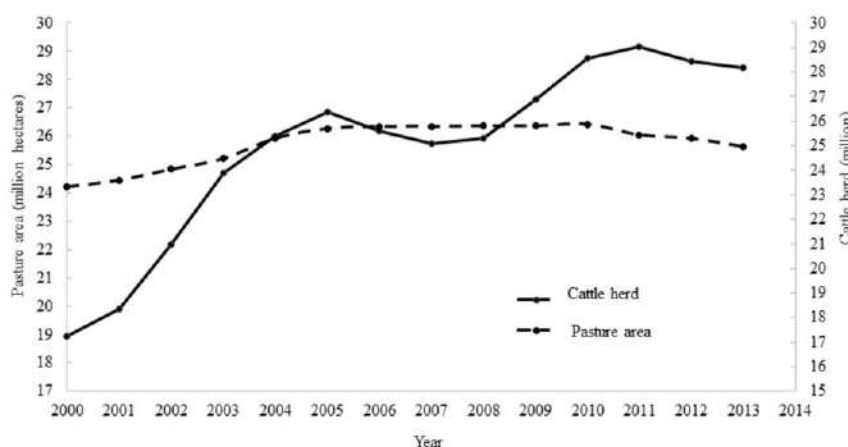
Fig. 5: Pasture area and cattle herd in the state of Mato Grosso, Brazil

The impressive growth observed in the cattle herd was based on the advance of this activity over areas in the Amazon Biome, north of Mato Grosso (Fig. 5). The stabilization that followed was the result of environmental laws, as well as the awareness among farmers regarding the importance of pasture renewal and correct management.

This consciousness is a key issue because the productivity of cultivated pastures in Brazil is no more than 34% of its potential. If 50% was reached, the resulting yield would be enough to meet beef demands until 2040, with no need for further conversion of natural ecosystems (Strassburg et al., 2014). Nevertheless, the herd increased more than the pasture area, with a 56% growth in occupancy rate from 2010 to 2014.

3.2 The meatpacking industry and its impact on Mato Grosso beef supply chain

Mato Grosso was divided in 1977, creating the state of Mato Grosso do Sul, officially established in 1979. This division led to a movement of the slaughterhouses, which first settled in the lowlands surrounding Cuiabá (capital of Mato Grosso) and Várzea Grande, later expanded to all microregions of Mato Grosso. In 2014, the north and west regions of Mato Grosso had the highest monthly slaughter capacities in the state, approximately 20% and 18% of the statewide production, respectively (IMEA, 2015).

The establishment of the first slaughterhouse unit in Mato Grosso was associated to the expansion of beef cattle in the southern part of the state (currently Mato Grosso do Sul) and logistics facilities, such as the railway

to São Paulo. Most of the slaughterhouses were established in small towns, which lead Mato Grosso to the first position in slaughtering capacity among Brazilian states in 2005 (IBGE, 2010).

In recent years, the commercialization of animals with adequate fattening degree in Mato Grosso has mainly targeted the supply of entire beef (hind quarter/front quarter/flank) to wholesalers of urban centers in the southeast region, as well as boneless cuts for the foreign market through three leading slaughterhouses (FAMATO & FABOV, 2007).

However, only approximately 46% of the installed slaughter capacity was used in 2014, slaughtering 5,521,878 units compared with the slaughter capacity of over 11 million units (IMEA, 2015). This low utilization rate reflects a crisis in the meatpacking industry, which began in 2008. From 2009 to 2010, large groups opened a legal request for judicial recovery, ceasing their operations.

Despite almost 300% growth in the cattle herd, in 2008, we observed a significant decrease, which may be related to the slaughter of breeding stock, a previous outbreak of foot-and-mouth disease (2005/2006), and the increase in the exportation of live animals, as well as the economic downturn observed during that period.

Even with the slaughterhouses working below their potential processing capacity, national and international demand fell short of supply, lowering prices for farmers. The expansion of Mato Grosso's herd (Fig. 5) also resulted in a higher slaughter rate for the period analyzed, as well as an increase in the beef export volumes (Fig. 6).
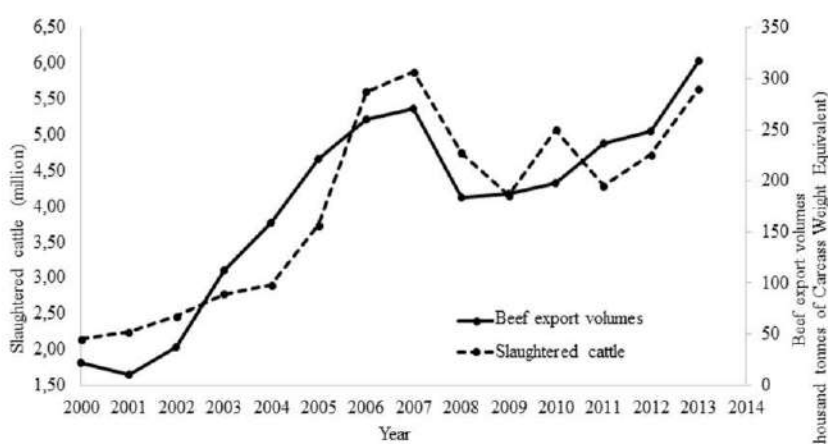
Fig. 6: Slaughtered cattle and beef export volumes of Mato Grosso state, Brazil.

Thus, slaughter capacity in the state was associated with the sale of beef abroad and to other states ($r^2 = 0.89$; $P < 0.001$). During the period under study, the Mato Grosso economy presented increasing positive results in its trade balance. In 2007, for instance, the total beef exports were approximately six times higher than in 1996.

Moreover, even though the international crisis had affected the results in 2008 and 2009, the general trend pointed toward a recovery.

3.3 Technology and competitiveness in beef cattle production

Despite the importance of the economic management in the modern hypercompetitive environment, many farmers still consider beef production to be different from other economic activities, ignoring basic principles, such as the law of supply and demand. This is also true for Mato Grosso.

In this state, we observed that the technological advances in cattle production are more related to the increase in the number of animals than to the increment of the pasture area.

Considerable technological advances have been observed in various countries, resulting in productive efficiency and superior quality in the final product (Bellows, 2000). In beef cattle, high production can be achieved by increasing the productivity of pastures and the herd itself (Strassburg et al., 2014).

However, these strategies involve the landowner, who must understand and accept the technological changes because the landowner is the producer who decides what actions will bring success or failure to the production systems (Dziuk & Bellows, 1983). Moreover, Brazilian production systems are very different among the country and range from traditional to intensive farms (Bungenstab, 2012), which difficult the understanding of farmers' characteristics and beliefs, as well as their aspirations, needs, and dreams.

Although the intensification of livestock farming may compromise local traditional practices, particularly for small farmers (Strassburg et al., 2014), it can contribute to sustainability and overall productivity of the supply chain. In beef cattle production, this efficiency depends on the adoption of technologies, which is influenced by technical and extension support and communication among farmers (Genius et al., 2014).

Furthermore, cost is the main competitive advantage of low differentiated products, such as beef (Porter, 1990), imposing the challenge of selecting technologies with consideration to the availability of capital, technical resources, farmers vocation, logistics, human resources, market, and the respect for the legislation for the environment (Barcellos & Suñe, 2011; Marques et al., 2011). Consequently, new technologies for efficient production and adaptation to the new regulatory framework require the farmers to have professional conduct and practices (Barcellos et al., 2011).

A final representative scheme was elaborated for the identified drivers of beef cattle expansion in Mato Grosso, including the historical and macroeconomic facts of this phenomenon (Fig. 7).

The BPM framework model was able to identify the drivers for the cattle herd expansion and provided an interesting analysis of the agricultural landscape in the Mato Grosso state. The Mato Grosso State Federation of Agriculture and Livestock Production used the structure proposed by this research as a tool to broaden the administrative vision of roles and responsibilities and as the foundation for its regional studies (FAMATO & FABOV, 2007).

In addition, the communication of this Mato Grosso outlook to other researches, investors, and policymakers can offer opportunities to advance in the development of technologies applied to beef also from a sustainable perspective (Gianezini, 2014). Moreover, although the level of technological intensification has increased, to achieve better efficiency in production, farmers must be aware of the regulatory framework guided by elements, such as traceability and environment/land legislation. Besides, despite the dominance of large groups in the meatpacking industry, it is necessary to emphasize the difficulties regarding logistics infrastructure, labor quality, and the distance from the main consumer markets.
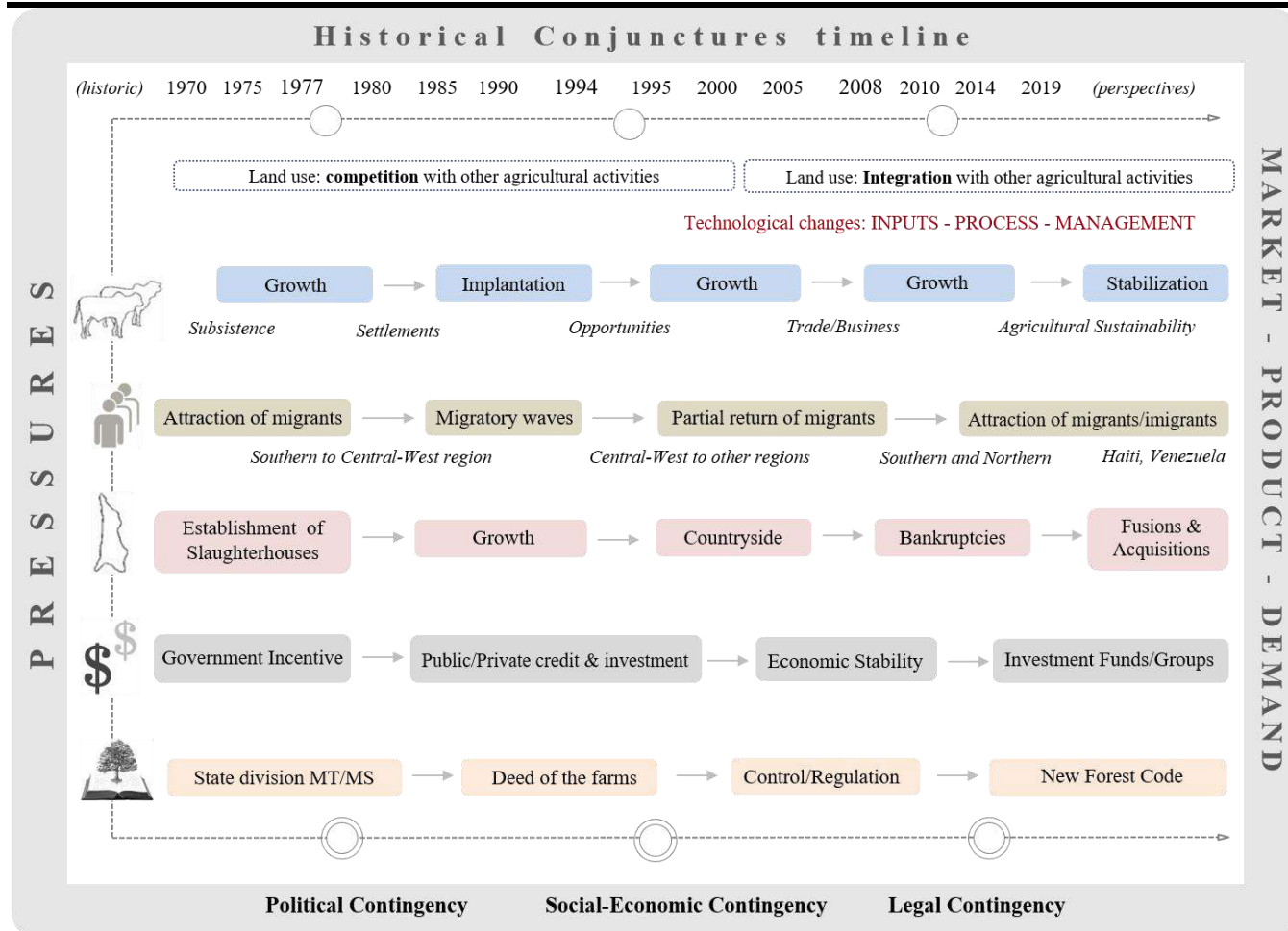
Fig. 7: Drivers and milestones for the expansion of beef cattle herds in the Mato Grosso State, Brazilian Legal Amazon

IV. CONCLUSION

The socio-economic landscape of Mato Grosso offered conditions for the expansion of the cattle herd. One of the most important factors in this scenario is the technological change that led to alterations in land use patterns, different from the geopolitical division that landmarked beef cattle expansion in the years 1970-1980. Some farmers have observed how grain farmers can be competitive and seek to copy them or integrate grain crops into their activities. Thus, instead of reproducing preexisting productive structures, recent agricultural advances in Mato Grosso have created a frontier where a technological change is a central element behind the state's agribusiness related to a new productive profile.

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Mining and its Impacts on the "Caatingas" of the Brazilian Semiárido

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Abstract — *Mining is one of the activities that affect the environment intensely, changing the location and environment where waste deposits are discarded. Being one of the basic sectors of the Brazilian economy, mining has contributed to the economic development, since operated with environmental responsibility, based on the precepts of sustainable development. The present study aims to demonstrate the socioenvironmental impacts and conflicts caused by mining activities in the rural community of Paredão, located in the north of the State of Bahia, as well as to discuss the ineffectiveness of Brazilian legislation through illegal mining without licensing. It is a qualitative, descriptive, observatory, bibliographical and participatory research based essentially on the Geosystemic Theory (Sotchava, 1977), the Ecodynamic Method (Tricart, 1977) and the GTP Theory (Bertrand, Bertrand, 2007). Discourse and Content Analysis of Bardin (2009). The results indicate that the area is totally degraded, directly impacting "the Caatingas" in loco, being with the soil and the subsoil deteriorated, completely naked, eroded and frail.*
Keywords — **Primary activities, Social conflicts, Environmental damage.**

I. INTRODUCTION

Mining is one of the activities that affect the environment intensely, altering the exploited area and all its surroundings, where waste deposits are discarded. Being one of the basic sectors of the economy, and having contributed to the development of cities and small towns, it has not always been operated with environmental responsibility, thus causing irreversible impacts on nature and society.

The history of Brazil bears witness to how old is the exploration of ore in the country and especially in the northeastern Sertão. In 1671, he was invited by Governor Afonso Furtado to lead a big flag in search of silver and emeralds Fernão Dias Paes, the emerald hunter, who had in his curriculum a previous trip to the Sertão with Raposo Tavares, around 1636. The invitation came from the governor through a Royal Charter, in which the monarch asked, the "men of São Paulo", to take to the field in search of a great dream of the Portuguese

government: the silver and emerald mines, which were supposed to exist in the undue Brazilian Sertão (FERRAN, 2007).

Based on these initial assumptions, this study aimed to demonstrate the negative environmental impacts caused in the Caatingas (native vegetation) by mining activities in the community in thesis, and the impacts and social conflicts generated from mineral exploration, as well as to discuss the ineffectiveness of the legislative applicability in Brazil, which implies illegal mineral exploration and without proper licensing.

This research is qualitative, descriptive, observatory, bibliographic and participatory based on the Geosystemic Theory (Sotchava, 1977), the Ecodynamic Method (Tricart, 1977) and the GTP Theory (Bertrand, Bertrand, 2007), in addition to the Discourse and Content Analysis method by Bardin (2009). In addition, for data collection, on-site visits and photographic records were used for real analysis of the impact on the area.

The results show that the area is totally impacted, with deteriorated soils and subsoil, completely naked, eroded and weakened. In addition, the wild and domestic animals with habitat in the area are chased away by the unwanted human presence, traffic and noise of transport and people, putting this ecosystem in total danger. As far as vegetation is concerned, it is totally suppressed, where species that should protect the soil and serve as shelter for animals and humans have been abruptly stoned to give way to the sinister "place of mineral exploration".

II. STATE OF THE ART RESEARCH

2.1 MINING IN BRAZIL

Mining in Brazil transcends seasons and has its records since Pero Vaz de Caminha. According to Ferran (2007) in reference to the Letter of Caminha, this is very clear when in 1590, in the captaincy of São Vicente found gold in the vicinity of the peak of Jaragua, and also to the north of the airport current Cumbica - Guarulhos, occurring the same in the Ribeira valley.

Already in 1671 Fernão Dias Paes, through the Royal Charter, was invited by the governor Afonso Furtado to head a large flag in search of silver and emeralds, since the same had experiences with previous trips to the region

with Raposo Tavares, in 1636. The request was to seek to discover the mines of silver and emeralds, which was assumed to exist in the indevassado the brazilian sertão. The record shows that there were more than seven years of marches and prospects. (FERRAN, 2007).

However, since the beginning of the history of our country that "the wealth generated by mining do not remain in Brazil (perhaps limited to the fifth - 20% - compulsory) and little went to Portugal" (Ferran, 2007, p. 36). The dependence of the Portuguese in relation to british power was the former, and "a large part of the debts of the Portuguese, ended up being paid with the gold of brazil, which allowed still more, a great accumulation of capital in the United Kingdom unprecedented" and that led to obviously the Industrial Revolution.

Was departing from the port of Paraty in Rio de Janeiro, crossing the Serra do Mar mountains and reaching the Valley of the Paraiba, which has reached the General Path of the Wild. Based on the Serra da Mantiqueira mountain range, through the Throat of the Embaú, and ventured into the hinterlands that, during the eighteenth century, would be devassados, in the first race of the gold of the modern era (SHELLARD, 2015).

And so came the first environmental impacts that are registered according to Shellard (2015):

> Through enslavement, massacre, and acculturation of native peoples, the frontier, colonial has expanded, causing a deep impoverishment of the culture and environment of the Americas. The forests have been destroyed, transformed in lavras, pastures, crops and towns, which included destructuring communities, whose survival depended on certain environmental settings (SHELLARD, 2015, p. 2).

It is noted that since the first steps were taken in Brazil for mineral exploration, that the negative consequences came in parallel to success, whether they are environmental consequences, whether social. Large areas of the mountains have been deforested and eroded the search for the gold of grupiara, that is, the mining has generated and continues generating severe environmental impacts.

Corroborating with Shellard, Santos (2008) argues that the Portuguese Crown articulated, imposing numerous guidelines on mining in Brazil, the local reality of the climate and economic european, and disengaged motivations of use and place, establishing new relationships between use and conservation of nature.

It is relevant to point out that the idea of hinterland in the colonial period relates much more to a perception of

socio-cultural space, the holder of a non - domesticated, hostile, than to aspects of the physical-climate characterized by the dry climate and the vegetation is sparse. In this sense, the barrens would be the hinterland, understood as non-civilised areas conflicting, inhabited by savages (RIBEIRO, 2008), that is, a stereotype created centuries ago.

In this way, Ferran (2007) states that the first emeralds found in Brazil took place in the de1960, in the town of Carnaíba in Bahia, but the idea to search for them, even coming from Portugal, must have originated prior to the Spain, since the treasures of pre-columbian brought to Spanish America, the did know.

2.2. MINING IN BAHIA

In 1942, in the middle of the Second World War, the Brazilian Group Pignatari, Lamination and Metals National, associated with the government of the State of Rio Grande do Sul, and with a third part to be divided between the holders of minors, constituted the CBC-Cia. The brazilian Covers, directed by the Engineer Pedro Barroso and Viktor Leinz, having as a highlight the "Pignatari", who was the first to explore the lands of Bahia and the interior of the interior.

When the collection of the CBC and Mina Caraíba in the state of Bahia, was assigned to the BNDES-Fibase in exchange for debts for labor, to be searched by Docegeo (Special Projects, the Caribbean and Camaquã), the Engineer Zorzanelli described Baby Pignatari, as "a man adjective" (FARRAN, 2007).

Still according to Farran (2007), in 1938, near the Macaúbas, Bahia, was found a stone with a different and heavier than the others, which melted down by a blacksmith, it was found that it was lead. "But the Compendium of the Minerals of Brazil of Luiz Caetano Ferraz (1928) refers, under the heading anglesita, as sulphate of lead, a density greater than 6 (six) and was only found in the State of Bahia" (p. 66). However, anglesita existed only in these stops, in the outcroppings of the Boquira mine, also in Bahia.

However, before 1928, Souza Carneiro, Polytechnic Institute of Bahia, mentioned in the book "Mineral Wealth of the State of Bahia" to the anglesita of the Sierra de Macaúbas. The bulletin was produced for the national exposition of 1908, being that this is the first reference to the occurrence of lead in the premises and may be where Caetano Ferraz in 1928, supporting his work (FERRAN, 2007).

Around 1954 a priest named Macário, on his way to his parish, based in the municipality of Macaúbas, decided to collect samples that were "open sky", near the village of Boquira in the surroundings of the mountain range of Macaúbas now known worldwide, blue quartzite

and the dumortierite that exists. Soon after the discovery, there was the exploration of the area by foreign groups.

According to Evangelista and Filho (2012), the importance of the blue quartzite of the Serra do Espinhaço Norte in Bahia, marketed under the name "Azul Macaúbas" and its varieties "Azul Boquira" and "Azul Imperial", has been growing in the market international market, presenting great potential as a source of foreign exchange for Brazil.

According to Ferran (2007: 68) "Boquira saw a revolution since the 1950s, but it ended before the end of the 20th century by the exhaustion of reserves." Still according to the author, it is now legal imperative to plan the closure of the mine, so that all infrastructure is used for activities compatible with the locality, and it is necessary to implement the Recovery Plan for Degraded Areas (PRAD) in a compulsory manner. Also in Bahia is located the Mineração Caraíba SA deposit that was discovered in 1874 and, in 1944, the National Department of Mineral Production (DNPM) identified its productive potential.

In 1969, Francisco Baby Pignatari began feasibility studies and in 1974 the enterprise was controlled by the National Bank for Economic and Social Development (BNDES). In 1979, under the name of Caraíbas Metais S/A, the mine's operating activities began at open sky, and in 1986, with the start-up of the Underground Mine, the copper ore was withdrawn simultaneously from the two sources (FRÁGUAS, 2013).

According to Fráguas (2013, page 3), in 1988 the former Caraíba Metais started the privatization process and in 1994 it entered the National Privatization Program, now known as Mineração Caraíba S/A. "In 2006, the leaching plant began operations to extract copper from the oxidized ore, which has been stored since the beginning of operations."

The mining company is located in the north of Bahia, more precisely in the district of Pilar, municipality of Jaguarari, with more than 1300 direct employees and almost 2000 in total (FRÁGUAS, 2013).

One of the questions of Fráguas (2013), is about the environmental licensing issues, where according to him:

> A factor that has become important and sometimes limiting to the feasibility of mining projects are the constraints of the TC (commitment terms) assumed in public hearings during the environmental licensing processes, forcing the Mining companies to have a sometimes expressive cost for activities together with the communities that should be the role of the state or municipalities (FRÁGUAS, 2013, p.8).

However, anyone who knows this mining company knows that it, even though it has the concession of exploitation by the Union, is not in the habit of acting clearly and with respect to the environment. It tries to convince the residents of areas with mineral deposits to be rewarded with simple works and without legitimate value, not doing the environmental compensations that the legislation demands. In addition, the mining company has not acted in a respectful way in relation to the existing flora, removing the vegetation to open the road for the drainage of its production. According to Filho (2011) Mineração Caraíba concentrates (12.1%) of the country's annual copper exploration is 1.1 million tons of sulfide, and 70 thousand tons of concentrate, with an average content of 37% copper.

2.3 MINING IN THE PAREDÃO/BRAZIL COMMUNITY

In the community focus of this research, the first expeditions and demarcations minerals also came with the "Pignatari", which with the support of the government sought to search areas throughout the state of Bahia to explore copper, gold, or any other mineral. Later, Mineração Caraíba SA continued its relentless pursuit.

In this way, since the decades of the 1970s and 1980s that the Mining Caraíba S/A explores areas in the north of Bahia, for they called Vale do Curaçá, areas close to the community Wall, leaving marks harmful to the environment and to the Caatinga biome, already so devastated from decades. The habit of open bites (variants like that are named by the community) and fincar paddocks (small posts marking the area), it has brought over the years numerous environmental damage to the communities targeted by the research of referred to mine.

However it is not a concern on the part of the company, reflect on the environmental damage and to seek a way to reward them, on the contrary, what the company seeks in fact it is the advancement in research, profit seeking new methods of improvement.

Thus, from 1998, MCSA started to use the modified vertical crater retreated (VCR) method, which allowed the ore to be recovered with greater recovery, safety and lower cost, with a view to its development in only two levels, one for drilling and another for production. The advantage for the company was the obtaining of a more homogeneous plowed product, which facilitated the concentration process without the need for a homogenization pile (SAMPAIO; CARVALHO; ANDRADE, 2002).

In addition, with the advancement of technologies, today, the methodologies used by it are very advanced, because to georeferentiate the soils and subsoils of the Paredão community they use airplanes with numerous

devices and chambers (according to figure 1) that fly over communities and cause uneasiness and some fear, for not being formally communicated of what is at issue and what are the real objectives and implications.
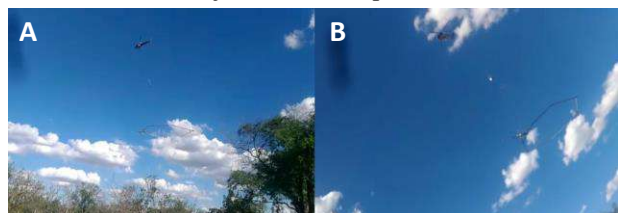
Fig. 1 – Georeferencing of the soil/subsoil the wall

Source: Moreira, Jader Hadad Rosa (2018)

However, the community has suffered from environmental crimes, where about one year ago the community had part of its reserve of pasture fund invaded by a group of illegal exploiters who, using the bad faith of a squatter (who illegally sold thirty hectares of pasture land), were grotesquely and irresponsibly seized with heavily armed jagunfos, provoking terror and conflict in the small rural community, consisting of just over twelve (12) families from one same family tree.

The area besides being invaded is having its soil, subsoil and devastated flora to give rise to immense craters where the mineral denominated ora of green quartz, hour of malachite is removed. Such indecision in describing the material collected is partly due to the knowledge that malachite is much more valuable than green quartz. As explorers propagate what is being quartz green, they are thinking about the possibility of being charged for royalties.

Native species of Caatinga o umbuzeiro (Spondias tuberosa L.), baraúna (Schinopsis brasiliensis), angico (Anadenanthera macrocarpa Benth.), Catingueira (Caesalpinia pyramidalis Tul), pereiro (Aspidosperma pyrifolium Mart.), Imburana (Commiphora leptophloeos Mart.), black jurema (Mimosa hostilis Benth), among others, are being devastated by both MCSA and clandestine explorers.

Through the many forms of reported and symbolic violence that directly and indirectly involve expropriation, the destruction of biomes and ecosystems, the elimination of local and regional economies, as well as the insecurity and annihilation of territorialized ways of being, doing and living, affected communities to seek legal means of claiming and claiming their rights based on environmental legislation. Thus, to the material and symbolic violence, intrinsic to the expansion of the mineral borders, the difficulties of rural communities in the semi-arid Sertão of Bahia (ZHOURI, 2018).

2.4 LEGISLATION AND ITS CONDITIONERS

Brazil has a subsoil with important mineral deposits. Yet despite this rich potential, the environmental and social impacts caused by this practice are indescribable. In addition, mining in the country is subject to a set of regulations, where the three levels of state power have attributions regarding mining and the environment (FARIAS, 2002).

Among the regulations is Law No. 6.938, dated August 31, 1981 and its amendments (Laws No. 7,804, of July 18, 1989 and Nº. 8,028, of April 12, 1990), which provides for the National Policy on Environment, its purposes and mechanisms of formulation and application. In addition to the aforementioned laws, there is Decree No. 97,632 of April 10, 1989, which provides for the Plan for the Recovery of Degraded Areas by Mining (PRAD).

To these laws and decrees mentioned, it is valid to add some resolutions that are indispensable as conditions for access to the use and exploitation of mineral resources, namely:

1.   CONAMA Resolution No. 1 of January 23, 1986, which establishes basic criteria and general guidelines for the Environmental Impact Report (RIMA);

2.   CONAMA Resolution No. 009 of December 6, 1990, which provides for specific rules for obtaining the environmental license for the extraction of minerals, except those for immediate use in construction.

3.   CONAMA Resolution No. 010 of December 6, 1990, which provides for the establishment of specific criteria for the extraction of mineral substances from immediate employment in construction.

4.   CONAMA Resolution No. 2 of April 18, 1996, which provides for the compensation of environmental damages caused by projects of significant environmental impact.

Finally, approval of the Environmental Impact Study (EIA) and Environmental Impact Report (RIMA) is the basic requirement for the mining company to apply for the Environmental Licensing of its mining project, if this is not the case in the search.

2.5 THE SOCIO-ENVIRONMENTAL IMPACTS OF ORE EXTRACTION

By impact it is understood that all forms of changes in the environment caused by anthropic activity can be positive or negative, and the negative represents a break in the ecological balance, causing serious damage to the environment and society.

Article 2 of CONAMA Resolution No. 1, dated January 23, 1986, is explicit in stating that it will depend on the elaboration of an Environmental Impact Study and its Environmental Impact Report, to be submitted to the approval of the competent state body, and IBAMA on a

supplementary basis, the licensing of activities modifying the environment, as described in paragraph IX of the same resolution, the extraction of ore.

Article 5 of the aforementioned resolution goes further when it states that the EIA, in addition to complying with the legislation, in particular the principles and objectives expressed in the National Environmental Policy Law, will obey the following general guidelines:

> I - Contemplate all technological alternatives and project location, confronting them with the hypothesis of non-execution of the project;
>
> II - Identify and systematically evaluate the environmental impacts generated in the phases of implementation and operation of the activity;
>
> III - Define the limits of the geographic area to be directly or indirectly affected by the impacts, denominated area of influence of the project, considering, in all cases, the hydrographic basin in which it is located;
>
> lV - Consider the governmental plans and programs, proposed and implemented in the area of influence of the project, and their compatility (BRASIL, 1986, p.1).

Thus, the need for responsibility and accountability of the ore explorer is evident, not only in relation to the environment, but also in relation to society, social actors who suffer the beneficial and harmful impacts of mineral exploration.

Among the beneficial impacts of a mineral exploration project are usually: the indemnification of occupied territories, the sale of land near the mine and the emergence of direct and indirect jobs. Already the evil impacts are countless and because of this, it is necessary to take into account the legislative procedures. It is possible to describe the evil impacts as being: damages that are often caused to the soils and the relief; devastation of forests and native forests by the removal of vegetation; soil degradation causing erosive cycles on a large scale due to the absence of vegetation; noise and vibration; air pollution from dust, smoke and soot; leakage, or irregular disposal of toxic mineral substances that can pollute watercourses and groundwater; besides the burning of the metallic mercury in the open air, among other environmental impacts of the ore exploration.

In addition, social impacts are as damaging as environmental impacts. It is possible to enumerate many, among them: insecurity due to the presence of unknown people; loss of large areas of native ecosystems or human use; abandonment of properties due to lack of safety and / or due to dust and daily soot that cause respiratory diseases; population raises disorderly, with workers attracted by the illusion of easy employment; problems of transportation, housing, education and public health increase, therefore, the system does not include such expansion; the lack of regulation of land use and occupations in areas of risk bring problems related to basic sanitation, among many other problems.

However, there are those who argue that mining does not cause as many impacts as we describe. Machado (1998) states that "the assertion that mining is the most aggressive economic activity to the environment is false. Other activities, such as agriculture, petrochemicals, steelmaking, large dams and urbanization itself, have more shocking characteristics than mining"(MACHADO, 1998: 648).

Although the activities described by the author have significant impacts, they are not, for the most part, irreversible, as is the case with many of the impacts of mineral exploration. Moreover, the laws described in the Federal Constitution of Brazil are coherent and indispensable, since the environment is one of the main impacts of the activity, passing through a period of degradation that results in constant changes in its physical structure as the landscape, in the biological aspect and especially in the social aspect.

The art. 225, paragraph 2 of the Federal Constitution of 1988 requires that anyone who exploits mineral resources should have the responsibility of recovering the environmental damages caused by the mining activity, consisting of the obligation to recover the degraded environment by means of a PRAD, with the technical solution required by the competent public agency that has licensed, in the form of a law.

III. MATERIAL AND METHODS
3.1 LOCATION OF THE RESEARCH

The rural community of the Breakwater is situated in the north of the State of Bahia, in the municipality of Juazeiro, being located at the coordinates 09º36'334" S and 39º96'363" W, as map 1.
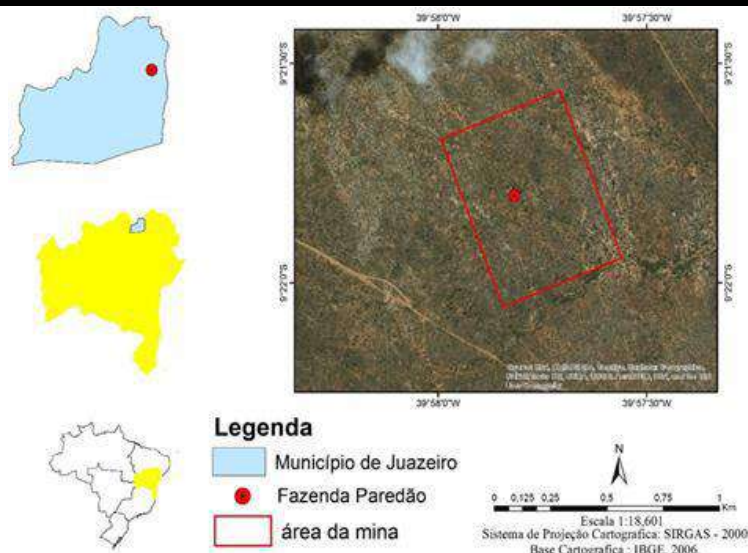
Map 1 – Geographic Location of the community Wall

Source: Authors (2018)

The community has about 4,000 hectares of land, including legal reserves and pasture funds. The whole area is home to the Caatinga ecosystem, with native vegetation and species almost extinct. It also has great diversity of fauna, which has o habitat the dry areas of the white forest. About 12 families live in the community (these are the target of the research), most of them elderly, all descended from the same family tree, which inhabited these lands for more than 200 (two hundred) years. Younger descendants live in the urban area of the municipality of Juazeiro and other municipalities, but they periodically visit the community and, consequently, their families, participating in all actions and decision-making in the community.

3.2 METHODS

The present research is classified according to Gil (1999), Andrade (2006), and Cervo et al. (2007), according to their nature, their technical procedures, the approach to the problem and the objectives.

Thus, from the point of view of nature, it is an applied research because it aims to generate knowledge for practical application aimed at solving specific problems. As the approach of the problem is a qualitative research, since it considers the existence of a dynamic relationship between the real world and the subject, being descriptive and using the inductive method and the obtained data are analyzed inductively.

In respect of technical procedures, this is literature, as it was developed from material written and already published, mainly comprised of books, e-books, reports and journal articles available on the Internet. It is also a research participant, where develops from the interaction between the researcher and the members of the situations investigated, from the direct contact of the researcher

with the phenomenon observed to acquire information about the reality of the social actors in their own contexts.

With respect to the objectives, this research, and exploratory, because it involves bibliographical survey and dialogue with people who have had practical experience with the problem researched, and also is descriptive because it involves the use of techniques, standardized data collection, such as systematic observation, where the facts are observed, recorded, analyzed, classified and interpreted, without the interference of the researcher.

Furthermore, such research is essentially based on the Theory Geosistêmica (Sotchava, 1977), in the Method Ecodinâmico (Tricart, 1977), and in Theory GTP (Bertrand, Bertrand, 2007) and the method of Discourse Analysis and of Content of Bardin (2009).

The field research started in January 2018, with weekly visits in the first two months on-the-spot observation, recording, analysis and interpretation of data. Later, for security measure, the visits were sporadic every two months, being completed in August 2018. Initially the area explored was open, without restrictions of entry of people in the space. However, with the course of actions on the part of environmental authorities, the exploited, using the documents "forged" if it was characterized to make the demarcation of the area with fences of barbed wire, making it difficult to lobby for the expansion of the research.

3.3 MATERIALS

To conduct the research we used the following materials: pen, notebook, Global Positioning System (GPS), camera, map of the community, and the Term of Free and Informed Consent (TCLE) from the Community

Association of the Stream of Mari, authorizing the conduct of research.

IV. RESULTS AND DISCUSSIONS

4.1 ENVIRONMENTAL IMPACTS AND LEGISLATION

The Resolution of the National Environment Council (CONAMA) n° 001 of 23 January 1986, in its Art. 1, it is considered as environmental impact any alteration of the physical, chemical and biological environment caused by any form of matter or energy resulting from human activities that, directly or indirectly, affect the health, safety and well-being of the population; the social and economic activities; the biota; the aesthetic conditions and health of the environment; and, the quality of environmental resources (BRASIL, 1986)

Upon such a premise, and based on the above-mentioned resolution, it can be said that the Community Paredão has suffered from numerous environmental impacts, taking into consideration that the safety of the same is threatened by the presence of unknown and explorers; by the economic activities that are being affected, since most survives the creation of goats, sheep and cattle, and these are restless, were pushed out and some fled to other distant localities on account of the human presence and noises of the very mineral extraction; and by attack immeasurable to the biota and to the natural resources in the community (as in figure 3), promoting the environmental degradation so clandestine and illegal.

Fig. 3 – Environmental degradation in situ in the mine area
Source: Author (2018)

As is visible in the picture, the soil was totally removed, and the vegetation of the Caatinga destroyed by the action of the tractor. It is possible to see the native species of umbuzeiro almost buried in the midst of the waste removed from the soil and piled on the umbuzeiro. In addition, it is possible to identify plastic bags abandoned in the soil and consequently will take a million years to decompose, contaminated soils have already

beaten.

The Art. 2 of the same resolution as versa that "will depend on the preparation of the Environmental Impact Study (EIA) and respective Environmental Impact Report (RIMA) to be submitted to the approval of the state organ competent, and of the IBAMA in character supplementary, the licensing of activities in the modifier of the environment, such as: IX - Extraction of ore, including those of class II, as defined in the Mining Code" (BRASIL, 1986).

However, none of the articles of the resolution mentioned has been fulfilled by the group explorer, as he was denounced by the community, without any prior consultation with the Association of Residents or the public hearing take possession of the land of the community. After a formal complaint to the environmental bodies, the group explorer suffered the intervention of the authorities municipal environmental by means of the Secretary of Environment and Urban Planning (SEMAURB), which autuou by the absence of environmental licensing for operation, as shown in figure 4.

Fig. 4 – Action of the municipal guard in place
Source: SEMAURB (2018)

The environmental damage in the area are severe with each passing month, being visible (figures 5 and 6) the level of degradation the site, both on the ground and in the ecosystem of the Caatinga, seen behind the image.

Fig. 5 – Crater and Material Explored
Source: Author (2018)

It is impossible to overestimate the actual values that are being polished of the heritage site and of the natural reserves of ores belonging to the province of Bahia, and consequently, of the community, which loses any right to take advantage of the profits and/or benefits with the processing of the ore.

Later, the group returned to the site and continued way illegal exploitation of malachite and copper (figure 7), which required more action by the community in order to safeguard their rights of landowners and local residents. By means of legal advice to the community formalized complaint with the Civil Police of Bahia; the Public Prosecutor of the State; the Federal Police; the State Institute of the Environment and Water Resources (INEMA); the National Department of Mineral Production (DNPM); and the Secretary of Environment and Urban Planning (SEMAURB) of the municipality of Juazeiro/BA.

However until the present moment, the only body that gave a formal response was the Public Prosecutor reported to represent the legal community (lawyer) the archiving of the process, considering that the same already running in another instance the federal is the Federal Police. Such a response, he left still more desolate the community for not having seen until the moment, no practical action from environmental agencies that will prevent the crimes and environmental damage committed.

Fig. 7 – Types of minerals exploited
Source: Author (2018)

However, problems arising from conflicts in areas of mineral extraction in Brazil have grown and have caused serious damage to society. Critical experiences reveal that the multiple processes of 'violences of affections' promoted by large-scale mining bring about the emergence of struggles and resistance contexts that intersect different trajectories of the Brazilian population (ZHOURI; OLIVEIRA, 2013).

4.2 THE SOCIAL IMPACTS

It is understood that the social impact are all situations that in some way will cause harm to the population. In this way, the concept of environmental impact should take note of the environmental cause, but also to the security of the territory and the quality of life of the populations. In this sense, in the Resolution n. 001/86 of the CONAMA in its Art. 1, brings right from the beginning the two items directly related to the social impacts, namely: elements that "directly or indirectly, affect, I - health, safety and well-being of the population; II - the social and economic activities [...]" (BRASIL, 1986).

In this respect, the community Wall has been directly affected in the health, both physical (particulate matter suspended in the atmosphere), as well as psychological and emotional, from the time that they feel 'cornered' within their own territory, intimidated, and without the effective support of the environmental authorities. Also, have their socioeconomic activities directly affected, since they live of the creation and the grazing of domesticated animals, and are frightened of leaving in search of the same (in the areas of fund of pastures), by the fact of having in their surroundings workers, strangers, of unknown origin, in addition to guards (gunmen) in a position that is threatening.

In the face of such reality, the residents feel they are not taking advantage of the law which is peculiar through of Art. 225 of the Federal Constitution that says: Art. 225. "Everyone has the right to an ecologically balanced environment, good of common use of the people and essential to a healthy quality of life, imposing to the public power and the collectivity the duty to defend it and preserve it for present and future generations" (BRASIL,1998).

Also, also are not seeing in practice the fulfilment of § 2, which says that "he who explore mineral resources shall be obliged to recover the environment degraded, according to the technical solution required by the public agency of competent jurisdiction, in the form of the law", and paragraph 3 which states that "conduct and activities considered to be detrimental to the environment sujeitarão the infractors, individuals or legal entities, to criminal and administrative sanctions, regardless of the obligation to repair the damage caused" (BRASIL, 1998).

Thus we have in this case a conflict socio-environmental which refers to a situation of dispute over the ownership of the resources and environmental services on which shall govern the conditions of disproportionality in access to natural conditions and legal, with inequality in the provision of the law, characterized by the rupture of ties between rights and duties, between the legislation of fact and law, between accountability theory and practice.

V. CATEGORIZATION ENVIRONMENTAL AREA

5.1 STRATEGIC PLAN ENVIRONMENTAL

The categorisation environmental area arises from the distinction of elements climatobotânicos that distinguishes one landscape from another. In this sense, the method adopted to analyze the ecodinâmica of the studied area, was based on the precepts of the Theory Geossitêmica that seeks to understand the variations of landscape as a historical product of the flows of matter and energy, including the action of man and in the grounds proposed by Tricart (1977) that allowed us to identify the processes morfodinâmicos responsible for the genesis of the relief, and as to the environmental stability of this landscape.

It was necessary for the analysis of critical factors, such as: surface structure of the soil, the use of the subsoil, vegetation, and surface processes. For each of these parameters, did the categorization of the level of balance numerically defined according to Tricart as: i. stable areas; ii. areas intergrades; and iii. areas strongly unstable.

In this sense, the area of the mine was categorized according to the theory tricart'iana, in:
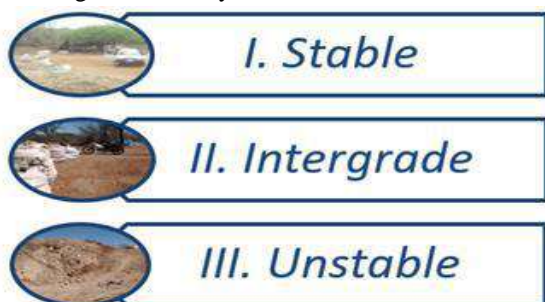
Fig. 8 – Categorization of the mine area

Source: Pacheco (2018)

In the area is still stable, it is still possible to verify the existence of the vegetation native to the area – sparse hyperxerophylous forest – that during the rainy season presents itself with the color green and lush.

However in the area intergrade noticed the steep decline of vegetables, getting more and more espassa and rala. Is the phase transition between the stable (with vegetation) and the unstable or strongly stable (with no vegetables).

Finally, the area unstable where not possible to discern any plant species, not to be obeservar processes degradacionais, practiced by the exploitation of ore in the location.

Thus, in view of the need to build strategies for the conservation and/or restoration of the area, is relevant for the entrepreneurial company of the damage, develops a Plan of Recovery of Degraded Area (PRAD) provided by the environmental legislation. The PRAD is a procedure for the preparation of the study, regulated by the Normative Instruction no. 4/2011 of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), in order to shape and guide the elaboration of projects with fulcrum in the recovery of degraded areas.

However, at the present time there is no indication of this accountability in the study area, and because of this, this research comes to support with the implementation of a Strategic Plan Environmental (PEA) to the affected area. Such a plan is based on the Theory GTP Bertrand and Bertrand (2007), where it takes into account the gessistema, the territory and the landscape.

Fig. 9 – Strategic Plan for Environmental

Source: Pacheco (2014)

Each strategic plan must be applied in their respective area, namely:

i. Environmental Management and Conservation Plan - aimed at areas that are still stable, so that they will not be damaged in the future because they are fragile and vulnerable due to climatic and socioeconomic conditions.

ii. Control Plan and Environmental Conservation - this would be applied to areas that are in transition from the stable aspect to the middle intergrades. It will be necessary to create degradation control strategies in the areas in process and strategies to conserve what remains of some stretches.

iii. Plan of Revitalization and Environmental Conservation - in this, if primary by strategies of revitalization/reforestation of the areas considered as strongly unstable and, from the results would draw a preservation control, analyzing the resilience capacity of the respective environments.

The proposals suggested above should come from those responsible for environmental damage, in the case in point, the clandestine explorers. Besides these, it is fundamental a partnership with the community that inhabits the surroundings of the degraded area, because it is these subjects who are living in this context, and can contribute in a positive way in this awareness.

5.2 MONITORING AND ENFORCEMENT

The enforcement and monitoring of the Strategic Plan Environmental (PEA) is based on the Theory Geossistêmica of Sotchava (1977), and it should be the responsibility of (the): 1. Illegal enterprise of mineral exploration; 2. The secretariat of Environment of the Municipality of Juazeiro/BA (SEMAURB); 3. Institute of the Environment and Water Resources (INEMA); 4. The National department of Mineral Production (DNPM); 5. Federal Public ministry (MPF); the Ministry of the Environment (MMA); 6. Local Community association.

For the implementation of the SAP, it is fundamental to the development and fulfillment of a schedule of activities, that should be constructed collectively, with the community, operator and environmental agencies. Here arises a suggestion of activities (table 1) that should precede the implementation of the PEA, namely:

Table 1 – Suggested Activities for Deployment of eap

ACTIVITIES	TIME PERIOD	RESPONSIBILITY
Public Hearing with the community (Community Association)	02 months	Federal Public ministry; Community Association; Operator; SEMAURB; INEMA; DNPM.
Signing the Term of Commitment between the Operator and the Community Association	01 month	Federal Public ministry; Community Association; Operator; SEMAURB; INEMA; DNPM.
Study of Environmental Impact assessment (EIA) and Environmental Impact Report (RIMA)	03 months	Environmental experts and a multidisciplinary team hired by the MPF and paid for by the Operator
Presentation of the EIA/RIMA to the Community/Company/Environmental Agencies	01 month	Environmental experts and a multidisciplinary Team responsible for the EIA/RIMA.
The Management Plan, and Environmental Conservation (PMCA)	03 years	Operator (deployment); Community Association; Environmental Agencies (oversight)
Control Plan and Environmental Conservation (PMCA)	03 years	Operator (deployment); Community Association; Environmental Agencies (surveillance).
Restoration Plan and Environmental Conservation (PMCA)	05 years	Operator (deployment); Community Association; Environmental Agencies (surveillance).

Source: Author (2018)

It is noted that the activities listed may be modified according to the need, as well as, the period may be relaxed if necessary, in order to the fulfilment of the Strategic Plan on the environment.

VI.   CONSIDERAÇÕES FINAIS

A referida pesquisa, visando atender aos objetivos e embasada na metodologia adotada, compreendeu a ecodinâmica da paisagem estudada na Comunidade Paredão no norte do Estado da Bahia, identificando os processos de degradação ambiental provocados pela exploração mineral, além de analisar os níveis de estabilidade do sistema ambiental, discutindo formas de conservação deste bioma, que é um representativo das características climáticas do Semiárido brasileiro.

No que concerne as observações e análises feitas, constatou-se que a área estudada se encontra altamente degradada, tendo em vista os impactos ambientais presentes no geossistema investigado, fundamentado nos preceitos de Tricart (1997) onde, em face disso, constatou-se que a área da pesquisa está classificada nos âmbitos estável, intergrades e fortemente instável e, por conta disso se faz necessário uma urgente sensibilização no que tange à gestão e ordenamento territorial da área.

Resta salientar a existência de uma proposta de conservação ambiental por meio do PEA para os três ambientes classificados e, a aplicabilidade desta, deve ser de responsabilidade da empresa exploradora de minerais, dos órgãos ambientais fiscalizadores em consonância com governos municipais e estaduais e, da Associação de moradores e, pois, são estes [os moradores] os maiores prejudicados, por serem vítimas de um projeto ilegal e irresponsável.

Ademais, espera-se que a população tenha seus direitos respeitados, que os organismos ambientais cumpram com seu papel de acordo com a Legislação brasileira, que os exploradores clandestinos possam ser responsabilizados pelos danos ambientais e sociais provocados a comunidade e ao patrimônio natural, e que o capitalismo não destrua as pessoas e as paisagens.

Por último, esta pesquisa não possui um cunho conclusivo e, nem se pretende aqui esgotar todo o debate acerca da temática em foco, tendo em vista a relevância dessa discussão nos dias atuais e no âmbito da gestão e ordenamento dos territórios ambientais, levando em consideração que os ecossistemas, especialmente os de caatinga, são mutáveis tanto pela sua dinâmica natural, como pela dinâmica social que o circunda. Sendo assim, a pesquisa e o debate continuam para além da finalização do curso ora realizado, por entender as questões aqui

elencadas como infinitamente pesquisáveis, mutáveis e, dignas de um repensar crítico, reflexivo e reconstrutivo.

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Geotraceability: An Innovative Strategy for Extraction of Information and an Aid for the Sustainable Cattle Raising

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Abstract — *The requirement of traceability of information for food is an increasingly important condition for gaining the confidence and loyalty of the consumer. The concept of geotraceability arose through the association between knowledge of a geographical nature with the traditional information provided by traceability. This study explored the use of design of spatial information inherent to biophysical parameters of the pasture (vegetation indices and evapotranspiration) combined with data collection on the mobility of cattle in pasture areas for extraction and availability of spatially explicit information that can assist sustainable cattle production. From the trajectories, it was observed the existence of a typical behavioral pattern of the animals, such as the preference to walk towards clean and flat terrain, search for areas that present better thermal comfort or regions near to supplementary feeding (salt, food, etc.) and the access to water. Overall, it is noticed that in a pasture environment, the animals prioritize their primary physiological needs, that is, water consumption and thermal regulation. The results are promising in terms of applied research for behavioral analysis of animals and environmental interactions associated with mobility. The technique used in the study has the potential to be applied in the implementation of cattle production geodecision systems that support good production practices and favor the quality and safety of food with environmental sustainability.*

Keywords — ***animal behavior, cattle raising, geo decision system, geo traceability, sustainability.***

I. INTRODUCTION

Consumers regard safety the most critical ingredient in food [1]. The repercussion of hazard caused by the ingestion of some food consumed in any part of the world is a piece of news that spreads in few instants, regardless of the distance of the occurrence. In this context, the requirement of traceability of food information is an increasingly important condition for gaining confidence and loyalty of the consumer.

The application of information technology (IT) tools allows to storage, in a database livestock, activities such as animal crossing, artificial inseminations, nutritional and sanitary aspects of each animal, weight, pasture quality, animal mobility, among other data. However, when the subject is sustainable production, it is of fundamental importance that the analysis of decision-making covers a better comprehension of the impact factors of the production system. Therefore, elements essential to the environment are necessary for the implantation of a system that besides allowing safe food is also ecologically correct.

Rural environment management is directly related to the geographical space: land use and coverage, topography, climatology, soil type, water resources, among others. The study of geographic space involves a series of knowledge and information that can be more easily and quickly worked by using new technologies [2]. In the last years, the use of geotechnology and geo-information by public and private organs and companies has grown considerably, primarily to support project planning, execution, and monitoring processes [3].

By using geotechnology and geo-information in an integrated analysis of the production processes of cattle breeding, covering not only the traditional practices production at local plan or punctual level (insemination, vaccines, weighing, etc.), but also those that provide a space-temporal vision, the concept of geotraceability has arisen [4, 5, 6].

Geotraceability is the ability to describe the history, use, and location of a product, allowing the tracking and monitoring of production until its consumption [5]. The space component stands out for adding value to market products, to the certification and labeling of retail marketing and communication with consumers, with the potential to induce further policies for the sector. In short, geotraceability is defined as the association between

geographic and traditional information provided by traceability [7]. This concept emerges as an innovative and strategic alternative for evaluating the behavior of cattle in extensive production systems, being useful as a management tool aimed at improving animal welfare.

Mobility of the animals on pasture can be tracked through equipment capable of collecting and storing data on the geographic position associated with the day and the hour. These data may contribute to the extraction of information related to, for example, patterns of social organization, as animals do not disperse at random into their environment. According to Paranhos da Costa and Costa e Silva [8], this non-causality in the use of geographic space is related to the physical and biological structures of the environment, to the climate and to the social behavior.

Hence, geotraceability becomes an innovative and alternative strategy for the monitoring of bovines in the extensive production system. More specifically, this work explored the use of spatial information plans essential to biophysical parameters of the pasture (vegetation indices and evapotranspiration) combined with the data collection of the cattle mobility on the pasture for extraction and availability of spatially explicit information that can help a sustainable production of bovine animals.

II. MATERIAL AND METHODS

This study was carried out in an experimental field with Brachiaria pasture, on Beef Cattle Embrapa farm, Campo Grande, state of Mato Grosso do Sul, Brazil (Figure 1).
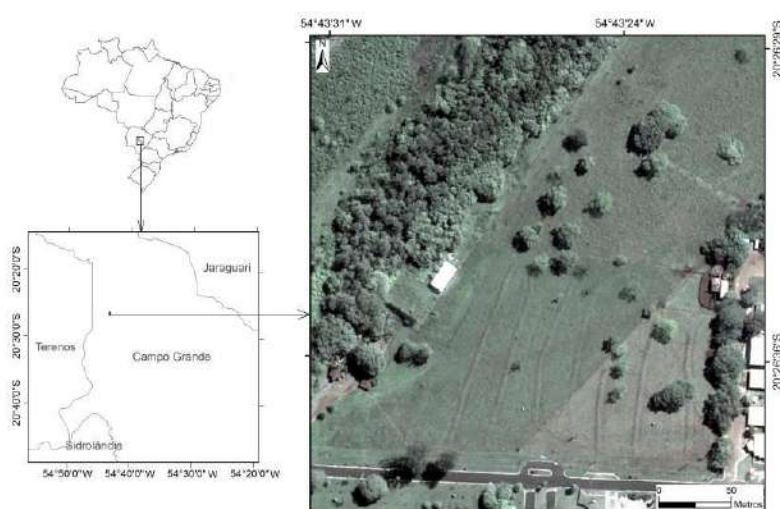
Fig. 1. Study area location. GeoEye-1 image on RGB (3,2,1) composition merged with panchromatic band.

Animal mobility data were collected through the application of GPS and transponder adapted on resistant leather collars and placed on bovines (Figure 2).

Fig. 2. Visualization of collar placement (A) and bovine already wearing the collars in experimental pasture area (B).

The collars allowed identifying the positioning of the animal in space and time. The principal elements of the electronic collars are: GPS device and its antenna, to determine the position of the animal; UHF system for communication with the base station; memory, to store the GPS data before they are transferred to the base station; a microcontroller, which manages the general

operation of the collar; and a feeding management element so the power consumption is as low as possible. Figure 3 shows the architecture of electronic collars.
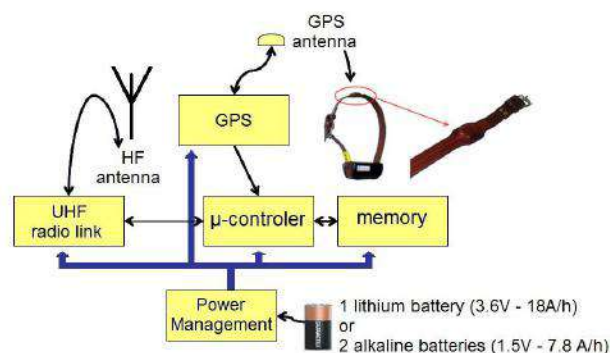
Fig. 3. General architecture of the electronic collars [9].

The positions then identified were transferred to a field base station and then forwarded to a central database. For the base of the system, base station architecture (Figure 4) has a PC104 (portable computer for embedded systems) with low power consumption with Microsoft Windows operating system; UHF (Ultra High Frequency) system

for communication with collars; power management system that controls every power supply from the base station using a battery and a solar panel. The control of the PC was carried out utilizing a touch screen connected via network. A USB connector was used to create the possibility for the operator to collect all data from the collars, which were stored in the PC memory.

The acquisition of animal mobility data was carried out as follows: in predetermined periods, the collar's micro-controller activates the GPS, synchronizes with the satellite and collects the animal's position, with subsequent deactivation of the GPS according to the programming defined by the operator, to reduce energy consumption.
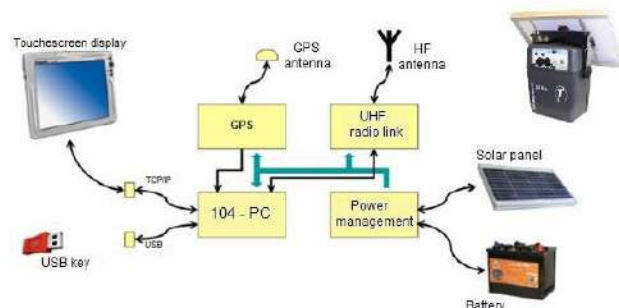
Fig. 4. General architecture of the base station [9].

Based on the collected position, the collar verifies its proximity to the base station, activates the UHF radio, and transfers the collected data to the base station. After that, data can be transmitted from the base station to the information system in two ways: (1) manually by using a flash drive; (2) automatically over a TCP/IP network. Figure 5 shows the base station set next to the balance scale (Figure 5a) and the bovine drinker (Figure 5b).
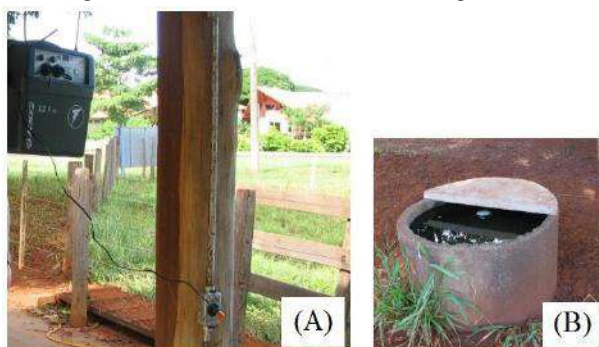
Fig. 5. Visualization of the base set next to balance scale (A) and the drinker (B).

One of the objectives of geotraceability is to be able to lead to good practices through the adoption of tools for data acquisition and treatment from different sources and formats (text, raster, and vector) and the diffusion of spatial information when using geographic information systems [7], shared through the Internet as WebGIS system, denominated SOMABRASIL [10]. In this case,

as the first step for the information management process, the animal mobility data collected through the collars were used together with remote sensing (SR) data to preliminarily evaluate the possibility of extracting information in the extensive cattle production system.

Animal mobility data were collected in March, April and May 2009. More specifically, from March 16th to 20th 2009; April 10th to 29th 2009 and on May 13th, 26th and 27th, 2009. Meteorological data (wind speed, radiation, and air temperature) were also used from INMET station located in the city of Campo Grande, state of Mato Grosso do Sul, Brazil.

The images from Landsat 5 – TM, Geoeye-1, and WorldView-2 from May 11th 2009, October 9th 2011 and April 13th, 2013, respectively, were used to evaluate the trajectories of the animals. The images were used to obtain the normalized difference vegetation index (NDVI) and evapotranspiration (ET) of the experimental picket pasture. Hence, the methodology detailed in Andrade et al. [11] was applied. Subsequently, the NDVI and ET maps were used as background information to evaluate the trajectory of the animals.

III.   RESULTS AND DISCUSSION

Figure 5 shows the trajectories performed by four animals with individual records collected through collars # 0001 (Figure A), # 0003 (Figure B), # 0004 (Figure C) and # 0006 (Figure D). Image GeoEye-1 allows identification of pasture sites that have the trajectories performed by the bovines. These trajectories refer to the first evaluations of the use of bovine collars in pasture areas in the state of Mato Grosso do Sul, Brazil. The results obtained in the study were promising in terms of research applied for animal behavioral analysis and environmental interactions associated with mobility [12].

Although the pasture area is not very extensive, from the trajectories of each animal it was possible to observe the existence of a typical behavior pattern of the animals. Silveira et al. [13] observe that cattle are gregarious animals (live in groups) and do not separate easily from herd companions to mix with other animals. Another critical issue is that animals, in search of food sites, prefer to use established paths, streets, open spots, than to penetrate dense shrub areas or to cross rugged terrain areas [14]. In this case, it can be observed in Figure 5 some common trajectories associated with the direction of the contour lines, and this may indicate that the animals prefer to walk towards clean and flat terrain. It is also pointed out some trajectories close to the picket fence; similar behavior was observed by Handcock et al. [12].
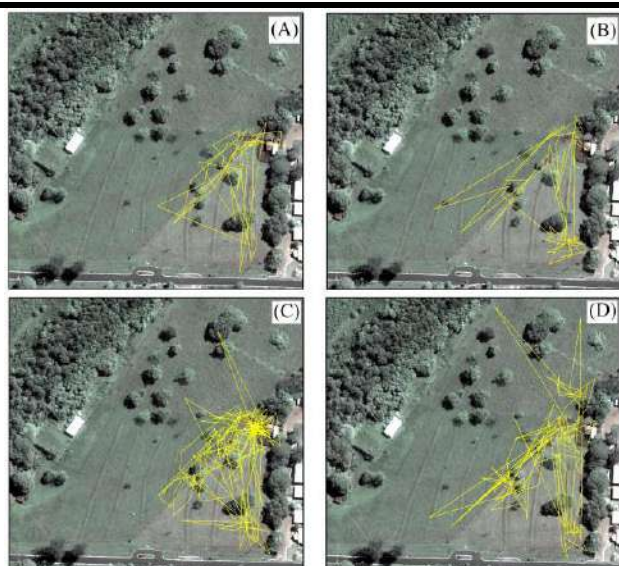
Fig. 5. Trajectories of four animals on an experimental pasture at Beef Cattle Embrapa, Campo Grande, MS, Brazil. Figures A, B, C, and D show the trajectories collected through collars #0001, #0003, #0004 and #0006, respectively. GeoEye-1 image obtained on October 9th, 2011 on the background, show non-RGB composition (3, 2, 1) merged with panchromatic band.

Fig. 6. Visualization of the local center of the trajectories of each bovine in experimental pasture area at Beef Cattle Embrapa, Campo Grande, MS, Brazil. On the background, GeoEye-1 image on October 9th 2011, show non-RGB composition (3, 2, 1) merged with panchromatic band.

Another common point observed in the study refers to some trajectories towards the trees in the pasture, indicating the search of shaded areas that present more favorable microclimatic conditions. In addition, preferential paths were observed towards the corral, and this mobility may be associated with the search for water and supplementary feeding (salt, feed, etc.). Santos et al. [14] report that within the pasture environment, the animals prioritize their primary physiological needs that is, water consumption and thermal regulation and, in turn, they directly influence the mobility of the herd. Thus, areas near water sources are grazed more frequently [15]. As shown in Figure 6, this bovine behavior was spatially confirmed. The animals with the collars # 0001 and # 0004 had central points of the trajectories performed by each animal (local center) in areas closer to the corral due to the likely search for water and supplementary feeding. On the other hand, the animals with the collars # 0003 and # 0006 displayed a local center in areas with trees which provide microclimatic conditions more favorable to animal welfare due to shading.

Figure 7 shows the trajectories performed by the cattle associated with NDVI map and daily real evapotranspiration (ET) estimated from Landsat 5 TM image on November 5th, 2009. For experimental picket pasture, NDVI varied from 0.20 to 0.65 (Figure 7A), and ET ranged from 1.25 to 2.75 mm / day (Figure 7B). Greater NDVI values point to better food availability for the herd; however, the spatial resolution of the Landsat 5 TM image (30 meters) in small pasture paddocks (<10 ha) resulted in a limitation. Therefore, canopies of trees located in the pasture influenced the values of NDVI and ET in some pixels. An example of this influence was found in pixels of the image representing the geographical region of the corral, which presented overestimated values for both NDVI (0.51 to 0.60) and ET (2.26 to 2.55 mm/day).
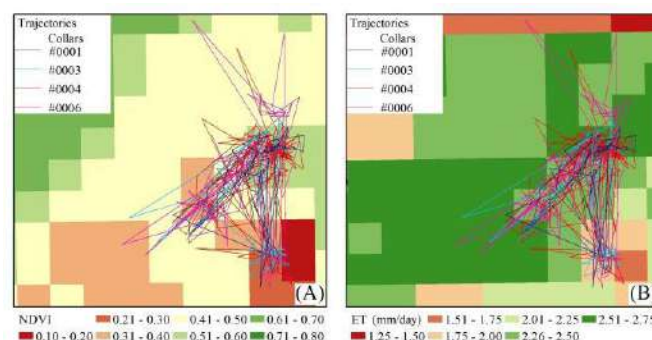
Fig. 7. Trajectories performed by the animals (collars #0001, #0003, #0004 and #0006) associated with NDVI maps (A) and daily real evapotranspiration (ET, mm/day) (B), estimated using Landsat 5 TM image on May 11th 2009.

For pastures fields of less than 10 hectares, high spatial resolution images (pixels <5 meters) may be a more interesting alternative to evaluate the relationship between cattle mobility and biophysical parameters of pastures [12]. Figures 8A and 8B show the NDVI estimated from GeoEye-1 (09/10/2011) and WorldView-2 (4/13/2013) image, respectively, with a pixel size smaller than 2 meters. It can be seen in these figures that NDVI values greater than 0.60 stood out particularly in representative pixels of tree canopies. This is much more evidenced in Figure 8A, where it is possible to observe good class discrimination with NDVI values that represent grass (0.20 to 0.50), tree canopy (NDVI> 0.60) and built-up areas (corral, sheds, roads, etc., with NDVI <0.10). In this case, it is likely that this better separation between pasture and shrub vegetation may be related to the seasonal climatic variations of the region, that is, in periods of low rainfall, pasture has a more significant water restriction when compared to the shrub vegetation that has a deeper root system, therefore, smaller drop of the canopy vigor.

For the day April 13th 2013 (Figure 8B), the pasture presented values of NDVI within the range from 0.30 to 0.78. However, it is observed that most of the pasture was distinguished in two NDVI intervals, one interval with values ranging from 0.30 to 0.50 and the other one between 0.50 to 0.78. Although the cattle trajectory data are from 2009 and the NDVI values shown in Figures 8A and 8b are for the scenes of October 9th 2011 and April 13th 2013, respectively, it is possible to notice the application potential of these trajectories for possible behavioral evaluations of cattle on pasture. For example, when trajectories are associated with NDVI, it is possible to evaluate whether the animals grazed in areas of the pasture with indicative of high plant biomass and the period they remained in these areas of greater food supply. In addition, other assessments are possible, such as evaluating the preference for grass types. In this sense, Handcock et al. [12] used NDVI values to assess the behavior of the animals by applying the Landscape Preference Index (LPI) that is given by the ratio between the proportionate time spent in the area of interest and the proportion of the area of interest in relation to the complete available area. The authors observed a variation in the individual behavior of the animals and also found the cattle preference for greener vegetation. However, the LPI contrasted with the total time that the animals remained in pasture areas with different levels of NDVI. One example was the high values of LPI near fences and gates, areas of greater soil compaction caused by trampling of the animals and that usually present soil exposure and, consequently, low NDVI values.
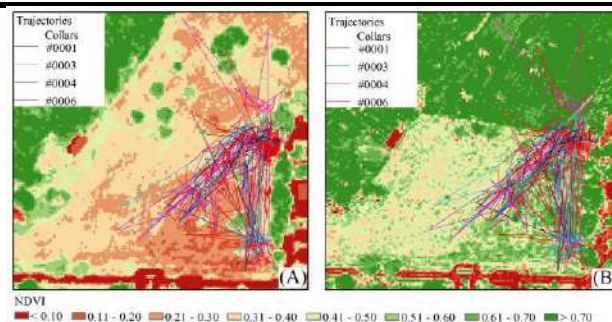
Fig. 8. Trajectories performed by the animals (collars #0001, #0003, #0004 and #0006) associated with NDVI maps estimated from GeoEye-1 image on October 9th 2011 (A) and WorldView-2 on April 13th 2013 (B).

Overall, for the study period, a similar mobility pattern was observed for all animals, that is, they remained mainly in the region closest to the corral and to the water fountain, where NDVI values were lower. Besides, the trajectories performed by the animals indicate that less than 50% of the area of the picket was visited or used for grazing. This information can contribute strategically, for example, so that food supplementation is carried out in troughs located in scarcely visited areas of the field, thus stimulating the animals to move and use more uniformly the available forage.

IV. CONCLUSIONS

This study explored the concept of geotraceability as an original strategy whose goal is the better understanding of the behavior of the herd on pasture and, through this case study, to evaluate the application potential related to the achievement of information for cattle sustainable management. Animal mobility data associated with satellite images are promising for the evaluation of the spatial-temporal behavior of cattle and environmental interactions related to mobility, which makes it possible to observe the existence of a typical behavior pattern of the animals. In this case, the results obtained in the study reveal the potential of this information for the implementation of a robust cattle farming geodecision system that makes it possible to determine the spatial-temporal origin of production and to contribute to adequate production practices, assuring food quality and safety combined with environmental sustainability.

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Operational Solution to Economic Load Dispatch (ELD) of power plants by different deterministic methods and Particle Swarm Optimization.

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Abstract—*Decision-making for operational optimization Economic Load Dispatch (ELD) is one of the most important tasks in thermal power plants, which provides an economic condition for power generation systems. The aim of this paper is to analyze the application of evolutionary computational methods to determine the best situation of generation of the different units in a plant so that the total cost of fuel to be minimal and at the same time, ensuring that demand and total losses any time be equal to the total power generated. Various traditional methods have been developed for solving the Economic Load Dispatch, among them: lambda iteration, the gradient method, the Newton's method, and so others. They allow determining the ideal combination of output power of all generating units in order to meet the required demand without violation of the generators restrictions. This article presents an analysis of different mathematical methods to solve the problem of optimization in ELD. The results show a case study applied in a thermal power plant with 10 generating units considering the loss of power and its restrictions, using MATLAB tools by developed techniques with particle swarm algorithm.*

Keywords —*Particle Swarm Algorithm, Load Dispatch, Mathematical Methods, Thermal Power Plants.*

I. INTRODUCTION

The Economic Load Dispatch Problem is to minimize the total cost and at the same time to guarantee the power plant demand. Thus, the classic problem of economic dispatch is to provide the required amount of power at the lowest possible cost[1], taking into account the load and operation restrictions.

Because of its massive size, this problem becomes very complex for solving, because it contains a non-linear objective function, and a large number of constraints.

Several techniques such as the integer programming[2, 3], the dynamic programming [4, 5], and the Lagrange functions[6]have been applied to solve the economic dispatch problem.

Other optimization methods such as "Differential evolution based on truncated Levy-type flights and population diversity measure[7], Artificial Immune algorithm [8], Harmonic differential search algorithms[9], Oppositional invasive weed optimization [10], Neural Networks[11-13], Genetic Algorithms[14, 15], and Real Coded Chemical Reaction algorithm[16], are also used to solve the economic dispatch optimization problem. Methods based on mathematical approaches have also been developed to provide a faster solution [17, 18].The multi-objective evolutionary algorithms (MOEA) [19, 20]were applied to solve the ELD problem.

Research papers included emission constrains on economic dispatch and selection of machines, but only focused in cost minimization [21, 22].Recently, in order to use the most appropriate numerical methods for solving the ELD problems, modern optimization techniques[23-26] have been successfully employed to resolve the ELD as a non-smooth optimization problem.

In [27]is presented a particle swarm optimization model (PSO) with an aging leader and challengers (ALC-PSO) to solve the optimization problem of the reactive power.

According to [28] the convexity of the optimal load dispatch problem makes it difficult to guarantee the global optimum. In [29] an evolutionary algorithm named "Cuckoo Search algorithm" was applied to not convex economic load dispatch problems.

In [30]it is presented a new hybrid algorithm that combines the Firefly Algorithm (FA) and Nelder Mead (NM) simplex method to solve Optimal Reactive Power

Dispatch problems (ORPD).The program is developed in Matlab and the proposed hybrid algorithm is examined in two IEEE standard test systems to solve ORPD problems.

A methodology to solve the economic load dispatch problem (ELD), considering the generation of reliability uncertainty of wind power generators is presented in [31].

The corresponding probability distribution function (PDF) of available wind power generation is discretized and introduced into the optimization problem in order to describe probabilistically the power generation of each thermal unit, the limitations of wind energy, ENS (energy not supplied), the excess of power generation, and the total cost of generation. The proposed method is compared to the Monte Carlo Simulation (MCS) approach, being able to reproduce the PDF in a reasonable way, especially when system reliability is not taken into account.

Comparing the different demand response strategies, using heuristics and linear programming, it was found that the one that minimizes the daily operation costs is the linear programming model, although it presents the highest increase in energy demand. [32].

In [33] it is presented a new variant of the optimization algorithm called "teaching-learning-based optimization (TLBO)", the authors called this new algorithm "Gaussian bare-bones TLBO (GBTLBO)" and in addition they make a modified version of the same (MGBTLBO) for optimal reactive power dispatch (ORPD) with discrete and continuous variables.

According [34]the dynamic economic dispatch (DED) is one of the most complicated nonlinear problems showing the non-convex characteristic in energy systems.

This is due to the "valve point" effect in cost functions for the generating units, to the velocity gradient limits and transmission losses.

The proposal of an effective method of solution for this optimization problem is of great interest, and the solution of Economic Dispatch (ED) problems mainly depends on the modeling of the thermal generators [35].

Physical changes such as generators aging and environmental temperature affect the modeling parameters and are unavoidable. Because these parameters are the backbone of the ED solution, periodic estimation of these characteristic coefficients is required for a precise economical load dispatch.

II. MATERIALS AND METHODS

1.1. *EconomicLoadDispatch.*

The economic load dispatch problem is to minimize the overall cost rate and meet the demand load of a power system. The classic economic load dispatch problem is intended to provide the necessary amount of energy at a lower cost possible[1]. The dispatch problem can be stated mathematically as follows: To minimize the total cost of fuel for thermal plants[29, 36-39]:

$$Min = F_{P_i} \sum_{i=1}^{n}(a_i + b_i P_i + c_i P_i^2) \quad (1)$$

The previous expression depends on the equality of constraints balance of real power.

1.2. *Economic Load Dispatch taking into account the "valve point" effect.*

The cost function of a fossil fuel generating unit is obtained from data points taken during the unit "run" tests when the input and output data are measured as the unit is varying slowly through its operating area.In the case of steam turbines these effects occur each time that the intake valve in a steam turbine begins to open, and produce a ripple effect on the unit power versus consumption curve.

The generating units based on multivalve steam turbines are characterized by a complex nonlinear function of the fuel cost. This is mainly due to the induced load ripples produced by the valve throttling or valve point. To simulate this complex phenomenon, a sinusoidal component is imposed on supplies quadratic curve of the engines.

In fact, a sharp increase in the loss of fuel is added to fuel cost curve due to the throttling effect when the steam inlet valve begins to open or close. This procedure is named as valve point. To model the effects of valve-point, a rectified sine function is added to the quadratic one [10, 40], as is showed in Figure 1.
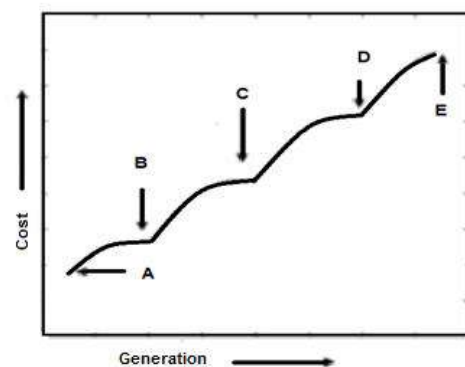
Fig. 1. Cost function taking into account the valve point effect with 5 valves. A: Primary valve, B: Secondary valve, C: Tertiary valve, D: Quaternary valve, E: Quinary valve.

Source: [40].

The cost expression taking into account the valve point effect can be expressed as[36, 41, 42]:

$$F_i(P_{i,t}) = a_i P_{i,t}^2 + b_i P_{it} + c_i + \left| e_i \sin\left(f_i\left(P_i^{min} - P_{i,t}\right)\right)\right| \left(\$/h\right) \quad (2)$$

Where a_i, b_i and c_i are the fuel cost coefficients of the (ith) generating unit, and e_i and f_i are the fuel cost

coefficients of the (ith) generating unit, but taking into account the valve point effect.

In [40, 43] it is established that the fuel cost function of each heat generating unit taking into account the valve point effects is expressed as the sum of a quadratic function and a sine function. The total fuel cost then can be expressed as

$$F_c = \sum_{m=1}^{M} \sum_{i=1}^{N} t_m \left[a_i + b_i P_{im} + c_i P_{im}^2 + \left| d_i \sin\{e_i(P_i^{min} - P_{i,t})\} \right| \right] \left(\frac{\$}{h}\right) \quad (3)$$

Where a_i, b_i and c_i are the fuel cost coefficients of the (ith) generating unit, and d_i and e_i are the fuel cost coefficients of the (ith) generating unit, but taking into account the valve point effect.

1.3. Economic Load Dispatch Constrains.

Some constrains are considered in this paper:

- An equality constrains of power balance.

For stable operation, the real power of each generator is limited by lower and upper limits. The following equation is the equality restriction [37, 39, 44]:

$$\sum_{i=1}^{n} P_i - P^D - P^L = 0 \quad (4)$$

Where P_i is the output power of each i generator, PD is the load demand and PL are the transmission losses.

In other words the total generation of power must cover the total demand PD and the real power losses in transmission lines PL. Thus:

$$\sum_{i=1}^{n} P_i = P^D + P^L \quad (5)$$

The calculation of the power loss P^L implies the resolution of the load flow problem, which has equality constrains on active and reactive power on each bar as follows [44, 45]:

$$P^L = \sum_{i=1}^{n} B_i P_i^2 \quad (6)$$

A reduction is applied to shape the transmission loss as a function of the output of the generators through the Kron loss coefficients derived from the Kron losses formula.

$$P_L = \sum_{i=1}^{N} \sum_{j=1}^{N} P_{Gi} B_{ij} P_{Gj} + \sum_{i=1}^{M} B_{0i} P_{Gi} + B_{00} \quad (7)$$

Where B_{ij}, B_{0i} e B_{00} are the power loss coefficients of the transmission network. Reasonable accuracy can be obtained when the actual operating conditions are close to the base case, from where the coefficients - B were derived [44, 45].

- An inequality constraint in terms of generation capacity. For stable operation, the real power of each generator is limited by upper and lower limits. Inequality constraint limits of the output of the generator is:

$$P_{min.i} \leq P_i \leq P_{max.i} \quad (8)$$

Where:

P_i – Output Power of i generator
$P_{min.i}$ – Minimal Power of the i generator
$P_{max.i}$ – Maximal Power of the i generator

- An inequality constraint in terms of delivery of fuel.
- At each interval, the amount of fuel supplied to all units must be less than or equal to the fuel supplied by the supplier, ie the fuel delivered to each unit in each interval should be within its lower limit F_{min} and its upper limit F_{max}. Thus:

$$\sum_{i=1}^{N} \begin{array}{c} F_{im} - F_{Dm} = 0 \\ m \in M \end{array} \quad (9)$$

Where:

F_{im} – Fuel supplied to the engine i in the range m
F_i^{min} – Minimum limit of fuel delivery to the engine i
F_i^{max} – Maximal limit of fuel delivery to the engine i
F_{Dm} – Fuel supplied in the range m

- An inequality constraint in terms of fuel storage limits.

The fuel storage limit of each unit in each range should be within its lower limit V_{min} and the upper limit V_{max}, so that:

$$V_{im} = V_{(m-1)} + F_{im} - t_m \left[\eta_i + \delta_i P_i + \mu_i P_i^2 + \left| \lambda_i \sin\{\rho_i (P_i^{min} - P_i)\} \right| \right] \quad i \in N, \ m \in M \quad (10)$$

Where:

η_i, δ_i and μ_i are the fuel consumption coefficients for each generating unit and λ_i and ρ_i are the fuel consumption coefficients for each generating units, taking into account the valve point effect.

1.4. Economic Load Dispatch Problem Formulation

1.4.1. Incremental fuel cost method.
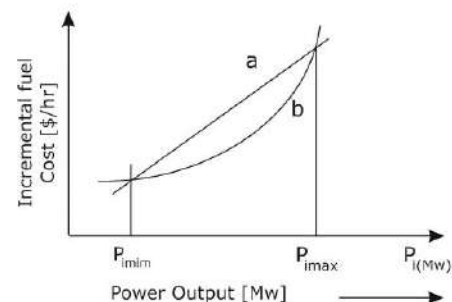
Fig. 2. Incremental Fuel Cost curve of generator i. Source: [48]

The incremental fuel cost can be computed by the following expression [46]:

$$IC_i = (2.a_i.P_{gi} + b_i) \qquad \$/hr \quad (11)$$

Where IC is the incremental fuel cost a_i is the actual incremental cost curve, and b_i is the approximate

incremental fuel cost curve (linear). P_{gi} is the total power generated[47].

The incremental fuel cost cruve is showed in Figure 2.

To load dispatch purposes, the cost is usually approximated by a quadratic or more segments, then the fuel cost curve in the generation of active power, takes a quadratic form

1.4.2. Lambda iteration Method

One of the most popular traditional techniques for solving the economic load dispatch problem (ELD) for minimizing the cost of the generating unit is the lambda iteration method. Although the computational procedure for lambda iteration technique is complex it converges very fast for this type of optimization problem [1], [49]. The Lambda iteration method is more conventional to deal with the minimization of cost at any power generation demand. For a large number of units Lambda iteration method is more precise and more incremental cost functions of all units are stored in memory.

The detailed algorithm for the lambda iteration method for the ELD problem is given below:
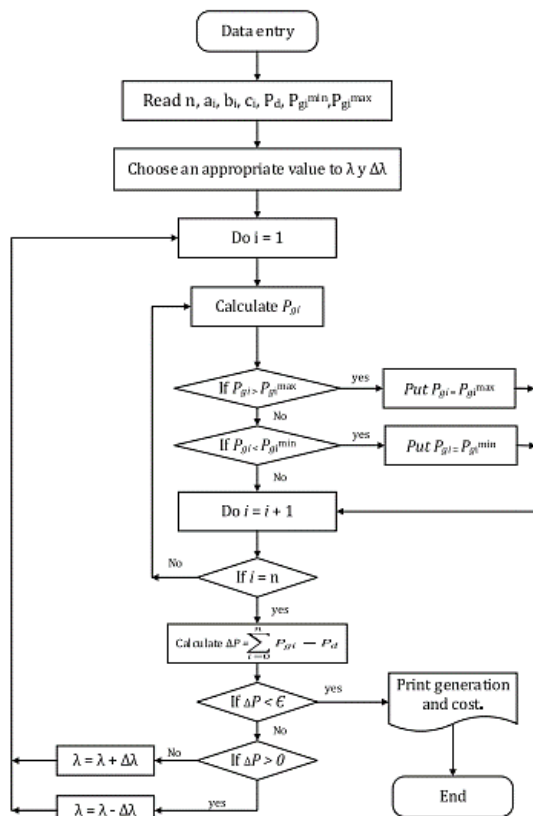
Fig. 3. Iteration Lambda (λ) Algorithm for solving the Economical Load Dispatch.
Source: Authors.

The steps for solving the Lambda (λ) iteration method algorithm are the following:

1. To Read the problem data:
   - The cost coefficients (a_i, b_i, c_i)

- The coefficients of losses B
- The power limits
- The power demand.

2. To Assume an initial value of λ and Δλ using the equations of cost curves.
3. To Calculate the power generated by each unit P_{gi}
4. To Check the limits of generation of each unit:

$$if\ P_{gi} > P_{gi}^{max}, \quad set\ P_{gi} = P_{gi}^{max}$$

$$if\ P_{gi} < P_{gi}^{min}, \quad set\ P_{gi} = P_{gi}^{min}$$

5. To Calculate the generated power.
6. To Calculate the difference in power, which is given by the following equation:

$$\Delta P = \sum_{i=0}^{N_g} P_{gi} - P_d \quad (12)$$

7. *if* $\Delta P < \varepsilon$ (Tolerance value), then stop calculations and to calculate the generation costs. Otherwise, go to the next step.
8. *if* $\Delta P > 0$, then $\lambda = \lambda - \Delta\lambda$
9. *if* $\Delta P < 0$, then $\lambda = \lambda + \Delta\lambda$
10. Repeat the procedure from step 3

1.4.3. Sequential Quadratic Programming

An efficient and accurate solution to the economic load dispatch problem does not only depend on the size of the problem in terms of the number of constraints and design variables but also depends on the characteristics of the objective function and constraints. When both objective functions and constraints are linear functions of the design variables, the economic dispatch problem is known as a linear programming problem. The quadratic programming problem (QP) refers to minimizing or maximizing an objective quadratic function that is linearly restricted.

The most difficult problem to solve is the non-linear programming problem where the objective function and constraints can be nonlinear functions of the design variables.

The solution of the latter problem requires an iterative procedure to obtain a search direction at each iteration. This direction can be found by solving a QP sub problem.

Methods for solving these problems are commonly referred to as SQP since a QP sub problem is solved at each greater iteration, they are also known as iterative quadratic programming, recursive quadratic programming, or constrained variable metric

The problems solved in this work, are from quadratic and nonlinear programming because the objective

function is quadratic and nonlinear, respectively, according to their equations. The SQP is in many cases superior to other methods of nonlinear programming optimization with constraints, having advantages in terms of efficiency, accuracy and success of obtaining solutions for a large number of test problems available in the literature[50-52].

1.4.4. Quadratic Programming Algorithm.

The quadratic programming is an effective optimization method to find the global solution if the objective function is quadratic and the constraints are linear. It can be applied to the optimization problems with non-quadratic objective functions and non-linear constraints[53]. For all the problems with quadratic objective and constraints, imposed restrictions should be linear

The non-linear equations and inequalities are addressed through the following steps:

*Step 1:*To start the procedure it is necessary to allocate the lower limit of generation of each plant and evaluating the transmission losses and loss coefficients and update the incremental demand.

$$P_i = P_i^{min} \ , \ x_i = 1 - \sum_{j=1}^{n} B_{ij} P_i \quad (13)$$

and

$$PD^{new} = PD + P_L^{old} \quad (14)$$

*Step 2:*Replace the incremental costs coefficients and solve the set of linear equations to determine the incremental cost of fuel λ as:

$$\lambda = \frac{\sum_i^n 0.5 \times \frac{b_i}{a_i}}{P_D^{new} + \sum_i^n 0.5 \times \frac{b_i}{a_i}} \quad (15)$$

*Step 3:*Determining the power allocation of each generator

$$P_1^{new} = \frac{\lambda - \frac{b_i}{a_i}}{2 \times \left(\frac{a_i}{x_i}\right)} \quad (16)$$

If the generator violates its limits should be set this limit and only the remaining generators should only be considered for the next iteration.

*Step 4:*To Checkthe convergence

$$\left| \sum_i^n P_i - PD^{new} - P_L \right| \leq \ \epsilon \quad (17)$$

ε - is the value of tolerance for the violation of power balance.

*Step 5:*Perform steps 2-4 until convergence is achieved. For all four steps above the objective is quadratic, and the restrictions are quadratic too, so the restrictions should be made linear:

Minimize: $XH \ X^T + f^T \ X$ (18)

Subject to: $KX \ \leq R, \quad X^{min} \leq X \ \leq \ X^{max}$
$$X = [x_1, x_2, x_3, \dots \dots \dots \dots x_n]^n$$
$$f = [f_1, f_2, f_3, \dots \dots \dots \dots f_n]^n$$
$$R = [R_1, R_2, R_3, \dots \dots \dots \dots R_n]^T$$

H is the Hessian matrix of size $n \times n$and A is the matrix $m \times n$ representing inequalities. For economic load dispatch with losses the quadratic programming algorithm can be effectively implemented, defining matrices *H, f, K* and *R*.

$$H = diag \left(\left[\frac{a_1}{x_1}, \frac{a_2}{x_2}, \dots \dots \dots \frac{a_n}{x_n} \right] \right) (19)$$

$$f = \left| \frac{b_1}{x_1}, \frac{b_2}{x_2}, \dots \dots \dots \frac{b_n}{x_n} \right|$$

K is a Matrix:$1 \times n K = [1, 1, \dots \dots \dots \dots .1]$, e$R = PD + P_L^{old}$

1.4.5. Newton Method

The economic load dispatch may also be solved by observing that the objective is to ensure that $\nabla L_x = 0$.

Since this is a vector function, the problem may be formulated as seek to take exactly the gradient to zero (i.e., a vector whose elements are equal to zero). The Newton method can be used to find this.

Newton's method to a more than one variable is developed as follows [54-59].Assume that the function g (x) will be conducted to zero. The function g is a vector and the unknowns, x, are also vectors. So to use Newton's method, must be done the following:

$$g(x + \Delta x) = g(x) + [g'(x)] \Delta x = 0 (20)$$

If the function is defined as:

$$g(x) = \begin{bmatrix} g_1(x_1, x_2, x_3 \\ g_2(x_1, x_2, x_3 \\ g_3(x_1, x_2, x_3 \end{bmatrix} (21)$$

Then:

$$g'(x) = \begin{bmatrix} \frac{\partial g_1}{\partial x_1} \frac{\partial g_1}{\partial x_2} \frac{\partial g_1}{\partial x_3} \\ \frac{\partial g_2}{\partial x_1} \frac{\partial g_2}{\partial x_2} \frac{\partial g_2}{\partial x_3} \\ \frac{\partial g_3}{\partial x_1} \frac{\partial g_3}{\partial x_2} \frac{\partial g_3}{\partial x_3} \end{bmatrix} (22)$$

That is the well-known Jacobean matrix. The adjustment to each step then is:

$$\Delta x = -[g'^{(x)}]^{-1} g(x) \quad (23)$$

But, if the function g and the gradient vector ∇L_x, so:

$$\Delta x = -inv\left[\frac{\partial}{\partial x}\nabla L_x\right] . \nabla L \quad (24)$$

For the problem of economic load dispatch, the expression to use is:

$$L = \sum_{i=1}^{N} F_i(P_i) + \lambda(P_{load} - \sum_{i=1}^{N} P_i) \quad (25)$$

and ∇L is as was defined above. The Jacobian matrix now becomes a compound of second derivatives and is called the Hessian matrix:

$$\left[\frac{\partial}{\partial x}\nabla L_x\right] = \begin{bmatrix} \frac{d^2 L}{dx_1^2} & \frac{d^2 L}{dx_1 dx_2} & \cdots \\ \frac{d^2 L}{dx_2 dx_1} & & \cdots \\ \vdots & & \vdots \\ & \frac{d^2 L}{d\lambda dx_1} & \end{bmatrix} \quad (26)$$

Generally, the Newton method will solve a problem with a correction that is much closer to the minimum value at a generation step than would be with the gradient method.

1.4.6. Dynamic Programming Method

The application of computational methods to solve a wide range of control problems and dynamic optimization in the late 1950 led to Dr. Richard Bellman and their associated to the development of dynamic programming. These techniques are useful in solving a variety of problems and can greatly reduce the computational effort to find the best paths or control policies. The theoretical mathematical background based on the calculus of variations, is a bit difficult. The applications are not, however, since they will depend on the particular expression of the optimization problem in appropriate terms for formulating a dynamic programming (DP)[1].

When programming power generation systems, DP techniques have been developed for the economic load dispatch of thermal systems, the solution of economic problems scheduling of hydrothermal plants and a practical solution to the problem of the commitment of units. If the valve points are considered at the input-output curve, should be considered the possibility of not convex curves if it is desired extreme precision

If the non-convex input-output curves are going to be used, the same incremental cost methodology cannot be used since there are several MW of output values for any given value of incremental cost. Under such circumstances, there is a way to find an optimal dispatch using dynamic programming (DP). The dynamic programming solution to the economic load dispatch is made as an allocation problem.

Using this approach, not only one set of optimal power (Mw) output of the generator is calculated for a specific total load, but a set of outputs are generated at discrete points to a whole range of load values [60]. A problem that is common to the economic load dispatch with dynamic programming is the poor performance of control of generators.

The only way to produce an order of load that is acceptable to the control system as well as being the best economically, is to add the ramp rate limits or velocity gradient for the formulation of economic load dispatch. This requires a short load forecasting interval to determine the most likely best load requirements and the ramp loading units. This problem can be approached as follows [61, 62]:

Given a load to be provided to increments of time t = 1... t_{max} With load levels of P_{load}^t and N generators on-line for supplying the load

$$\sum_{i=1}^{N} P_i^t = P_{load}^t \quad (27)$$

Each unit must comply with a limit relation, such that:

$$P_i^{t+1} = P_i^t + \Delta P_i \quad (28)$$

and:

$$-\Delta P_i^{max} \le \Delta P_i \le \Delta P_i^{max} \quad (29)$$

Then, the units must be programmed to minimize the cost of power supply during the time period in which:

$$F^{total} = \sum_{t=1}^{T max} \sum_{i=1}^{N} F_i(P_i^t) \quad (30)$$

Subjected to:

$$\sum_{i=1}^{N} P_i^t = P_{load}^t \quad (31)$$

for $t = 1 \cdots \cdots t_{max}$ and:

$$P_i^{t+1} = P_i^t + \Delta P_i \quad (32)$$

with:

$$-\Delta P_i^{max} \le \Delta P_i \le \Delta P_i^{max} \quad (33)$$

1.4.7. Representation of Particle Swarm Optimization (PSO).

Let p be the coordinates (position) of a particle and v its corresponding flight speed (speed) in a search space,

respectively. Therefore, the i_{th} particle is represented as $P_i = [P_{i1}, P_{i2}, P_{i3}, \ldots, P_{iNG}]$, in the NP-dimensional space. The best previous position of each particle is recorded and represented as $Pb_i = [Pb_{i1}, Pb_{i2}, Pb_{i3}, \ldots, Pb_{iNG}]$. The index of the best particle among the particles of the group is represented by $[G_1, G_2, G_3, \ldots, G_{NG}]$, the particle speed ratio is represented as: $v_i = [v_{i1}, v_{i2}, v_{i3}, \ldots, v_{iNP}]$ The new velocity and position of each particle can be calculated using the current speed and distance from Pb_{ij} to G_j, as shown in the following expression[47][63][64]:

$$v_{ij}^{r+1} = w \times v_{ij}^r + C_1 \times R_1 \times (Pb_{ij}^r - P_{ij}^r) + C_2 \times R_2 \times (G_{jr} - P_{ij}^r)(i = 1,2, \ldots NP; j = 1,2, \ldots NG) \quad (34)$$

$$P_{ij}^{r+1} = P_{ij}^r + v_{ij}^{r+1}(i = 1,2, \ldots NP; j = 1,2, \ldots NG) \quad (35)$$

Where:

NP - The number of particles in the group.

NG- The number of members on the particle

R- The interaction pointer (generation)

w- The inertia weight factor

C_1 and C_2 - The acceleration constants

R_1 and R_2- The random values in the range [0,1]

v_{ij}^r-The speed of the j_{th} member of the i_{th} particle in r_{th} iteration.

$$v_j^{min} \leq v_{ij}^r \leq v_j^{max} \quad (36)$$

P_{ij}^r– The current position of the j_{th} particle in the r_{th} iteration.

The parameters v_j^{min} and v_j^{max} determine the resolution, or ability, to look for regions between the current position and the target position.. If v_j^{max} is too high, the particles may fly through good solutions. If v_j^{max} is very low, the particles cannot explore sufficiently and can lead to local solutions.

The C_1 and C_2 constants represent the weighting of stochastic acceleration pulling each particle toward the Pb_{ij}^r, G_{jr}. Low values allow the particles to move away from the target area before being lured back. Moreover, high values result an abrupt movement toward or passing the target regions [47].

A. Solution to the Economic Load Dispatch by the criterion of incremental cost (λ) and particleswarmalgorithms, case study.

The problem to be solved by particle swarm algorithms can be formulated as follows:

$$Minimize \sum_{i=1}^n F_i(P_i) \quad (37)$$

$F_i(P_i)$ is the fuel cost equation of the i_{th} engine. It is the change in the cost of fuel (\$) versus the generated power (Mw). Normally, it is expressed by the continuous quadratic equation:

$$F_i(P_i) = \sum_{i=1}^n (a_i + b_i P_i + c_i P_i^2) \quad (38)$$

Power losses are calculated by the expression:

$$P_L = \sum_{i=1}^N \sum_{j=1}^N P_{Gi} B_{ij} P_{Gj} + \sum_{i=1}^M B_{0i} P_{Gi} + B_{00} \quad (39)$$

The restrictions used in this case are the following:

$$P_{min.i} \leq P_i \leq P_{max.i} \quad (40)$$

$$\sum_{i=1}^n P_i - P^D - P^L = 0 \quad (41)$$

The selected reference plant for the case study is composed of 10 motors with their characteristics described in Table 1, The first three columns are the coefficients a_i, b_i, and c_i, and the last two the minimum and maximum power of each engine.

TABLE 1, contains 10 lines (each line is a machine of the plant), and 5 columns (representing the coefficients of the cost of fuel and the limits of the plant).

1. Coefficient "a" (\$/Mw^2)
2. Coefficient "b" \$/Mw
3. Coefficient "c" (\$)
4. Lower power limit in (Mw)
5. Upper power limit in (Mw)

TABLE 1: Technical Specifications Of Plant Engines.

Motor	a_i ($/Mw ^2$)	b_i ($/Mw)	c_i ($)	P_{min} (Mw)	P_{max} (Mw)
1.	0.007	7	240	0.66	3.35
2.	0.0095	10	200	0.9	3.7
3.	0.009	8.5	220	0.8	3.6
4.	0.009	11	200	0.66	3.35
5.	0.008	10.5	220	0.72	3.45
6.	0.0075	12	120	0.66	2.97
7.	0.0075	14	130	0.88	3.5
8.	0.0075	14	130	0.754	3.33
9.	0.0075	14	130	0.9	3.9
10.	0.0075	14	130	0.56	2.35

Source: Authors.

Loss coefficients (Bm) are determined by a square matrix of size n x n, where n is the number of engines, demonstrated in TABLE 2.

TABLE 2: Matrix of Losses of the 10 Plant Engines (All Values Must be Multiplied By 10 E^{-4}).

M	1	2	3	4	5	6	7	8	9	10
1	0.14	0.17	0.15	0.19	0.26	0.22	0.34	0.38	0.43	0.45
2	0.17	0.6	0.13	0.16	0.15	0.2	0.23	0.56	0.23	0.51
3	0.15	0.13	0.65	0.17	0.24	0.19	0.25	0.38	0.43	0.45
4	0.19	0.16	0.17	0.71	0.3	0.25	0.43	0.56	0.23	0.51
5	0.26	0.15	0.24	0.3	0.69	0.32	0.18	0.37	0.42	0.48
6	0.22	0.2	0.19	0.25	0.32	0.85	0.97	0.55	0.27	0.58
7	0.22	0.2	0.19	0.25	0.32	0.85	0.67	0.38	0.43	0.45
8	0.19	0.7	0.13	0.18	0.16	0.21	0.28	0.56	0.23	0.51

| 9 | 0.26 | 0.15 | 0.24 | 0.3 | 0.69 | 0.32 | 0.18 | 0.37 | 0.42 | 0.48 |
| 10 | 0.15 | 0.13 | 0.65 | 0.17 | 0.24 | 0.19 | 0.25 | 0.38 | 0.43 | 0.45 |

Source: Authors.

The demand for power to be provided by the plant is 20Mw

Demand (Mw), $P_d = 20$;

III. RESULT ANALYSIS AND DISCUSSIONS.

According to the non-compliance with any of the restrictions, the program offers the following messages:

==
ERROR! The demanded power is less than the minimum power.
Minimal Power: 0.56 Mw > 0.50 Mw of Demanded Power.
==

This restriction is related to the minimum capacity of the engine of smaller capacity among all of them, ensuring that the demanded capacity is greater than minimum generation capacity of the plant.

==
ERROR! It is not possible to reach the demand with the current capacity of the plant.
Current capacity: 33.50 Mw <200.00 Mw of power Demand.
==

This restriction is related to the maximum capacity of the set of all machines, ensuring that the required capacity is less than the maximum capacity of power plant generation

There was used a population of 300 individuals and 1500 generations.

The results after running the program were the following:

==
Economic Load Dispatch using Particle Swarm Optimization -Results:
Demanded Power: 20 Mw
Minimal Power: 0.56 Mw
Maximal Power: 3.9 Mw
Fuel Cost: 1922.72
Power losses: 0.01
Power of each motor:

| Pm1 | Pm2 | Pm3 | Pm4 | Pm5 | Pm6 | Pm7 |
| 3.35 | 3.70 | 3.60 | 2.16 | 3.45 | 0.66 | 0.88 |

| Pm8 | Pm9 | Pm10 | Total P. |
| 0.75 | 0.90 | 0.56 | 20.01 |
==

The solutions report shows the input parameters to run the program, as power demand, minimum and maximum capacity of power of the engines and the results of the total cost of fuel, total power loss as well as the optimum power for each one of the plant engines.

Fig. 4 shows the convergence of the particles (values), in green, particles with better trajectories, in blue, current positions of the particles and in red the axes with the Global best position to be found. Each particle establishes its path combining their past experiences with the experiences of their neighbors (other particles with which they communicate), obtained by PSO, generated by MATLAB.

Particle Dynamics

PSO Model: Common PSO
Dimensions : 10
Num. de particulas : 300
Minimize to : Unconstrained
Function : Total Cust
Inertia Weight : 0.83396
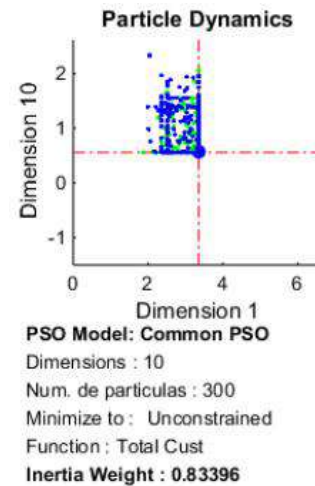
Fig. 4. Particles convergence.
Source: Authors.

Fig. 5, shows the convergence of the cost function for the lowest total cost considering the ten generating machines, obtained by PSO, generated by MATLAB.
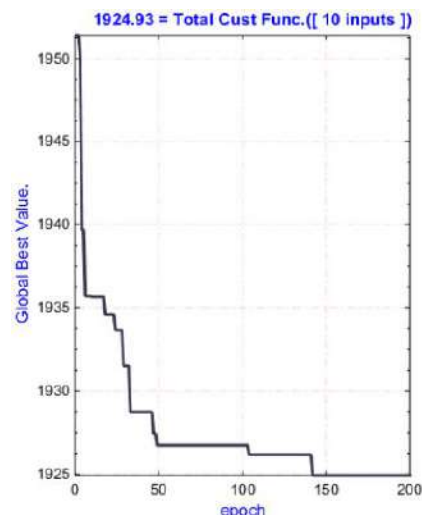
Fig. 5. Total cost convergence.
Source: Authors.

In *Fig. 6*, there are offered the graphics of the lowest Total Cost of Fuel and Best Overall Value, obtained by PSO, generated by MATLAB.
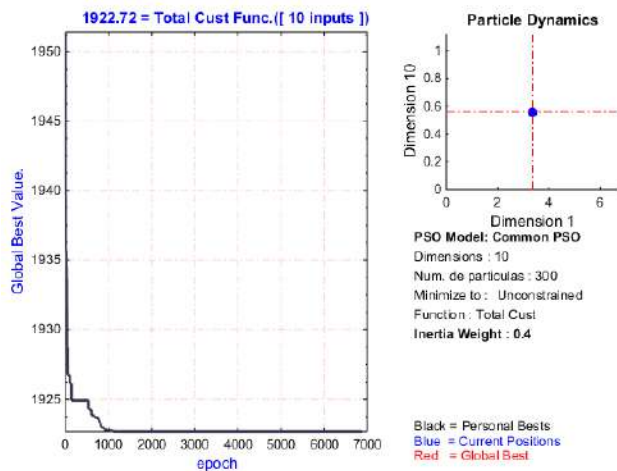
Fig. 6. Consumo total de Combustível e Melhor Valor Global.

Source: Authors.

IV. CONCLUSIONS

In this paper it was developed an analysis of ELD problems and different approaches to solving the problem. Conventional methods such as lambda iteration method converge rapidly, but the complexity increases as the system size increases. Furthermore, the lambda method always requires provide or meet the power output of a generator and then to assign an incremental cost for this generator. In cases where the cost function is much more complex, it can be used Newton's method. If the input-output curves are not convex, then can be used the dynamic programming to solve economic dispatch problems. Hence, different methods have different applications. In this paper the operational optimization problem of Economic Load Dispatch (ELD) was solved using the lambda iteration technique and the Particle Swarm algorithm. It was analyzed as a case study a generating plant with 10 units or motors. The results agree with the actual load dispatch. The lambda iteration method applying the particle swarm algorithm is a simple way to solve the ELD problem with good results.

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Ecology of Contributions for Women Association with Brazilian Semiarid

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Abstract— We bring this work some historical perspectives on the conceptions socially constructed about gender and sexual division of labor, and dialogued with some theorists that reference the topic further highlight some narratives that illuminate the emancipatory bias of women's active participation in production in spaces of Family Farming. Thus, the study discusses the role of women in Food Safety production space, because we believe that discuss food security in the Brazilian semiarid region (SAB) implies reflect gender relations and women's participation in the production of food for the family and to the market and their participation in the management of property and public spaces.

Keywords— Family farming. Food Safety. Genre. Sexual division of labor.

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I. INTRODUCTION

Since mankind's early history of women is inextricably linked to agricultural production, in the process, their participation was fundamental to human social development, expanding the pillars of production and reproduction of work, family and society. The woman who invented agriculture (DIAS, 2010), enabling greater food security and the settlement of people in suitable environments for the development of humanity. But with a sedentary lifestyle and technology also came to lust for power, dividing humanity into oppressors and oppressed groups (FELIZARDO, 2015).

The first population groups vied with each other and the animal's territories with greater abundance of food and water. With the advent of agriculture humans can be installed in places with more security and went on to live longer and to produce surpluses. For it was essential to ensure the possession of the best land, which led to the culture of private ownership of land, the surplus production, tools and after the domination and enslavement of people. Came the towns and then cities. The family structure has also changed, humanity left to live in flocks and lived in families with few members, now headed by the man who won this power by force, gained over many thousands of years lived as hunter. At that juncture it was no longer possible to guarantee the possession of the best land without the family's control and inheritance. The woman, who until then was considered a deity to have the ability to generate life (MONTEIRO; SITA, 2013), was controlled by man, for life had to now also be controlled, manipulated in the service of a new model society.

The advent of agriculture and sedentary lifestyle has spread around the world and how to exercise power and control are established in different ways in different people that have formed. In parts of Africa, Asia, Europe and America people continued and still living nomadic way or semi-nomadic, which leads us to the reflection that the history of mankind cannot be thought of linear and evenly, there are several ways of living and organize themselves socially. But we cannot deny or ignore the pressure that other forms of social organization suffering on the part of people who want to impose at all costs a unique model of society based on private property, social control and exploitation of natural resources and human being.

Our territory (before being appointed Brazil) lived up to 500 years ago, other forms of social organization that were not based on inactivity or on private property. Before the Portuguese colonization this region was inhabited by various peoples 100,000 years ago, however, with the arrival of the Portuguese in Brazil, from 1500, social relations between man and man, man-woman and the relationship between society and nature was fully modified. In the Portuguese caravels came only men, priests, soldiers, adventurers and convicts who had no claim to settle definitively, only plunder the natural resources they could find. The Portuguese saw the native people like animals as described in Gandavo (1980, p. 34) "on earth or have homes or villages where they live, live among the bushes as brute animals." Native men who

bowed to slavery were killed and captured women to sexually serve the settlers and also in domestic service. The woman was likened to a beast of burden, especially being responsible for the task of fetching water, either in the head or the donkey's back. Phrases like "my grandmother or great-grandmother was caught the dog tooth" reflect the way women were treated by society and meant to say that the woman was hunting literally domesticated and was "tied" - and here we bring the metaphorical perceptions but also physical - indoors subservience to her husband. were the head or donkey's back. Phrases like "my grandmother or great-grandmother was caught the dog tooth" reflect the way women were treated by society and meant to say that the woman was hunting literally domesticated and was "tied" - and here we bring the metaphorical perceptions but also physical - indoors subservience to her husband. were the head or donkey's back. Phrases like "my grandmother or great-grandmother was caught the dog tooth" reflect the way women were treated by society and meant to say that the woman was hunting literally domesticated and was "tied" - and here we bring the metaphorical perceptions but also physical - indoors subservience to her husband.

Thus, we bring this work some historical perspectives on the conceptions socially constructed about gender and sexual division of labor, and dialogued with some theorists that reference the topic further highlight some narratives that illuminate the emancipatory bias the active participation of women production in the spaces of Family Farming.

For these assumptions, we will support what we see along the colonization history of Brazil, especially in the semiarid region, where the woman began to accumulate double working hours, having to reconcile the household chores and read in the field. However its activities are hardly recognized, being cited mostly as help when.

II. MATERIALS AND METHODS

The research was conducted as literature, given a necessary survey on the topic in question. Nature's point of view, the survey was established as basic research, as it sought not present solutions to an existing problem, but understand a certain reality and how it is presented in the context in which it operates (Gerhardt; SILVEIRA , 2009). Regarding the approach, we chose the qualitative research, given that this emerges in the context of a vision that questions the research models established by modern science.

Thus, the qualitative approach was presented as consistent ability to be used to direct the research. For it is proper "to the study of history, representations and beliefs, relationships, perceptions and opinions, ie,

products of the interpretations that humans do in their lives, the way they build their material artifacts and themselves, feel and think "(MINAYO, 2008, p.57).

Another important and necessary element to be explained about the research presented here refers to the overall objectives as one of the working assumptions. In this case, performed a descriptive, since it sought to describe the studied phenomenon and its characteristics (Doxsey; DE RIZ, 2002).

III. RESULTS AND DISCUSSION

In Brazil, after centuries of colonization there is no news of a social group that does not have in its structure elements of the patriarchal society, even in the case of indigenous peoples, traditional communities, quilombolas and peasant communities that have different ways of relating to each other with other groups and with nature and the different forms of production and existence we can perceive macho traits, especially with regard to land management and property and in relation to women. Moreover, we can describe traits of physical and psychosocial violence against women in all social strata and groups, this reality is found in the field of population as well as in urban populations, as described ADITAL (2013, p. 1 emphasis added).

> In Brazil, in the period 2001-2011, it is estimated that there were more than 50 000 femicides, Which is equivalent to approximately 5000 deaths per year. Between 2009 and 2011 it is estimated that there were an average of 5,664 deaths of women from violent causes each year, 472 every month, 15.52 every day, or one every half hour. The Northeast, Midwest and North had the highest femicide rates, respectively, 6.90, 6.86 and 6.42 deaths per 100,000 women. young women were the main victims: more than half of the deaths (54%) were women 20-39 years.

The reality disclosed in above citation shows how brutal treatments are still exempt women in our country. So understand this number requires realizing that there is a deafening silence in society that neglects the number of women murdered, assaulted, silenced, they had and still have their rights violated in the daily life of Brazilian society. Against this reality and taking possession of the purpose of this paper, we present other possibilities emanating from the field in the Brazilian semiarid region and demonstrate the existence of women who have reached new prospects for production, work, life.

The sexual division of labor is a major elements of maintenance and macho patriarchal society (PERSON; Viana 2008). Socially man's work is seen as more important, even if it is not. According Kergoat (2002, p.

4) the sexual division of labor is nothing but the "priority appointment of men to the productive sphere and women's reproductive sphere, and at the same time, capturing the men of the functions with strong value aggregate social ".

In this sense, we see in many communities, when it comes to food production, for example, at certain times of year to plant corn and beans and creating ox are the least profitable activities the family is a negative balance in such cases , which keeps the family is the creation of goats, chickens and backyard activities those that are managed by women and thereby raising chickens is "women's work" in view only when the amount of animals and production is mainly for family consumption. However, when the creation becomes more technology-dependent, with egg production on a large scale with more profitable business purposes, the man seizes the activity, does the gardening.

In the current context, we can see that they are not as numerous official statistics on the work of women in agriculture and family extraction, being most common data on your home journey. This is directly due to the devaluation of women's work in this business. That is [...]:

The conventional economy also devalues or does not consider the work of women. What is more important than 70% of the world's companies continue to say that they have no income or are just for self-consumption. Feminist economists stop, however, any conceptualization of competitiveness through all the processes of production of goods and services oriented to a subsistence and the reproduction of the people, including of which they are produced (...) The insertion of the women in the spaces of work is not greater, the greater financial income, since men are the own resources and those who define alone where they are employed. Another important measure is, just as women's work is invisible to men and women, often also because they are also disregarded and devalued (PACHECO, 2009, p. 8).

This indicates how the work done by women in family agriculture is socially undervalued and about this CORDEIRO (2015, p 07.) Complements stating that "still dominates the view that men are who actually works; women only help. For many years, women do not even have civil and labor documents; and when they had, they were framed them as domestic and home. ". Studies with respect to women in agricultural production, indicate that while 98% participate in activities related to this industry, only 60% participate in decision making in communities. The few women who participate are younger belonging to the current generation (SILVA, 2010).

However, it is clear the role of women in production for self-consumption, accounting for 90.9% in poultry and small animals, 69.2% in horticulture and fruit farming and fishing 26.5 (MELO, 2009). To the sustainability of family farms and dignified stay of the family in the field, this work is very important because, according to Melo (2009, p 04.):

Understanding the characteristics and significance of production for self-provisioning of the family and the property itself remains a bit-depth issue, as well as their importance for food security, for sociability and the transmission of knowledge needs to be further studied.

In the case of rural populations, the vast majority fall within the concept of family farming. Second (SILVA, 2010 cited NODA et al, 2009, p. 7):

In Brazil, the number of establishments classified as family farms represent 85.2% of total establishments, 30.5% of the total area, corresponding to 37.9% of the gross value of production. Compared to yields of large farms, family farms has a 38% higher agricultural productivity per unit area and double the return, when it quantifies the amount of credit used in production. These data indicate the positive results that investment in agricultural policies for small producers can bring, as well as financing of production that can benefit society as a whole.

This audience accounts for 70% of all food consumed by the population. Food produced by women, men and young people. It is the strength of family work, with few technological resources and few machines available, the higher the family a chance to production, so the culture of large families in rural areas. In family structure there is a very clear distinction between men's work and women's work, where the role of women is always seen as secondary, less important, but what we see is that women participate in the same activities and the same intensity as men. Besides having to reconcile the activities of the field (productive) activities with domestic (reproductive), food and children's education, their productive activities are viewed as not working an activity that does not generate income and resources for the production process of family farming (SILVA, 2010). However, often your workload is less than of man, for reconciles the household chores with agricultural activities, working up to 14 hours on average per day (LORETO, 2005).

Another important thing to note in this kind of relationship is the control of material goods and citizenship. Women until today have not yet achieved equivalence to men with regard to the legal control of land tenure, access to public policies for credit and

participation in family decisions, property, community, other public spaces and not even decide over their own bodies. According to Jalil:

> Although women represent 47.8% of the population living in rural Brazil (PNAD, 2006), only 16% are owners of the land where they live. According to the Brazilian Institute of Geography and Statistics (IBGE), 40% of the rural population does not have any document and of those, 60% are women, that makes it impossible to have access to social protection, basic social rights and credit. That means nearly 15 million women who, in most cases, are deprived of access to citizenship for not having recognized its condition of family farmer, peasant, maroon or rural worker (JALIL, 2009, p. 9).

It is noticed that one of the most important factors for maintaining this unequal relationship or to overcome it is to access information, the possibility of knowing the world beyond the borders of their community or municipality. Realizing this the macho culture tried to create means for the perpetuation of this situation. For example: from birth children are directed to take certain behavior differentiated by gender (girls play dolls and house; boys play ball, fight and drive) making as adults seem natural that the public environment is of men and women remain restricted to the private environment. Another aspect to consider is access to income, since there empirical evidence reported by scholars as Deere (2002) "that guarantee the physical well-being conditions of women and children and the fight against poverty significantly depend on whether women or not they have direct access to income and assets productive "(PACHECO, 2009, p. 6).

This behavior is not innate gender or sex, culturally is produced in every society, from birth and maintained through various forms of education, with a strong presence in the games, how to dress, to the religious and scientific dogma. Even with all this pressure, the existence of family farming is only possible because of the work of women.

> The domain knowledge that the woman has over the production process in family farming ensures the sustainability of the property, in the sphere of work with the land and influence the sphere of gender relations, beyond the specific scope of work in sustainability as a whole production, since it has its base of support in the family. From the perspective of sustainability, the woman's role is to defend the food security of the family unit, through its productive activity. (Et.al. CASTRO, 2008 cited ADITAL, 2013, p. 07).

In the semiarid region in a special way, the share of women farmers has been decisive for the construction of more resilient production systems and adapted to the effects of climate change. According to Silva (2010,P. 11):

> Their participation in sustainability is due to the knowledge and know that this is in use and manage the land. The woman seems to have control over biodiversity and understanding grounded in the fields of natural phenomena, it is aware of the importance of nature conservation.

Sharing this perspective, we agree here that the existence of the sexual division of labor whether in the field or in other communities / life organization schemes, does not favor the sustainable development of the community or more than that: the good life of societies. We demand, therefore, the need for dialogue, understanding and equality in society so that it strives to recognize, in addition to reproduction, productive and creative capacity of women by eliminating discrimination that women suffer. This discrimination is particularly reflected in the following areas:

The work done by women, especially by rural workers, is not properly valued and recognized. Much of the workers do not have the necessary documentation relating to their profession, which brings a lot of disadvantage for them when they reach retirement age, when they are denied this right. Within families the man is considered boss, is he who makes the decisions, leaving the woman without power.

The man has every right to hold title to the land and to have access to credit, legalized by law. Although find are significant changes in the "paper" in practice it has not changed much. Is it not written that women are prevented from having access to credit, but it is also not clear that they have that right. Most of the time the financing agent interprets and acts according to its own (pre) concepts. Often it is women who ensure, with their tireless work, the support of the family, especially in the countryside.

In times of drought when man migrates to the cities trying to find a job, the woman is left alone (the widow of drought called) is responsible for caring for the family, water, garden, breeding. However it is not recognized as the manager of the property.

The woman is often prevented from participating in the training processes. So, for lack of deeper knowledge, it was just getting out of the decision process. From the perspective of interfering in this scenario, we understand how important this include discussion on the principles and the set of Coexistence with the semiarid region, aiming to break with the social and cultural discrimination and equality argue with the role of each

person in the human and sustainable development of this region.

In this process, it seeks to guarantee the right of men and women, without distinction, to resources such as access to land, home water supply, food in quantity, quality and regularity, credit, work, schooling, vocational training, health, access the market and control and participation in the distribution of benefits of production.

The growth in the supply of water in the communities through rain water harvesting, used especially for human consumption with the use of tanks and other technologies for animal use and gardens with ponds and caxios has considerably reduced the daily workload of women contributing to that do not require more have to fetch water from a great distance. We booked this room in this discussion to clarify the potential and possibilities of Living with the Semi-Arid Brazilian from the experiences that enhance the activities of women working in the production of family farming in the San Francisco Wilderness Territory.

In the San Francisco backwoods territory the municipality farther and more difficult access is Campo Alegre de Lourdes / BA, in almost all rural dwellings capture rainwater from the roofs with the use of tanks. The 4,000 tanks lay water equivalent of 8,000 tank trucks, which means a saving of at least R $ 400,000.00 to the county each year. Assuming that each tank contains 10,000 liters of water, equivalent to 500 cans of 20 liters, we will see a savings of 1,000,000 (one million) of working hours of women, as the average spent to fetch water is 2 hours per can.

The woman not only in Campo Alegre de Lourdes, but in many realities of Brazil besides taking care of routine activities at home, also takes care of the animals and works in the cultivation of fields which ensures the family livelihood. But in addition, changes in production enable a sustainable agriculture: feed production with fodder and diverse plants and adapted to the climate semiarid and soil, reducing the number of inappropriate practices, such as deforestation and burning in soil preparation.

IV. CONCLUSION

Gradually the improvement of Living technologies leads women, especially young women, to question the current model of society and to experience other ways of living in society and family life. Importantly, these initiatives are still pioneering experiences of some groups who take the lead and start to rebuild their life stories. They are young ladies and women, illiterate and universities that together are opening new avenues for life in society in semiarid

region. Including men, who are also learning new ways of relating to the opposite sex and with their peers. This has been the primary role of women in production. In the production of culture, knowledge and humanity.

Thus we would like to highlight some points as the great inventiveness of women who are reinventing life in the semiarid region, discovering new products, transforming activities that for centuries were kept as production activities for self and now emerge as sustainable possibilities of food production also the market.

Other women can have economic warranty and own income by planting vegetables and the processing and marketing of what is produced in family farming, such as: candy production, jams and local fruit juices Caatinga as umbu, bush passion or xique-xique collaborate so that women do not sell another umbu bag of 60 kg for R $ 5.00, but so that they can get away with the same amount of fruit made into jelly, jam and juice, an income own up to R $ 100.00 and have first money that can spend according to your criteria.

Women's work values the natural resources of the Caatinga,changing the concept of inhospitable region to place full of natural riches and possibilities. Many native plants, that were felled and burned today are protected and cultivated for the commercial use of their fruits, thanks to the initiative of women to try new possibilities for use of these plants.

Women's work contributes to the promotion, preservation and restoration of Caatinga. When the plants of Caatinga become utilized in the manufacture of food, medicine and handicrafts, people who before destroying the native vegetation to deploy exotic crops start to recover Caatinga and protect what still exists for now realize the value of Caatinga in foot.

Women's work helps to raise self-esteem and pride of being and backcountry backwoods of children and youth Semi-Aridto realize the region's potential. Like the local production of food for school feeding. The fact consume local, natural and environmentally friendly products, in school, in place of artificial products imported from other regions passes subjectively for children to information that their region has potential, varieties and flavors.

Women's work is rescuing the tradition of solidarity and mutual aid,through the organization of fruit processing groups and other products from the region, where is the exchange of information on good manufacturing practices, on new recipes and new products. Unlike urban development who preach the wild and unfair competition among producers and consumers of the sale, processing of work and industrialization of products Caatinga are only possible thanks to the

cooperation and solidarity among women of the same group and between different groups. States, groups of women can production volume to reach new markets and the joint purchase of inputs for the manufacture of products.

With the construction of tanks and other forms of capturing rainwater and subsoil women increased the production of fruits and vegetables began marketing in municipal fairs of agro-ecological products, increasing and varying your revenue possibilities.

Women's work is changing the face of rural dwellings, bringing more comfort and dignity for families. With the income acquired in the sales of their products women invest in the renovation and expansion of houses and to purchase home electronics.

Women have, and develop increasingly great administrative capacity, since most of the projects of solidarity economy in the semiarid region, which in fact are working, have the direct participation of women. Women can bring to the project its experience in shared and joint management, gained over the years in your routine to manage the house and the family unit, always done in partnership with the family and with neighbors. This experience has contributed much to the strengthening of solidarity economy.

All these activities have produced another phenomenon that is contributing to the change in gender relations. As previously reported, two of the forms of social and political control of the people in the macho culture is to prevent them from having contact with the public environment and prevent them from access to financial resources and control and asset management. However, with the actions of production and marketing of Caatinga products and fruits and vegetables of productive backyards, women now have the opportunity to interact with other people and in other environments beyond their community fences, having a vision more expanded the world and the possibilities of social life, increasing the production of the existence of a freedom that is conquered and consolidated gradually, and transforms realities and undoes socially constructed imprisonments.

That from the elements mentioned in the text can to list new positive and negative elements lived in our midst, seeking to enhance and expand the positive and negative elements to be aware of and so work to dissuade them. Women to realize even more how key people in building a sustainable society and assert themselves as protagonists. That men recognize the increasingly important contribution of women and are part of this movement, side by side, men and women in the construction of Coexistence with the Brazilian semiarid region.

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Irrigation of the mammary glands of sows (*Sus scrofa domesticus* Linnaeus, 1758)

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Abstract— *The irrigation of the mammary glands of crossbred sows was studied by contrast radiographic examination in order to provide subsidies to related areas. Dissection had been performed on seven female pigs, with different body weights, and prior to puberty, with a mean age of three months, originated from pig farms in Brazil. Barium Sulfate had been injected in four specimens. Radiographic examination was performed for visualization of the arterial distribution to the glands. It has been concluded that the mammary arteries responsible for the irrigation of the mammary glands in sows originate from the superficial cranial and the caudal epigastric arteries. Among the arteries identified by dissection and contrast radiography, it has been verified that the cranial arteries present larger calibers when compared to caudal arteries. The use of contrast radiography has revealed to be efficient for the topographic identification of the vessels, the caliber, and the distribution to the mammary glands.*

Keywords— Anatomy, Arteries, Radiography, Swine, Teats.

I. INTRODUCTION

For centuries now, human beings have been resorting to swine as a source of protein and as biological models, whereas these animals contribute for the development of biotechnology as bio-reactors (being modified to produce therapeutic proteins in the study of diseases) and they moreover provide man with organs where their genetic traits are reformulated (xenotransplantation) [1].

Pig farming is a branch of production in constant growth over the latest decades, and a major part of that

phenomenon is owed, among other factors, to the genetic enhancement added to a formulation of a high-quality diet that is being deployed on the species [2]. Pork meat is the most widely consumed variety in the whole world, as it accounts for providing nearly 38.0% of the entire daily protein intake worldwide [3].

In Brazil, over the 2nd quarter of 2016, 10.46 million swine were slaughtered, generating an 8.0% increase by comparison with the same period of the previous year - that being an all-time record, since the these polls commenced in 1997 [4]. Since the production of swine takes on an international high level, there must be concern in regard of a product's having quality and quantity, whilst strict measures of sanitary and nutritional control are attained. Nevertheless, the phase which requires a higher degree of caution is that of the piglet. When these animals are not well nursed, huge negative impacts on the production and on the payoff are generated - especially when there is a reduction or a disruption in the lactogenesis of the swine matrices [2].

The intake of colostrum within the first 24 to 36 hours after birth is very important for the viability of the piglets, which are born without any immune protection against pathogenic microorganisms that exist in their new environment and, when the piglets ingest the colostrum, they acquire antibodies from the mother, gaining passive immunity [5-7]. This secretion is also capable of providing the energy and the nutrients that account for the maturing and the development of the intestinal epithelium, whilst propitiating anatomical, immunological, and physiological alterations that are crucial to the efficiency of the digestive system [8].

The mammary gland is one of the forming organs of the female reproductive system, being responsible for the lactation, the final phase of reproduction [9]. Although that structure is similar throughout all the species that comprise the mammals, there are variations in regard of its morphological aspect and the concentration of the components found in the secreted milk [10]. The differences in size of the caudal mammary glands - in relation to the cranial ones - is an aggravating factor in the growth of piglets, as is seen that the cranial ones are bigger and, as a consequence, provide the ejection of colostrum with a higher number of immunoglobulins [11].

In light of the importance played by nursing in the development of piglets, it is plausible that the knowledge surrounding the irrigation of the said gland is of utter importance to provide subsidies for the reproduction and the related areas. Thus, it has been sought to provide a description of the irrigation of the said gland in female subjects of the swine species.

II.   MATERIALS AND METHODS

Seven crossbred sows (*Sus scrofa domesticus*) - with different body weights (weighing from 40kg to 50kg), and prior to puberty, with a mean age of three months, originated from pig farms in the municipal unit of Patos de Minas - MG, Brazil - were used. The pigs were obtained after natural death at the very farm and were subsequently forwarded to the Laboratory of Animal Anatomy of the University Center of Patos de Minas, where they were initially cleaned and identified.

For the marking of the arterial system of each animal, an incision was made in the dorsal third of the chest wall, between the third and the fifth intercostal space, with identification of the descending thoracic aorta, the brachiocephalic trunk, and the left subclavian artery. after insulation of the same, the said vessels were subjected to the procedure of cannulation with urethral catheter and filled with a 50% latex-based aqueous solution (Artecola® –Altamira Indústria e Comércio de Látex) stained with specific pigment (Suvinil® Tintas e Pigmentos – latex paint dye). The fixation was carried out by means of intramuscular, subcutaneous, and intracavitary injections of 10% formaldehyde aqueous solution (Chemco® – GEIII formaldehyde solution) prior being immersed in receptacles containing the same solution, where they were kept in for 15 days.

An incision in the mean third of the neck was made saiming to commencing the dissection at the level of the trunk for access to the internal thoracic arteries, after the opening of the thoracic transverse muscle. These vessels were followed, as they extended towards the abdominal cavity - where, from the xiphoid cartilage of

the xiphoid process of the sternum, the arteries in question pass on to being referred to as the cranial superficial epigastric arteries - and branched off to the thoracic and cranial abdominal mammary glands, in direct and indirect branches. For the dissection of the arteries in the inguinal and caudal abdominal teats, the access took place from the external iliac artery, at the root of each pelvic limb. This artery followed underneath the pubis, at which point it branched off the pudendal epigastric trunk artery which, after a short path, gave rise to the caudal epigastric and the external pudendal arteries. From the external pudendal artery, the superficial caudal epigastric artery was branched off, which would be then followed until the end of the same, in direct and indirect branches to the mammary glands.

In four animals, prior to the vessels' being filled with latex aqueous solution, the Barium sulfate contrast (radiopaque) was bilaterally injected from the cannulation with urethral catheter in the internal thoracic arteries and the internal and external pudendal arteries. The animals were forwarded to the sector of diagnostic imaging of the Veterinarian Clinic Center which belongs to the same academic institution, where they would then be subjected to radiographic examination in the ventral dorsal and right and left oblique positions, whilst facilitating the identification of the arterial distribution.

A schematic drawing of the artery branching spread out towards the mammary glands was made. The statistical analysis adopted was simple descriptive, with verification of the presence or the absence of arteries spreading out towards the thoracic, the abdominal, and the inguinal teats, as well as the average of branches produced by the same.

The anatomic nomenclature for designation of the structures is in accordance with the International Committee on Veterinary Gross Anatomical Nomenclature [12]. The work had been approved by the Ethics Committee for the Utilization of Animals of the University Center of Patos de Minas – UNIPAM, under the protocol number 13/17.

III.   RESULTS

It was observed a mammary complex composed by the seven teats in each antimere, separated by the intermammary groove, disposed at the level of the ventral medial line. Those teats are disposed bilaterally and in an asymmetric fashion, from the ventral region of the thorax, at the level of the seventh rib, to the inguinal region.

All of the mammary glands would receive a direct arterial branch and varying numbers of indirect branches. The direct branches were identified and designated in accordance with the name of the irrigated teat (Fig. 1).
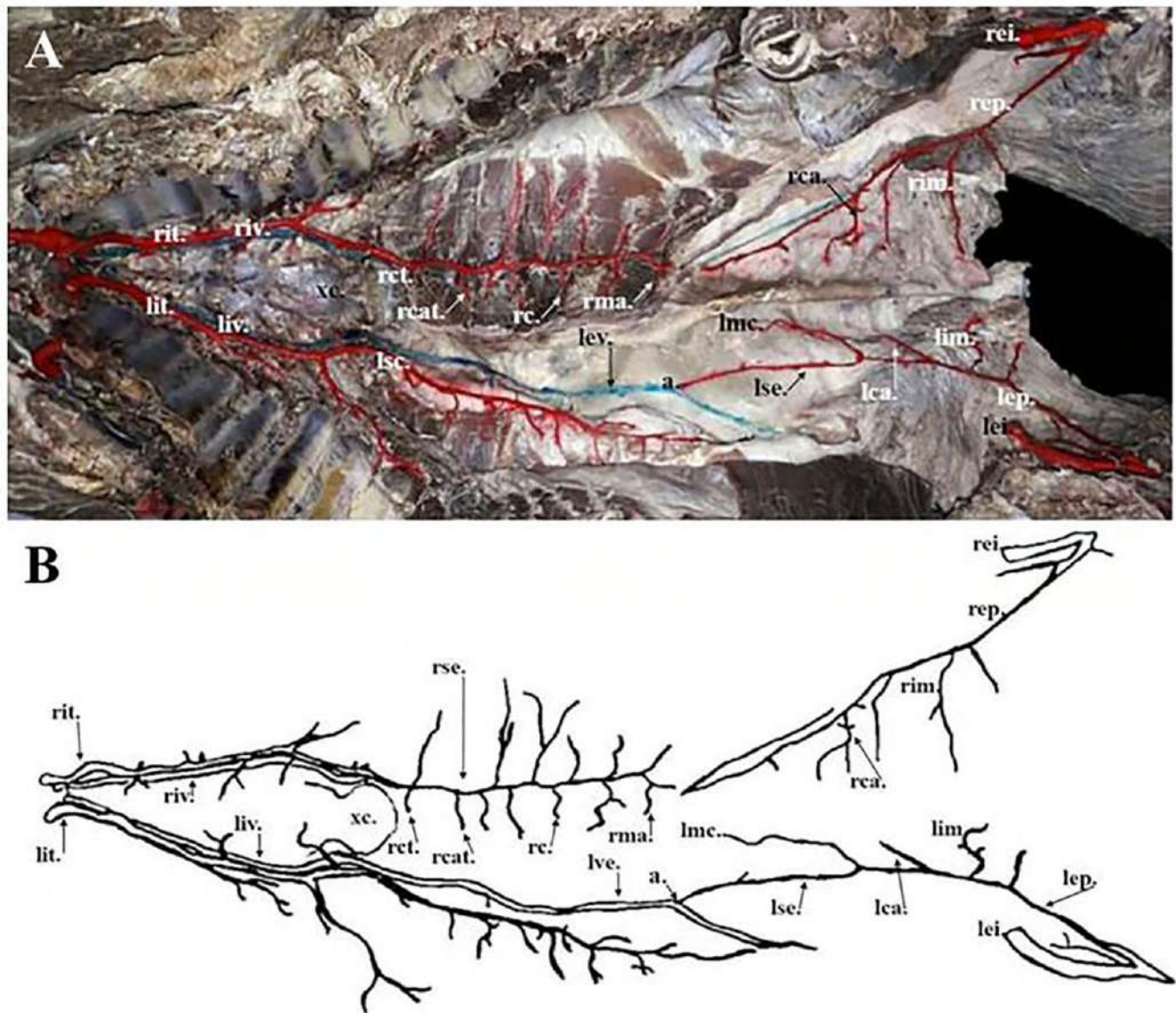
Figure 1 – (A) Dorsal views of the ventral walls of the thoracic and of the abdominal cavities and of the inguinal region of a crossbred sow; (B) Schematic of the arterial distribution to the mammary glands of sow. Left internal thoracic artery (lit.), right internal thoracic artery (rit.), left superficial cranial epigastric artery (lsc.), right cranial thoracic mammary artery (rct.), right caudal thoracic mammary artery (rcat.), right cranial abdominal mammary artery (rc.), right medial cranial abdominal mammary artery (rma.), left external iliac artery (lei.), right external iliac artery (rei.), left external pudendal artery (lep.), right external pudendal artery (rep.), left inguinal mammary artery (lim.), right inguinal mammary artery (rim.), left caudal abdominal mammary artery (lca.), right caudal abdominal mammary artery (rca.), left medial caudal abdominal mammary artery (lmc.), left superficial caudal epigastric artery (lse.), xiphoid cartilage of the xiphoid process of the sternum (xc.), left superficial cranial epigastric vein (lev.), left internal thoracic vein (liv.), right internal thoracic vein (riv.), and anastomosis between the indirect branch of the left superficial caudal epigastric artery and the left superficial cranial epigastric vein (a.).

The cranial thoracic, the caudal thoracic, the cranial abdominal, and the medial cranial abdominal mammary glands are irrigated by the direct and indirect branches of the superficial cranial epigastric arteries, which are the direct continuation of the internal thoracic arteries - these being visualized with significant calibers

and with no spread of direct and indirect ramifications to the mammary glands.

Apart from the indirect branches, the right cranial thoracic mammary gland received the direct branch described as homonymous to the teat it irrigates (right cranial thoracic mammary artery). Irrigating the left

cranial thoracic mammary gland, the left cranial thoracic mammary artery and other indirect branches stemming from the same artery were noticed.

The direct branches of the superficial cranial epigastric arteries - termed right and left caudal thoracic mammary arteries - converged to the right and left caudal thoracic mammary glands. It has also been noticed that, at the level of the cranial region of the abdomen, the cranial abdominal mammary glands are found in each antimere, wherein the right and left cranial abdominal mammary arteries are observed - these also derived from the right and left cranial epigastric arteries, respectively.

The right and left medial cranial abdominal mammary glands are irrigated by direct branches from the superficial cranial epigastric arteries, termed right and left medial cranial abdominal mammary arteries. Nevertheless, they also receive indirect branches from the superficial caudal epigastric arteries.

The medial caudal abdominal, the caudal abdominal, and the inguinal mammary glands are irrigated by direct and indirect branches from the superficial caudal epigastric arteries, which are the continuation of the external pudendal arteries, which have not produced either direct or indirect branches towards the teats. The direct branches have been termed in accordance with the mammary gland which sustained the blood support.

Initially, there had been visualization of the direct stemming of the right and left inguinal mammary arteries, which provide blood support to the right and left inguinal mammary glands, respectively. To the right and left caudal abdominal mammary glands, the right and left caudal abdominal mammary arteries were respectively observed. In the right and left medial caudal abdominal mammary glands, there has been observation of the right medial caudal abdominal mammary artery towards the right teat, and of the left medial caudal abdominal mammary artery towards the left teat.

The presence of arterial-venous anastomosis was observed in all of the dissected animals, among the indirect branches of the superficial caudal epigastric arteries with the superficial cranial epigastric vein.

By means of the contrast radiography technique, there has been visualization of the arteries described and of the actual path run by the same in order to facilitate blood supply to the mammary glands in the thoracic, the abdominal, and the inguinal regions. It was also possible to compare the calibers of these vessels revealing that the superficial cranial epigastric arteries have diameters that are larger than those of the superficial caudal epigastric arteries (Fig. 2 and 3).
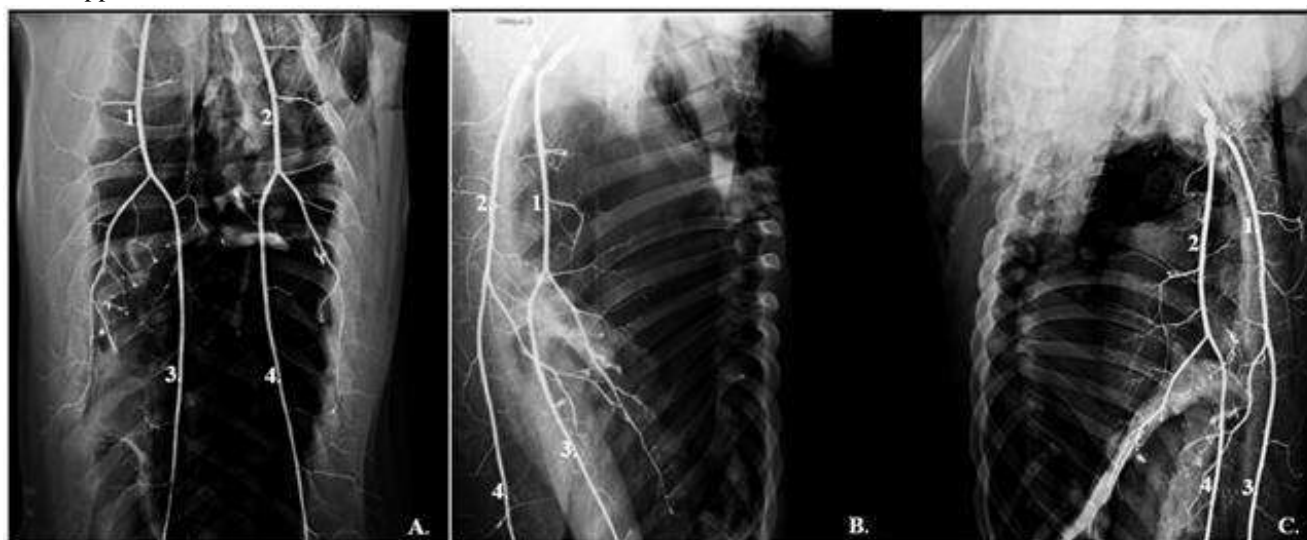
Figure 2 - Contrast radiographs of the thoracic cavity of sow, in ventral dorsal positioning (A), right oblique (B), and left oblique (C), Being: right internal thoracic artery (1), left internal thoracic artery (2), right superficial cranial epigastric artery (3), and left superficial cranial epigastric artery (4).
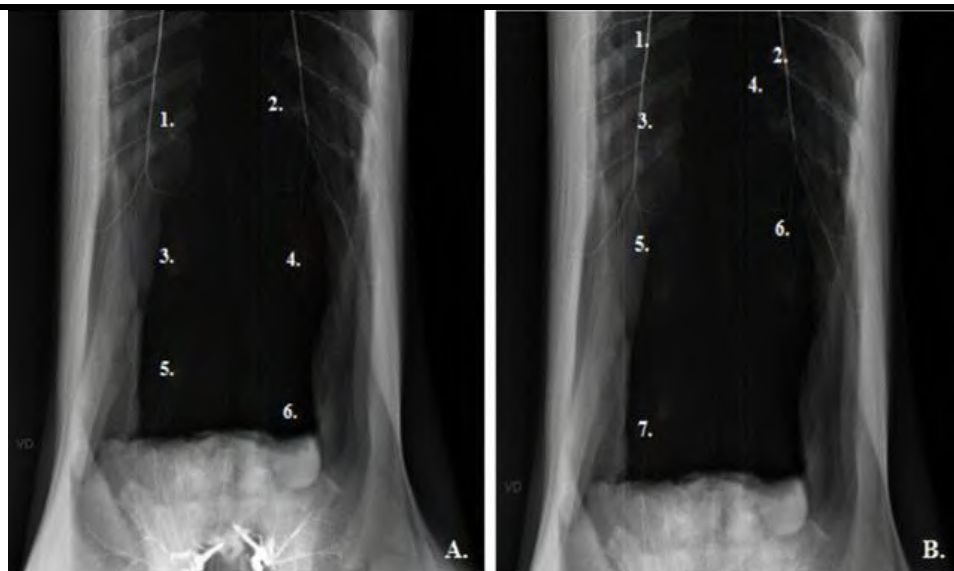
Figure 3 - Contrast radiographs of the caudal third of the thoracic cavity, of the abdominal cavity, and of the cranial third of the pelvic cavity of sow, in ventral dorsal positioning. (A) Right medial cranial abdominal mammary gland (1), left medial cranial abdominal mammary gland (2), right medial caudal abdominal mammary gland (3), left medial caudal abdominal mammary gland (4), right caudal abdominal mammary gland (5), and left caudal abdominal mammary gland (6). (B) Right superficial cranial epigastric artery (1), left superficial cranial epigastric artery (2), right medial cranial abdominal mammary artery (3), left medial cranial abdominal mammary artery (4), right medial caudal abdominal mammary artery (5), left medial caudal abdominal mammary artery (6), and right caudal abdominal mammary artery (7).

IV.   DISCUSSION

In swine farming, it is important to know more about mammary glands to understand why the cranial glands are larger than the caudal - that factor being an aggravation in the uniform development of the piglets [11]. The circulatory system of this tissue, with all of its main vessels and ramifications, calls for a high level of knowledge, due to its significance on account of being responsible for carrying the nutrients, the hormones, and the oxygen in order for a matrix sow to produce milk [13].

In relation to the number of teats found, it is in accord with that which had been described by Frandson, Wilke and Fails [14], who reported that, for domestic swine, the normal number of teats is seven pairs - the first pair being found immediately caudal to the junction between the sternum and the costal arch, whereas the last pair is found in the inguinal region. Getty [15] describes a distribution similar to that of bitches, this being in two rows, which König and Liebich [13] have reported to be parallel to the ventral medial line of the trunk, being separated by the intermammary groove. They are thus distributed: 2 thoracic pairs, 4 abdominal pairs, and 1 inguinal pair; being adhered by fat tissue to the wall, surrounded by elastic and connective tissue [17]. Supranumerary teats may be found among normal teats, although such occurrence had not taken place in this

study. In average, the sows present 2.5 teats beyond the average number of their litters [14].

The distribution of the left and right mammary complexes follows that established by König and Liebich [13], in which they are not found at the same transversal plane but, rather, are distributed in an alternate fashion to facilitate access to the piglets, when the female is in lateral decubitus. These authors moreover describe that each of those complexes has two or three mammary units and that, in each of the same, an individualized orifice is open at the end of the papilla. In this study, no pathology has been observed to affect the mentioned glands analyzed.

The description pertinent to the irrigation of the mammary glands in this species chosen for the study is scarce, while Dyce et al. [18] report that the local blood supply of the mammary glands of sows is performed from the internal thoracic, the superficial cranial epigastric, and the superficial caudal arteries.

Frandson et al. [14] characterize that the caudal distribution is performed by the superficial caudal epigastric artery and that the cranial pairs receive blood from the branches of the superficial cranial epigastric arteries - besides specifying that the same do link dorsally to the abdominal mammary glands. However, the superficial cranial and caudal epigastric arteries end in direct and indirect branches for the blood supply of the

teats - the aforementioned communication not being maintained.

König and Liebich [13] portray that the responsible for the irrigation of the cranial abdominal and thoracic mammary complexes is a single punching branch that originates from the internal thoracic artery, termed the mammary branch of the superficial cranial epigastric artery, and that branches emerging from the external pudendal artery - described as mammary branches of the superficial caudal epigastric artery - irrigate the caudal and the inguinal abdominal teats. Nevertheless, multiple direct branches (described as mammary arteries) and indirect branches have been observed, which stem from the cranial and the caudal epigastric arteries and distribute to the entire mammary complex. Still in contradiction, these authors report that segmental ventral intercostal branches of the internal thoracic artery may convey blood to the thoracic glands.

In bovine females, König and Liebich [13] have described a caudal blood distribution originating from the same branches observed in sows, though with a different ending for their ramifications. The mains artery that irrigates the udder is the external pudendal which, after crossing the inguinal ring, converges caudally until the base of that gland, whilst bifurcating in the cranial mammary and the caudal mammary arteries which cranially perform an anastomosis with the superficial caudal epigastric artery, being in continuation with the superficial cranial epigastric artery. Caudally, the ventral labial branch of the internal pudendal artery is distributed to the udder - a ramification that is not observed in domestic swine.

Luiz and Miglino [19] describe that the present literature uses the irrigation of the mammary glands of bovine females as a standard for the other species - a fact that should be reviewed due to the peculiarities present in each species, as has been demonstrated for the swine as from this study. Upon their analyzing the irrigation of the mammary complex of goats, these authors have reported the similarities with the arterial supply in cows, whilst observing that the same is performed as from the external pudendal artery (this being the mains vessel), apart from two other sources of blood supply, also visualized by Magilton and Getty [20], Schmidt [21], Berg [22], Getty [15], Schummer et al. [23], Lahunta and Habel [24], and Dyce et al. [18]; which is an anastomosis of the ventral perineal artery, the dorsal labial branch, and the mammary branch to the ventral labial branch or the perineal, apart from the anastomosis at the level of the umbilical scar of the superficial caudal epigastric artery, which comes from the external pudendal artery, with branches from superficial cranial epigastric artery, originated from the internal thoracic artery.

Luiz et al. [25], whilst evaluating the blood supply of the mammary glands in 45 adult canines - crossbred and at different ages - (15 multiparous females, 15 nulliparous females, whilst those remaining were male), have been able to conclude that, in this species, the blood supply comes from the superficial cranial and caudal epigastric arteries - results that are similar to that which has been found in sows, hence those are the precursors in the blood distribution to the mentioned glands.

Still, according to Luiz et al. [25], the distribution to each gland takes place as flows: in the three groups analyzed, there had been the predominance of irrigation in a terminal direct fashion in the cranial thoracic and the cranial abdominal pair of teats; in the caudal thoracic teats, there had been greater incidence of a terminal direct type of distribution in nulliparous females whilst, in multiparous females and in males, an equivalence has taken place in regard of the indirect and the direct terminal irrigation in these pairs of mammary glands. In the caudal abdominal teats, there had been nearly absolute predominance of the indirect distribution - a mode of irrigation found in the inguinal glands of all animals from all of the groups assessed. In the swine females, all of the animals evaluated have expressed a direct mode of irrigation - these branches being termed mammary arteries - besides varying numbers of indirect branches.

Luiz et al. [26], whilst also describing the irrigation of the mammary glands in dogs, conclude for the presence of two arterial subdivisions found in all of the cases: a cranial complex arising from the internal thoracic artery, and another caudal complex which arises from the external pudendal artery; the same being found in sows.

Whilst evaluating the morphology of the mammary glands of six female adult subjects of coati (*Nasua nasua*), with one of them being in a nursing stage, Casals et al. [27] describe the teats of that species as being similar to those of the other animals which are part of the Procionidae family, apart from the domestic animals. In spite of the variation in regard of the number of pairs of glands, whilst presenting only three (one pair in the cranial abdominal region, another one in the caudal abdominal region and, finally, one pair in the inguinal region) - four pairs short from the sows - these have received ramifications from practically the same arteries: the superficial cranial epigastric artery and the superficial caudal epigastric artery. Bellatine et al. [28], after having dissected three adult females of South American Raccoon (*Procyon cancrivorus*), with no defined ages, observed the same arterial distribution reported.

As conceptualized by Han and Hurd [29], the contrast radiographic study achieves, as a purpose, the plotting of an outline between an organ or a system and

the soft tissue surrounding the same, whilst the establishment of the size, the shape, the position, the localization, and the function of an organ.

Luiz, Miglino and Santos [26], whilst resorting to the aforementioned methodology, have attained a description in detail of the irrigation of the mammary glands in bitches, highlighting the localization and the quantity of arterial anastomoses of the mammary complex of the species with the neighboring territories, making it possible to establish the intersegmental limits and the relations with other organs, especially the skin.

In this perspective, better identification and understanding of the blood supply to the mammary glands of sows was possible, since the implantation of the contrast radiography proved efficient for the identification of the direct and indirect branches of these glands.

V. CONCLUSION

The mammary arteries responsible for the irrigation of the mammary glands in sows originate from the superficial cranial and the caudal epigastric arteries. The direct branches have been termed in accordance with the glands which they distributed to, and the indirect branches have presented variation in standard and size. The deployment of contrast radiography has revealed to be efficient for the identification of the direct and the indirect branches, whilst ensuring better visualization of the irrigation and a specific description for each mammary gland. It is worth to mention that the reduced caliber of the direct branches derived from the superficial caudal epigastric arteries corroborates with the information that the caudal mammary glands are smaller and that, as a consequence, they have lesser productive performance.

ACKNOWLEDGEMENTS

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Evaluation of Water Quality of the Urban Supply Reservoir in the Municipality of Porto Nacional - Tocantins

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Abstract— *In the city of Porto Nacional – TO the only source of water supply is the São João River, and for this reason it is so important the preservation of this important natural resource that supplies this municipality. Based on this information, this work was developed to verify the water situation regarding the levels and amount of pesticide that is found in the sediments of this dam. Thus, the general objective is to analyze the water quality of the urban supply reservoir in the municipality of Porto Nacional - TO. And from this general goal, some specific objectives are outlined, such as identifying the multiple uses of water and analyzing the presence of glyphosate agrotoxic in the sediments. Therefore, the values obtained in the study should be correlated with the standards determined by the environmental legislation and technical literature, to verify the presence of glyphosate agrotoxic. The research to be performed will use the gas chromatographic method.*

Keywords — *Sediment; Glyphosate; Agrotoxic.*

I. INTRODUCTION

Water is a natural and very essential resource for the origin and preservation of life, and although renewable, on the last couple of years a great deal of concern has been expressed regarding water scarcity, as water is losing the capacity for self-purification.

Many sources of water are already exhausted by now because of misuse. To paraphrase Umetsu et.al (2012 p.92) the environment is immensely subordinate and helpless to changes in hydrological conditions.

With complexity, but with subjectivity, it is important to realize that "socio-environmental responsibility can be generated in all places where there is human activity" (LUIZ et al. 2009 p.141).

However, because of the great increase in the world human population, negative environmental impacts are observed as a result of the degradation of natural resources and the accumulation of residues, evidencing threats to the sustainability of human life, compromising natural resources through pollution (punctual and diffuse form).

The agricultural activity appears as one of the responsible for the degradation of the waters, both superficial and underground. Precisely because primary vegetation is replaced by large plantations and by the use of pesticides used to improve and maintain them. Without the primary vegetation the pesticides are adsorbed by the soil, and when there is precipitation, they are taken directly to the water source.

In the study area in question, glyphosate is the most widely used pesticide, because it is very efficient in combating insects, fungi and weeds, in addition to combating pests, it still helps in the growth of plants.

Queiroz et al. (2011) states that although glyphosate is cited as the world's best-selling agrochemical and has great efficiency in pest and disease control, there is evidence of its environmental degradation, such as destruction of animal habitat, pollution of rivers and, in humans, health related problems such as pulmonary edema and respiratory distress.

The river basin of the São João River, which is located in the municipality of Porto Nacional - TO, is currently its only source of urban supply through surface capture. With the growing increase in agricultural production in the region, the question arises whether the water conditions of São João River are still suitable for use, mainly for the capture and supply of the population, and if there are residues of pesticide glyphosate present in the sediment of the supply dam.

Thus, this study has the purpose of analyzing the water of the reservoir and determining the concentrations of glyphosate agrotoxic present in the sediments of the supply dam of the São João river basin, municipality of Porto Nacional - TO.

II. MATERIAL AND METHODS

STUDY AREA

The river basin of the São João River is located in the central region of the state of Tocantins, in the municipality of Porto Nacional, which is in a distance of 63 km from Palmas, the state capital.

According to SILVA (2010), the hydrographic basin of São João River (Figure 01) is located between the parallels 10 ° 46'43 "and 10 ° 41'20" south latitude and between the meridians 48 ° 14'16 "and 48 ° 24'51 "west longitude, in the southeast portion of the municipality of Porto Nacional.
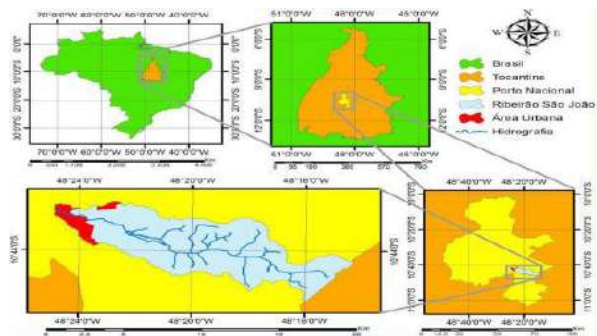
Fig.1: Map of the location of the São João Ribeirão Basin.

Source: SILVA (2010)

The economy of the municipality of Porto Nacional is the fourth largest in the state of Tocantins, located in the geographic center of this state, in the eastern mesoregion, with an average altitude of 212 meters above sea level, a surface of 4,449.9 km² and coordinates 10 ° 42'29 "latitude and 48 ° 25'02" west longitude.

Porto Nacional has an estimated population of 52,510 inhabitants (IBGE, 2016). According to the Ministry of Agriculture and Agrarian Reform (1992), the predominant vegetation is the savannah, the climate is typically tropical, with an annual average temperature of 26.1ºC and an annual rainfall average of 1,667.9 mm. The rainy season occurs between October and April, corresponding to about 80% of annual rainfall, while the dry season corresponds to the months of May to September (MUNICIPAL COUNCIL OF PORTO NACIONAL, 2007).

São João River has its source in the rural area, at Pilão Farm, following the municipality of Porto Nacional, crossing several rural properties and some neighborhoods of the city, with its mouth in the Tocantins River.

POPULATION AND WATER SAMPLE

For the study in the river basin of São João River, the sample unit was delimited and identified. The climatic regime is characterized to better understand the characteristics of the genesis and the climatic dynamics by the pluviometric variations. The choice of the collecting points was defined from a good interaction related to the preservation and conservation of riparian forest, allowing the bathymetry to determine the point for sediment collection for the analysis of glyphosate agrotoxic residue in the sediment after sampling were detected by GC/MS (Gas chromatograph with mass detector). The samples were collected in the sampling unit at the Porto Nacional water supply dam in the rainy season, where the highest sediment load occurs in the water source.

A satellite image was used to better understand the processes that occur in the vicinity of the studied watershed for quantification and qualification of the sampling unit.

FIELD METHODOLOGY

For the analysis of the glyphosate agrotoxic concentration the bottom sediment was collected in the water supply reservoir, which were performed using the Pertesen type sampler.

- Sampling point:
- Latitude -10°43'04.52''
- Longitude - 48°22'19.77''
- located in the reservoir of Porto Nacional - TO.

SAMPLE COLLECTION

The collection of the bottom sediment samples was performed using the Pertesen type sampler, which consists of two buckets that close together when touching the river bed, due to a bar device, to collect an upper layer of the material.

The collected bottom material samples containing slightly wet sediment were usually packed in plastic sacks and sent to the IFTO laboratory (Instituto Federal Tocantinense) for sediment analysis.

TEST PERFORMANCE

a) Sample preparation - (NBR 6457/2016):
The sample was prepared for the characterization tests with the previous drying method of the sample material

b) Sedimentation:
I. The material was passed through the 2.0 mm sieve, about 120 g, for sedimentation and fine sieving;
II. The material was transferred to a beaker, along with a deflocculant (sodium hexametaphosphate solution) and then stirred until all material was immersed. Soon after the material was rested for 12 hours;
III. The material was transferred to the dispersion cup. Distilled water was added until the level was 5 cm below the edges of the beaker, then it was subjected to the action of the dispersing apparatus for 15 minutes;

IV. The mixture was transferred to a graduated cylinder, completed with distilled water to a 1000 ml level, then stirring the soil/water mixture;

V. The densimeter (figure 10) was read at 30s, 1 and 2 minutes, 4, 8, 15 and 30min, 1, 2, 4, 8 and 24h.

VI. After the last reading, the material of the beaker was placed in the 0.075mm sieve, then the sample was washed in the sieve with low pressure drinking water, removing all material from the sides.

c) Fine Screening

The material retained in the 0.075 mm sieve was placed in the oven at 105 ° C to 110 ° C for 24 hours after leaving the oven (Figure 11). The material was washed to the mechanical stirrer to pass through the sieves of 1.2,0.6, 0.42, 0.25, 0.15, 0.075mm. The results were registered with a resolution of 0.01g in the retained mass accumulated in each sieve.

LABORATORY ANALYSIS

Glyphosate was detected by GCMS (Gas Chromatograph with mass detector) using capillary columns containing several stationary phases and the use of selective detectors, following the standards according to Standard Methods (APHA, 2005).

Considering that Gaseous Chromatography is currently the most used technique for the characterization of pesticides. The limitation of this technique is that it requires the sample to be thermally stable and volatile.

The collected sediment was analyzed by the equipment, identified and quantified the presence of glyphosate in the sediment of the Hydrographic Basin.

Equipment used were:

- Chromatographic System Reservoir. The most commonly used gases are H2, He and N2, which are contained in cylinders under pressure; the flow of the entrainment gas, which must be controlled, is constant during the analysis.

- Sample Introduction System. In Gas Chromatography, the injector (or vaporizer) is the place where the sample is introduced. Where solid samples are present, they may be dissolved in a suitable solvent. In order for the sample to completely volatilize, the injector must be at the boiling temperature of the sample, so the sample is charged to the column, when the temperature is higher than the boiling point the sample may decompose. The sample should enter the column in the form of a narrow segment to avoid the widening of the peaks;

- Chromatographic Column and Column Temperature Control. After passing through the sample introduction system, the sample is introduced into the chromatographic column,

where the separation is carried out. The analysis is done as a function of the time the substance passes through the chromatogram. What makes it possible to analyze the quantity is that the substances present in the apparatus as peaks with area proportional to their mass.

- The detector quantifies and indicates what comes out of the electronic treatment column and purifies the noise for better analysis;

- Signal recording: Analyzes and evaluates the data obtained in the process.

The results obtained in the laboratory analysis of the agrochemical will be presented below.

III.   INDENTATIONS AND EQUATIONS
ENVIRONMENTAL IMPACTS

To ensure environmental protection, it is important to maintain at least the water quality parameters within pre-established limits. In Brazil this regulation is based on Resolution No. 357 of CONAMA - National Environment Council (Brazil, 2005) and Order No. 2914 of the Ministry of Health (Brazil, 2012), which provide for the maximum permissible limits. In the absence of information on the chemical groups of pollutants in water, limiting values are sought in international legislation, such as those of the United States Environmental Protection Agency (USEPA, 1995) and the European Union (CEE, 1980).

PERMISSIBLE   QUANTITY   LIMITS   OF GLYPHOSATE

According to the CONAMA Resolution 357/2005, the limit of the organic substance glyphosate in fresh waters is of 65 µg/L, and the Ministry of Health (Brazil 2012) states that for this purpose the limit quantity is 500 µg/L. However, international parameters such as the United States Environmental Protection Agency (USEPA) define the limit as 700 µg/L as the maximum value of the substance glyphosate in potable water. As for the European Union (CEE, 1980), the established value is 0,1 µg/L for any pesticide. Currently in the European Union there has been a ongoing discussion regarding the prohibition of the commercialization of the herbicide in all of its Member States.

The active substance of the glyphosate did not present sample values superior then the ones stablished by the CONAMA resolution (2005). The chromatography test showed that in the sediment in the bottom of the São João River contained in the average of a 5-months period of mg/l is of 0.038.

The collection was carried out during the non-rainy period corresponding to the months of August and September, and rainy in the months of October,

November and December, with the months of October and November corresponding to the months of application of glyphosate in the field, Queiroz et al. (2011), states that the substance is present about 60 days after dispersion in surface waters where the herbicide can be adsorbed in the sediment and is therefore a long term contamination factor and not expected to detect any amount of the agrochemical.

Table 1- Results of glyphosate detection analyzes.

RESULTS OF GLIFOSAT ANALYSIS		
MONTHS	UNIT	RESULT
AUGUST	µg/L	0.03
SEPTEMBER	µg/L	0.03
OCTOBER	µg/L	0.06
NOVEMBER	µg/L	0.06
DECEMBER	µg/L	0.07

Table 2 – Permissible quantity limits of the glyphosate.

PERMISSIBLE QUANTITY LIMITS OF GLYPHOSATE		
PARAMETERS	UNIT	RESULT
Result Chromatography	µg/L	0.038
CONAMA 357/2005	µg/L	65
Ministry of Health	µg/L	500
United States Protection Agency (USEPA)	µg/L	700
European Union (CEE 1980)	µg/L	0.1

According to Marcus Vinicius (2018), the amount of agrochemical glyphosate present in the bottom sediment of the São João river stream barrage, which was collected in the dry season and about five months after the application of glyphosate in the crop was of 0.01 µg/l., when comparing with this research that the result was of 0.038 µg/l it´s possible to see that they were different, but not very relevant, because although this research was carried out in different months of the previous research, in the rainy and dry season, none of the two results presented in the samples values higher than the limits established by resolution 357 of CONAMA (2005).

IV. CONCLUSION

The results obtained in the period under study regarding the presence of glyphosate agrotoxic in the bottom sediment of the supply dam of the São João river stream, allow the following conclusion:

The results obtained in the period under study regarding the detection of agrochemical glyphosate did not present in the sample values higher than the limits established by resolution 357 of CONAMA (2005).

The results indicate that the collections were carried out before and after the application of glyphosate in the crop, and the results detected in the samples were below the limits established by the legislation; however, it is a factor of cumulative long term contamination in the sediments, and preventive and preservation measures must be adopted in the management of the water resources of the São João river basin.

As a preventive measure it can be adopted the terracing system, which on agricultural land is one of the most used practices for the control of water erosion. Terraces are structures composed of a dam and a channel, arranged transversely according to the declivity of the terrain, forming physical obstacles to reduce the speed of the surface runoff, but this is a subject that suggested for the next works.

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Impact of Fibromyalgia on the Quality of Life of Patients in Brazil

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Abstract—*Background: The use of specific evaluation instruments in research demonstrates the reliability of criteria and reliability of the results, giving significance to the context. Methods: Through a search of an online database (LILACS, MEDLINE and SCIELO).*

Results: This systematic review selected 6 research articles that used FIQ as a collection instrument and presented the results in a total score. It was identified the predominance of research in the southern region, and the quality of life of fibromyalgia patients is significantly reduced for all samples analyzed.

Conclusions: There is a need for research and qualified professionals throughout the country to meet the needs of this complex clinical picture.

Keywords—*Fibromyalgia, Quality of life, Fibromyalgia Impact Questionnaire.*

I. INTRODUCTION

Fibromyalgia is classified as a rheumato logical syndrome from the patient's complaint regarding the presence of distributed pain throughout the body, without obvious trauma, with the persistence of pain for more than 3 months continuously and the associated the other disturbances such as fatigue, stiffness, paresthesia, headache, irritable bowel syndrome, sleep disorders, anxiety, depression, and difficulty concentrating, occurring preferentially on women aged between 30 and 60 years [1]. Of yet unknown etiopathogenesis but multifactorial, the diagnosis is clinical, according to the complaints of the patient, whereas the complementary examinations will exclude the possibility of other diseases related to the anamnesis [2].

Use the scenario of quality of life (QL) to assess the commitment of diseases in health became a prominent tool on the definition of health in relation to physical, mental and social well-being [3], defining the term as the individual's perception of their position in life, inserted in the cultural and values context, respecting their expectations, standards and concerns [4].

The measurement of the QL of patients with fibromyalgia uses the Fibromyalgia Impact Questionnaire (FIQ) as facilitator, sensitive and reliable instrument, as well as affordable, simple, easy interpretation and response. In Brazil, was translated by Marques et al. (2006) [5], revised and validated recently as FIQR-Br by Lupi et al (2017) [6]. In this, the 21 questions are scored from 0 to 10 and separated into 3 domains (function, global impact, and symptoms), and the lower the score, the better the quality of life.

In view of the clinical picture, Fibromyalgia interferes negatively in the context of physical, mental and social health of the patient, that is, the presence of the disease interferes with the quality of life. Thus, the assessment of the impact of the disease on patients quality of life reveals itself as an important tool to check the magnitude of compromises and even the effectiveness of treatment, highlighting the need to know the impact of Fibromyalgia on quality of life of Brazilian patients with the use of the Fibromyalgia Impact Questionnaire (FIQ).

II. MATERIALS AND METHODS

This systematic review began with the selection of teams - related terms from the health sciences descriptors [7], such as Fi- bromyalgia (FM) and quality of life (QL), to search in free health electronic holdings. Access to the Virtual Health Library presented the context indexing in the following bibliographic databases: LILACS, MEDLINE and SCIELO, with the amount of 1,004 results for FM to refine the search using the terms FM and QL, showing 222 results. Reading the summaries followed the criteria of the sample population of Brazilian women and use of FIQ as an instrument of data collection in 69 articles. From reading the original articles available in full to the presentation of FIQ numerical score, finishing the refinement with the selection of 6 articles, as illustrates the flow diagram (Figure 1). The timeframe and the language

selection were not used as fill.

Were eligibility criteria: research on QL in Brazilian women diagnosed with FM, using the FIQ as an instrument of collection and presentation of the results in the total score. Were exclusion criteria, the comparative research of FIQ in interventions of therapeutic methods and the duplication of files? The article found in the MEDLINE database was deleted by presenting a male volunteer in the sample.
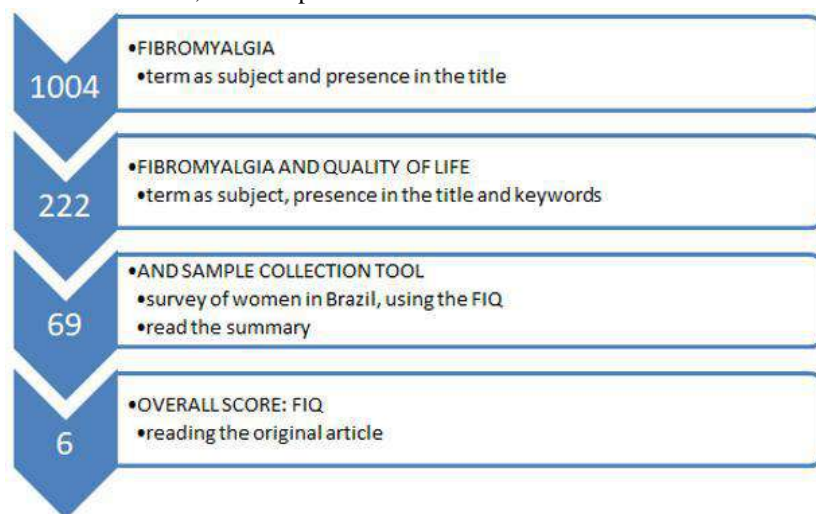
Fig. 1: Flowchart for identification and selection of articles for a systematic review of the impact of FM in QL of Brazilian women using FIQ
Source: Authors, 2017.

III.   RESULTS AND DISCUSSION

The 6 selected articles are structured in table 1 from the time lapse of existing research, and from 2011 to 2016. The characterization of the sample by age reveals the diversity of incidence of fibromyalgia since the average involves adults. In relation to the average overall score of FIQ stands out the negative impact of fibromyalgia on quality of life, with scores between 60 and 75 points, that is, moderate impact (50 to 70) to severe (70 to 100).

The geographical distribution of the research reveals the insertion of the EpiFibro group as national data collection network in Fibromyalgia, concentrating its researchers in the South and Southeast and revealing the absence of them in the North of the country.

You can still highlight the low amount of available sources, despite the severity of the patient's commitments in relation to disease, which requires continuous attention due to your chronic character.

Table.1: Characteristics of research on the impact of FM in QL of Brazilian women using FIQ, second author, year, title, sample, age, rank, and base location.

Authors	Title	Sample	Age (years)	FIQ = 0 - 100	City/State	Base
Homann et al, 2011	Assessing the functional capacity of women with fibromyalgia: direct methods and autorrelatados	n=38	20-64	73,11 DP ± 16,93	Curitiba / PR	SCIELO
Homann et al, 2012	Perception of stress and depressive symptoms: functionality and impact on the quality of life in women with fibromyalgia	n=20	29-52	68,88 DP ± 15,04	Curitiba / PR	SCIELO
Rezende et al, 2013	EpiFibro-a national database on fibromyalgia syndrome – initial analysis of 500 women	n=500	17-89 média = 50 DP = ± 10	60,82	SP, RJ, MG,PR, RS, MS, PE	LILACS
Gequelim et al, 2013	Clinical-epidemiological study of fibromyalgia in a university hospital in southern Brazil	n=146	média = 50,93 DP = ± 9,67	65,78 DP ± 15,09	Curitiba / PR	LILACS
Lorena et al, 2016	Evaluation of pain and quality of life of patients with fibromyalgia	n=45	30-55	75,9	Recife / PE	SCIELO

| Batista et al, 2016 | Assessment of the dietary intake and quality of life of women with fibromyalgia | n=43 | 18-60 | 69,12 DP ± 18,85 | Curitiba / PR | SCIELO |

Source: authors, 2017.

Homann et al (2011) [8] in order to verify the functional capacity of women with fibromyalgia of rheumatology outpatient clinic of the Clinical Hospital the Federal University of Paraná (ROC/CH/UFPR), used dynamometric and 6-minute walk test in a sample of 38 volunteers with an average age of 47 years. Yet compared the result of functional capacity questionnaire reply HAQ (evaluation of patients with rheumatological diseases functionality), FIQ and AVS (analogic visual scale) which were applied before and after the physical tests of functional capacity. They observed that the pain intensity is incapacitating and the main cause of the impairment of activities of daily living and QL.

Evaluating the perception of stress, depressive symptoms, functionality, impact the quality of life and painful intensity, Homann et al (2012) [9] investigated 40 women from ROC/CH/UFPR, divided into two groups, one with a diagnosed volunteer with FM and other healthy patients. From results observed that women with FM have a higher perception of stress and pain intensity, thus reducing the functionality and quality of life, and these factors are directly related to depressive symptoms of these patients.

Gequelim et al (2013) [10], through the standard questionnaire EpiFibro, conducted the evaluation of 146 women met in the ROC/CH/UFPR, relating to FM with high rates of headaches, sleep disorder and paresthesias. The volunteers average age was 50 years, noting that the FM presented with late diagnosis and most of them took more than six months to seek care. Noting that the criteria of the American College of Rheumatology of 2010 have a higher diagnostic sensitivity when compared to 1990.

In order to compile the epidemiology of FM in Brazil, along with the consequences for individuals who suffer from this disease, Rezende et al (2013) [11] used the EpiFibro group database (online questionnaire filled out by doctor and patient) with 500 women between the ages of 17 and 89 years from public and private hospital. The results revealed that there are several symptoms related to FM, such as depression, sleep disturbance, fatigue, anxiety, headache, paresthesia, and there is a relatively large delay both in the search for medical help as in diagnostic rheumatologist. The QL of the volunteers was greatly affected after the emergence of sorrows and most of them have the impression that the trigger point for FM was the stress at work, consequently affecting the musculoskeletal system.

In the study by Lorena et al (2016) [12], with women of the middle ages in 46 years, recruited at the time of the first appointment in the service of rheumatology of a University Hospital in Recife, the volunteers were evaluated by FIQ, GPI (generalized pain index) and AVS so that the quality of life is inversely proportional to pain caused by Fibromyalgia.

In search of Batista et al (2016) [13], developed in the ROC/CH/UFPR, evaluated 87 women with an average age of 47 years, divided into two groups of volunteers, one of 44 healthy and another with 43 with fibromyalgia, investigating the macro and micronutrients intake feed for three non-consecutive days. The control group showed both qualitatively and quantitatively intake higher than the volunteers with fibromyalgia, correlating the threshold of pain reduction and impact the quality of life. Food intake ratio and threshold painful observed that the higher protein intake increased tolerance to pain, and yet, vitamin E deficiency and related to worse QL.

The research on the quality of life of the patient with fibromyalgia is unanimous in the use of FIQ as a validated instrument. Since the higher incidence of use is the measurement of the effectiveness of therapeutic methods, as occurs for Komatsu et al (2016) [14], Kawakami et al. (2014) [15], Silva et al. (2012) [16], Letiere et al (2013) [17].

In relation to the epidemiological profile, Avila et al. (2014) [18] corroborate the description of patients with fibromyalgia being women, with an average age between 30 and 55 years old, married, with low education, low income, with delay of diagnosis, presence the disease for many years and low quality of life significantly when compared to the control group, according [11] .

Was consensus for Homann et al (2011) [8] and Homann et al (2012) [9] that high body mass index, in overweight and obesity, consists of aggravating factor to the worsening of quality of life. Batista et al. (2016) [13] still argue about the importance of a balanced diet to prevent other chronic diseases, overweight and worse quality of life.

General analysis on components that trigger and worsen the FM, Gequelim et al. (2013) [10], Rezende et al. (2013) [11] and Lorena et al. (2016) [12] identified the working environment as a factor to trigger clinical picture. Already Homann et al. (2012) [9] highlight that the intensity of the pain and the psychological disorders such as anxiety and depression are directly proportional,

whereas both factors favor the worsening of quality of life [11].

The delay in the diagnosis of FM is justified by the absence of complementary exams specific to the disease, in addition to the diversity of complaints that mask the initial pain, since the demand for this treatment refers to the commitment skeletal muscle to set often by orthopedic surgeon, that is based on direct trauma injuries evident [10] [11].

The pharmacological treatment prescribed by doctors who specialize in the area consists mostly of simple analgesics, as this class is not able to reduce the pain. The ideal drug, conduct prescribed by the rheumatologist is the combined utilization between antidepressants, anti-anxiety drugs, anticonvulsants, muscle relaxants, anti-inflammatory, and analgesic powerful sleep inducers [19].

Physical therapy reveals the combination of aerobic type exercises, strengthening and flexibility to conduct more effective in the long term to improve the clinical picture and thus the quality of life [23].

Several studies confirm that the physiotherapeutic treatment greatly improves the QL of women who live with the FM, of treatments ducts are numerous both in water as on land. The exercises in the aquatic environment provide doubly therapeutic effects in relation to exercise mechanically and hydrotherapy, corresponding to immersion and muscular relaxation [21]. Komatsu (2016) [14] by using the pilates as a physiotherapeutic treatment showed improvement in QL and the reduction in painful points in volunteers with fibromyalgia. Letieri (2013) [17] and Silva et al. (2012) [16] also evaluated patients treated in the aquatic environment through hydrotherapy kinesiotherapy and also achieved great results when compared the. FIQ before and after the intervention protocol. Confirm with that statement the search of Kawakami (2014) [15] that reports after a period of nine months by associating hydrotherapy and group psychotherapy, there was a considerable reduction in a number of areas of FIQ.

Alternative methods based on oriental medicine are also reported in the literature as beneficial to patients with fibromyalgia as Oliveira, Sousa, and Godoy (2014) [22] that verified the effect of acupuncture in reducing the intensity of the pain and the severity of symptoms.

To complement the multidisciplinary treatment, psycho-behavioral interventions are extremely important due to the vast commitment in relation to anxiety and depression on QL, and changes in habits are able to reduce the severity of clinical picture [1]. The effectiveness of the treatments available to FM is determined by the diversity of techniques and conducts long-term continuity since recurrences of crises arising from physical and/or psychological stress interfere negatively in the clinical picture and consequently impacting on the quality of life [15].

IV. CONCLUSION

The general analysis of the availability of FM research reveals the greatest concentration of large samples data centers located in regions with higher technological development, such as South and Southeast, and to the North and Northeast region lacks epidemiological and experimental studies, although the national scenario of qualified professionals to meet the demand for services in rheumatology is still precarious, undermining the clinical picture of the patient.

Still, the FIQ must integrate into this context as an instrument of measurement of the QL of patients with FM on the impact of the disease, in order to encourage the beneficial, evaluating prognosis both clinical evolution of painting as therapy prescribed.

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Favourable and unfavourable aspects for the Adoption of a Healthy Diet in Families of Private Primary School Students

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Abstract— *This study aimed to know the understanding of the parents or guardians of students of a private school in Aracaju on favorable and unfavorable aspects for adopting a healthy diet for the family. Descriptive-exploratory qualitative-quantitative study. 40 students and 12 parents or guardians participated. The nutritional status of the students was evaluated using weight, height and their anthropometric indicators. The parents or guardians answered a sociodemographic questionnaire and their understanding on favorable and unfavorable aspects in the adoption of healthy eating was obtained by the technique of the focal group. 50% of the students presented overweight in the Body Mass Index for Age. The thematic analysis of content allowed to identify seven favorable and unfavorable aspects for the adoption of healthy food. Favorable aspects were: family organization, food supply, willingness and priority, and nutritional orientation; while the unfavorable ones were: time and money, family food habits and lack of knowledge.*
Keywords— Food and nutrition education, health promotion, healthy diet, nutritional status, students.

I. INTRODUCTION

The formation of eating habits is a process that starts from birth, with the feeding practices introduced by the parents, the first guardian for this formation, and extends through all other phases of the life cycle (Medonça, 2009, Yokota et al., 2010). The introduction of new foods implies the presentation of flavors, textures and colors, sensory experiences that will influence the food pattern to be adopted by the child (Barbosa et al., 2005).

In this context, the school has a relevant role in training future citizens through theoretical and playful mechanisms, which allow the consolidation of a healthy lifestyle from childhood, standing out as an adequate space for health education (Simurro, 2007).

It is noticeable that the recommendations of healthy eating are disseminated to the public through public policies, government programs, campaigns, involvement of health professionals and the media, which generates the thought that most people, in some way, can have access to that knowledge. However, what is observed in the habitual feeding of the Brazilian population is a standard considered unhealthy. These findings reiterate that, although knowledge contributes to the development and maintenance of dietary practices, its action is not enough, because even with professional guidance, adherence to the recommendations faces obstacles (Lindemann, Oliveira, & Mendoza-Sassi, 2016; Santos, 2002; Rangel, Lamego, & Gomes, 2012).

Although there are few studies that seek to know the difficulties for adopting a healthy diet, research carried out in Brazil (Santos et al., 2012), in European countries (Alquaiz & Tavel, 2009; Serour et al., 2007; Lindemann, Oliveira, & Mendoza-Sassi, 2016) and Asia (Petrovici & Ritson, 2006) lack of time, financial resources, willpower, difficulty in changing eating habits as unfavorable aspects in the adoption of healthy food, revealing that the problem is repeated in a global way, regardless of cultural aspects.

This study aimed to know the understanding of parents or guardians of students of a private school in Aracaju on favourable and unfavourable aspects for the adoption of healthy diet by the family.

II. METHODS

The present study was conducted at a private school in Aracaju. The project was approved by the Research Ethics Committee of the Adventist University Centre of São Paulo (UNASP) under CAAE 69571317.0.0000.5377 and by the school's director. Ethical aspects followed the recommendations of Resolution 466/12 of the National Health Council (Brasil, 2012).

This was a descriptive-exploratory study with a qualitative-quantitative approach with sample for convenience. Students from the evening period (fourth and fifth years), 67 students, as well as parents and/or guardians were invited to participate in the study. The invitation for the participation of the research occurred during the first meeting of parents of the second semester of 2017, with the necessary clarifications.

Only the students who presented the Informed Consent Form (ICF) signed by their parents or guardians participated in the research

The research was conducted during the second half of 2017 with the participation of 40 students (59.7%) in the anthropometric evaluations. The parents or guardians participated in two moments, in the first, responding to a self-administered questionnaire (n = 38) and in the second, in the focal group (n = 12, 31.6%).

A self-administered questionnaire was sent to parents or guardians who signed the ICF. One containing sociodemographic variables, referring to consumer goods at home, public services and education of the head of the family and each father, separately. The socioeconomic classification followed the criteria established in the Brazilian Economic Classification, which divides economic classes into A, B1, B2, C1, C2 and D-E (ABEP, 2015), grouped in this study in A, B, C and D-E.

At the school, anthropometric measurements (weight and height) of the students were carried out during physical education classes, following the requirements of the Technical Standard of the Food and Nutrition Surveillance System - SISVAN (Brasil, 2011).

The nutritional status of pupils up to 10 years of age was determined by means of the Stature for Age (S/A), Weight for Age (W/A), Weight for Height (W/H) and BMI for Age (BMI/A) in Z-score and classified according to the standards proposed by the World Health Organization (Brasil, 2011).

Students over 10 years of age were evaluated for BMI/A and S/A indices. The values were expressed as Z-score and compared to the reference values for nutritional status classification recommended by Tanner (1986).

An individualized and confidential information was delivered, including the result of the nutritional evaluation of the student and the questionnaire answered by the parent or guardian, with suggestion of multidisciplinary professional follow-up to contribute to the adoption of a healthy diet.

In order to evaluate the parents 'or guardians' understanding of the favorable and unfavorable aspects of adopting healthy food, we used the focal group, which is a fast and inexpensive technique for evaluating and obtaining data and qualitative information (Gomes & Barbosa, 1999).

The focus group strategy provides for data collection based on the planned discussions on a specific subject in a flexible and non-constraining environment (Westphal et al., 1996).

For the accomplishment of the focal group a lottery was made between the parents or guardian participants of the research obeying the amount of 10 parents or guardian of students of the 4th year and 10 parents or guardian of students of the 5th year, regardless of gender, race or social class. The draw took place in each classroom in the presence of the students, the teachers and the pedagogical coordinator. The participants were invited to participate in the focus group through a communiqué sent on their child's school schedule.

The focus group was attended by 12 parents or guardians, led by the researcher who at the beginning of the meeting reminded the participants of the research objectives as well as the methodology used.

The meeting was conducted by the researcher, based on guiding questions, encouraging participants to freely express their opinions, feelings and ideas on the proposed theme. The development of the focal group lasted 70 minutes and the dialogue was recorded using a microphone coupled to the portable computer.

All analyzes were performed using the statistical package SPSS 22 and GraphPad Prism version 6.0, both for Windows. The results were expressed as means + standard deviations and their respective 95% confidence intervals (95% CI). The normality of the variables was tested using the method of D'Agostino and Pearson. Comparisons between girls and boys were performed using Student's t-test. Prevalences were analyzed using the chi-square test and the results expressed in percentages.

To analyze the qualitative data, the transcription of the speeches for Word of the Microsoft Office package was done. According to Lervolino e Pelicioni (2001) there are two ways of analyzing the data collected in the focus group: the ethnographic summary and the data coding, via content analysis.

For this research was adopted the codification of the data through analysis of thematic content, proposed by Bardin (2009), with the aim of critically understanding the topic addressed. Knowing the subjects' speeches reveals the perceptions, meanings and understanding mechanisms

not revealed on the subject previously. According to Franco (2008), the results of the content analysis should reflect the objectives of the research and be supported by manifest and capturing clues within the scope of the communications issued.

The pre-analysis stage was performed through floating reading of the speeches transcribed from the focal group, in order to establish the themes, using as an indicator the repetition and relevance of the same. The construction of the themes, as well as the hypotheses, was elaborated *a posteriori* in an inductive (emic) way.

The emic approach adopted in this study is characterized by the view of the observers, internally, assuming a particular, unique and analytical posture (Rosa & Orey, 2012).

The process of exploration of the material happened after successive readings using the technique of cutting and sorting (Ryan & Bernard, 2003) que, which consists in identifying the speeches or expressions that stand out and then organizing them into sections of common sense, grouping the passages.

The sections were grouped in different colors according to the repetition of the speeches and similarities in the sense, thus giving rise to the categories of analysis (themes) (Bardin, 2009).

The analysis began in sequence prioritizing the construction of the codebook in order to present the themes, their definitions, how they should be applied (Bardin, 2009; Macqueen, Mclellan, & Milstein, 1998) and its application by the researcher in charge.

The codebook consisted of five elements: the code (theme), abbreviation of the code, detailed description of the code, inclusion criteria (guidelines for when to apply the code) and examples (Macqueen, Mclellan, & Milstein, 1998).

In the next step, the codebook was applied by two other coders who were free to create new themes and / or group existing themes. These two other coders were invited because they already work with the same methodology and are part of the research group "Food, food and health

promotion", the responsibility of the guidance of this research.

Because they were familiar with the research, methodology and application of the codebook, it was suggested by the invited coders to construct two codebooks covering two major themes. The first codebook points out the favorable aspects in the adoption of healthy food and the second highlights the unfavorable aspects in the adoption of healthy food.

After the evaluation of the agreement between the coders regarding the categorization, and the discussion of each theme until reaching a consensus, the two proposed codebooks were then constructed.

Excluded from the codebooks were uncategorized units of analysis, irrelevant portions for the proposed themes (favorable aspects and unfavorable aspects in the adoption of healthy food) and the sections with a dubious or ambiguous sense.

The themes found in the codebooks will be described and analyzed in the following section being presented according to the aspects that most represent the theme and more appear in the speeches of the focus group participants.

Throughout the work, the excerpts from the lines will be identified by the letter "P" followed by a number (P1, P2, P3, ...) referring to each parent / guardian, indicating that different numbers represent different people.

III. RESULTS

A total of 40 children aged 8 to 13 years (9.6 ± 0.89 years) were evaluated, with 22 girls (55%, 9.41 ± 0.56 years) and 18 boys (45%, 9.81 ± 1.16 years), as well as their respective parents or guardians. The socioeconomic evaluation (ABEP, 2015) revealed a score of 33.0 ± 7.5 points, 4 (11%) of class A, 26 (68%) of class B and 8 (21%) of class C. Eight parents or guardians (21%) had 8 years or less of schooling and 30 (79%) more than 8 years.

Table 1 summarizes the anthropometric and nutritional findings.

Table.1: Anthropometric evaluation of students from a private school, Aracaju, 2017.

Variables	All	Girls	Boys
Height (cm)	143,6 ± 0,1	143,7 ± 0,1	143,4 ± 0,1
Categories			
Short	1 (3%)	0 (0%)	1 (6%)
Adequate Stature	36 (90%)	19 (86%)	17 (94%)
High stature	3 (7%)	3 (14%)	0 (0%)
Weight (kg)	39,8 ± 11,1	41,3 ± 10,7	38,2 ± 11,7
Categories			
Low weight	0 (0%)	9 (0%)	0 (0%)
Suitable Weight	31 (78%)	16 (73%)	15 (83%)
High Weight	9 (22%)	6 (27%)	3 (17%)
BMI (kg/m^2)	19,1 ± 3,7	19,8 ± 3,8	18,2 ± 3,4
Categories			
Thinness	2 (5%)	0 (0%)	2 (11%)
Eutrophy	20 (50%)	11 (50%)	9 (50%)
Overweight	7 (18%)	5 (23%)	2 (11%)
Obesity	11 (27%)	6 (27%)	5 (28%)

Regarding height, 100% of the girls and 94% of the boys had adequate results for the age.

Regarding body weight, 73% of the girls and 83% of the boys had adequate results for the age. However, 27% and 17%, respectively, exhibited high body weight for age.

Regarding BMI/A, 50% of girls and 39% of boys exhibited overweight (overweight plus obesity) for age. There was no significant difference between the sexes in the anthropometric indicators evaluated.

Regarding BMI/A, 50% of girls and 39% of boys exhibited overweight (overweight plus obesity) for age. There was no significant difference between the sexes in the anthropometric indicators evaluated.

In the thematic analysis of the speeches of the focus group two main themes were extracted: favorable aspects (FA) and unfavorable aspects (UA). Of these major themes, seven sub-themes were identified, four of which belong to the great theme FA, Organization (ORG), Offer (OF), Willingness and Priority (WP) and Orientation (OR), and three subthemes to the great theme AD, Time and Money (TM), Lack of knowledge (LK) and Family food practices (FFP).

Regarding the theme **Favorable Aspects**:

The first sub-theme highlights the **Organization** as a favorable aspect for healthy eating, emphasizes the use of time, the previous preparation of food as a means to get the organization to improve nutrition. This perception can be observed in:

P4 - "I think we could program better, what we can get ready, a healthier diet and try to organize to get ready a healthier diet. (...) to wake them up early for them to eat before leaving, I think that would be the way."

P1 - "The solution is that! Be programmed! Take advantage of the time you have and leave things ahead for when it's time to eat have something healthier!"

The second theme concerns the **Offer** of healthy food, emphasizes that when access to these foods is part of the family routine, the adoption of healthy food is facilitated, which can be seen in the lines:

P12 - "I think the point is to get used to it! My grandson came to live in my house with a year, I always gave everything to him since that age, he got used to eating everything! Already another grandson I have is not so; he is still small, but the mother only gives "gogó" [milk with Mucilon], the boy does not come any more!"

P8 - "[At home] we already offer the healthiest food possible."

The sub-theme **Willingness and Priority** reveals aspects related to the willingness to adopt and the availability of prioritizing healthy food as an important element for health, showing that the adoption of healthier food practices is achievable as the individual is prepared to develop it, the which can be observed in:

P8 - "The solution is to want! When you want something, we always do! If it's a priority we can do it! "[...]" But if we stop doing something to prioritize our food, we can do it!"

P3 - "The solution is really priority! If it's a priority, we'll get organized!".

Guidance was identified as a relevant subtopic that favors healthy eating as it provides adequate knowledge on the subject, clarifies doubts and encourages; this thought becomes clear in:

P5 - "I think they could talk more about these [food] issues, with their parents too, so we could learn more"

P6 - "I had to talk about these matters [food] and others too, talk always."

In the above excerpts one could see the focus on the need to obtain more knowledge of the subject, more frequently and not only for the students, but also for the parents or guardians.

Regarding the theme **Unfavorable Aspects**:

The fifth sub-theme, **Time and Money**, brings the perception that issues related to financial condition, cost of food, as well as lack of time as a consequence of modern life, interfere in an unfavorable way to healthy eating, which can be observed in:

P4 - "In my case it's a matter of time. Working out, there you can not maintain a healthy eating pattern; I always have to leave food ready for them, so you have to leave something simple ..."

P1 - "My difficulty is also time. As I work out too, they wake up a little late and leave without having coffee, do not eat lunch, a rush. It's only when I'm free, in the days off, that they eat a more prepared, healthier food."

P9 - "In my case, it's time! I seek the most practical and cheapest! Sometimes I even wanted to, but without time with little money ..."

P6 - "I also think it's time and money!"

P2 - "It's the time and the custom ..."

P11 - "I think it's time! Nowadays everybody runs a lot, there it is better to eat what comes ready, or just put it in the microwave "

P10 - "Surely it's time! If I had time to look for different ways of making food it would be better! But for those who work all day it's difficult!"

P3 - "The interesting thing is that due to the rush of life we opted for more practical things, what is more practical for the children, is to open a package of stuffed biscuit, open a" cheetos ", salted, a little box, we know that the best juice is the fruit, but the most practical is the canister, we do not have time to stay at home, everyone goes out to work and the children are alone at home and go after what is more practical , this is the greatest difficulty, the rush of modern life makes us look for what is more practical and what is practical is not always healthy."

Lack of knowledge was the sixth sub-theme identified as an unfavorable aspect for healthy eating, revealing nuances of how little familiarity with the topic interferes with adopting healthier dietary practices, presented in:

P5 - "I have a hard time knowing what's right! Because on the packaging comes so much writing ... Every hour is a novelty ... "

The last sub-theme was characterized by **Family food practices**, making mention of domestic food practices that do not stimulate healthy food development;

indicates that inadequate dietary practices adopted in the family are transmitted from the older to the younger. It should be clarified that in the speeches, in which the subjects used the word "custom", they opted to understand it as eating practices, so that the semantic definitions are not confused. This subtopic can be observed in:

P7 - "The difficulty is to get used to it, I do not like fruit very much and worse still, I do not buy too much. Then my granddaughter did not get used to eating, now if I try to give it to her, it's no use!"

P2 - "It's the time and the custom ..."

P4 - "... because at home I always had this difficulty, my husband and I always had this defect of not eating in the morning, and they seem to have inherited it, they eat badly in the morning."

P7 - "It's because at home we do not have the habit of eating a lot of fruit ..."

The results found in this study provide a range of discussions, interpretations, reflections, suggestions, which will be discussed in the following sections.

IV.   DISCUSSION

The findings of this study show a predominance of socioeconomic class B and parents or guardians with more than 8 years of schooling. In relation to the students, the majority presents high prevalence of overweight.

The perception of parents or caregivers on the favorable aspects of adopting a healthy diet point to the organization, offer, willingness and priority, organization, while the unfavorable ones for time and money, lack of knowledge and familiar eating practices. These results give opportunities for discussions, interpretations, reflections and suggestions, which will be discussed below.

In relation to the socioeconomic class, this study showed a higher proportion of parents or guardians belonging to class B, different from the study of Oliveira *et al.* (2015) who found a higher proportion of class C members in their research that aimed to relate the nutritional status and sociodemographic characteristics of 355 primary school students in Carapicuíba, aged between 6 and 10 years.

This study found no association between the nutritional status of the students and the socioeconomic class of the parents or guardians, similar to the study of Oliveira *et al.* (2015), quoted above, and different from Zsakai e Bodzsar (2014) who evaluated 9479 boys and 9304 girls aged 3 to 18 years and found that the better the socioeconomic conditions of the parents or guardians, the better the nutritional status of the students. Regarding the parents' or guardians' schooling, there were no associations with the students' nutritional status.

Knowledge about food and nutrition are fundamental to the development of healthy eating

practices, however, to make such concepts, as they are assimilated, can interfere and rebuild the practice of healthy eating is a great challenge (Davanço *et al*., 2004).

A longitudinal study by Deminice *et al*. (2007) which involved 142 elementary school students from the city of Ribeirão Preto - SP, whose objective was to develop and implement a food education program and evaluate the effects on the level of knowledge in nutrition, dietary practices, nutritional status and level of physical activity, observed an increase in students' levels of nutrition knowledge.

This finding underscores the importance of studies that seek to promote health based on the understanding of the subjects' speeches, on factors that influence the adoption of healthy eating, in addition to previous knowledge about this subject.

There is no single model of healthy eating to follow. Many factors should be taken into consideration when adopting a healthy diet. The culture and the region of the country where one lives, the climate, religion, habits and food preferences of the family coupled with popular and scientific knowledge are elements in the search for healthy eating (Brasil, 2014).

Regarding the parents' or guardians' understanding of the aspects that interfere in the adoption of healthy eating, identifying them as favorable (organization, offer, willingness and priority and orientation) and unfavorable (time and money, lack of knowledge and custom family). These results provide opportunities for discussions, interpretations, reflections and suggestions on this topic that is so important and of great importance for Public Health.

It was observed that the organization of family members in relation to pre-meal preparation, or small changes in the family routine, such as raising the pupils earlier could be conducive to healthy eating. The woman is culturally guardians for the purchase, preparation and supply of food, as well as the care of the home and the Family. Their insertion in the labor market brought changes in this scenario, reducing the time devoted to these tasks and being one of the reasons for increased food outside the home and the demand for food considered more practical (Oliveira *et al*., 2012; Lelis *et al*., 2012). To minimize this problem, it is recommended to value commensality, which involves all members of the family, creates stronger ties, facilitates the sharing of culinary skills and the construction of family food practices aimed at healthy eating (Brasil, 2014a).

Another favorable aspect identified in the speech was the offer of healthy foods, indicating that when it is offered items that make up a healthy diet from the earliest years of life it becomes easier to practice and adopt it. This finding shows that families play an important role in the development of children's eating habits because it is the first social influence to which they have access (Jaime *et al*., 2017).

The behavior of an individual over food encompasses all that he has apprehended throughout his life in regard to practices, skills, knowledge, information, meanings, representations, values, perceptions, opinions, that is, whatever he thinks, feels and does about the act of eating and eating (Bento *et al*., 2015). For Patrick and Nicklas (2005) the availability and repeated exposure to certain foods is a determining factor of the food preferences acquired during childhood.

Will and priority have also been highlighted as topics that contribute to healthy eating. This highlight shows that the desire to practice healthy eating, as well as the attitude of prioritizing it in the family routine, can serve as a stimulus to healthier eating practices. It is known that the concept of healthy eating is incorporated based on the experiences lived, the sources of information accessed, the priorities listed, social rules, restrictions, adopted values, psychological factors, demographic and cultural characteristics, enabling the conception of healthy eating be lifelong and may vary depending on the complexity and context (Boog, 2013).

The last aspect that favors the adoption of a healthy diet is the nutritional orientation on topics that involve the practice of healthy eating, not only to students in the school environment, but also to parents or guardians. Bento *et al*. (2015) when checking the perception of parents or guardians of preschool children in a day care center in Belo Horizonte, about difficulties to make healthy eating real, stressed the urgency in guiding parents or caregivers about eating practices and their influence on the choices of students, by means of strategies that allow them to reflect and recognize the benefits of healthy eating for health promotion.

As for the aspects that interfere in an unfavorable way in the adoption of a healthy diet, the time and the money appear of marked form in the spoken ones of the analyzed subjects. The study of Batalha *et al*. (2005) which evaluated individuals' perceptions about the price of foodstuffs, showed that the most consumers have the perception that the price of food is high, influencing the moment of food purchase. Regarding lack of time, Bento (2012) in a study with users of popular restaurants in Belo Horizonte, found that the financial condition and lack of time to prepare and buy healthy foods was a difficulty pointed out by the research participants.

Knowing the productivist urban rhythm is a fundamental factor to understand the food consumption of society, since the accelerated rhythm that invades the social life of citizens, especially in large cities, dictates consumption behaviors due to the shortage of time. Due to

the convenience and the lack of time, it is increasingly frequent to have meals outside the home and adoption of fast food (Ortigoza, 2008).

The lack of knowledge about healthy eating has been flagged as a factor that hinders the adoption of healthy eating, because often the information is incomplete. Lamas and Cadete (2017), when conducting qualitative research, with the objective of analyzing the strategies and resources used in the processes of construction of the change of eating habits of twelve health professionals in Belo Horizonte - MG, found that information about healthy eating is widely disseminated through the media. communication, and that access to them is advancing at great strides, especially in large centers, as a result of globalization.

They also emphasize the importance of dialogue as an essential element in the process of education and change in people's eating behavior, emphasizing that, however developed an intervention technology, it will not be able to substitute education for dialogue, which gives meaning to actions and promotes effective changes in the eating habits of individuals (Lamas & Cadete, 2017).

A condition that may interfere with the search for knowledge is the source used to obtain information about healthy eating. The internet, due to its agility and easy access, has been configured as a tool for disseminating content in nutrition, in an interactive way and without any burden of time and locomotion to the user (Gomes *et al.*, 2005).

The polarization of the use of smartphones and tablets connected to the internet with the use of applications, are being integrated to the daily life as an artifact in the education in nutritional health (Curioni *et al.*, 2013). However, information on healthy behaviors, fad diets, healthy or unhealthy foods, herbal remedies, physical exercises, among others, are randomly transmitted in the cyber-space, to all individuals disregarding their individualities (Rangel, Lamego, & Gomes, 2012).

Family feeding practices have been identified as an unfavorable aspect of adopting a healthy diet, in which the food consumed and/or the ways in which they are prepared can compromise the quality of the family's food. Savage *et al.* (2007) mention that in the first years of life children learn what, how, when and how much to eat, according to the socio-food environment to which they belong and based on the cultural transmission of beliefs, attitudes and practices around food.

Based on the assumption that each individual carries with him a food repertoire constructed from the experiences, the nutritional status and the nutritional knowledge of the students are linked to the alimentary habits transmitted by the family. Parents or caregivers with more schooling can positively influence students regarding

healthy eating. However, having satisfactory knowledge is not prerogative to change habits, multifactorial causes interfere favorably and unfavorably in the adoption of healthy eating patterns.

V. CONCLUSION

It is concluded that parents' understanding of the favorable aspects that interfere in the adoption of healthy eating are: organization of family members in relation to previous food preparation, offer of healthy foods, willingness and priority, and nutritional orientation. The unfavorable aspects were time and money, family eating habits and lack of knowledge.

These results provide opportunities for discussions, interpretations, reflections and suggestions on this topic that is so important and of great importance for Public Health.

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Prevalence of Mental Disorder in Adults and Elderly

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Abstract— *These functional loses can be quantified at the population level by multiplying the prevalence of those disorders by the average level of disability associated with them, it is estimated that 50 million years of life are lost because of these disabling morbidities. It is a cross-sectional and descriptive epidemiological research. The sample consisted of 1356 individuals. For the evaluation on mental disorders - stress, anxiety and depression - BECK's inventory and Lipp's stress questionnaire were utilized. It was verified that adults are more stressed (64.5%) than the elderly (60.1%). Regarding the anxiety and depression levels, adults had higher diagnostic numbers, with 27% and 17,8%, respectively, against 24,9% and 16,4% among the elderly. With high global prevalence, being considered a public health problem. It's worth pointing out that in our finding, the highest prevalence was of stress in adult population, however, it was verified in data analysis a linearity in relation to the proportions between adults and the elderly, leading to the understanding that adults with mental disorders tend to be elders with mental disorders. The incentive of healthy habits, a favorable environment for the practice of leisure and social life, are responsible factors for the most effective prevention in order to reduce the morbidity burden of mental disorders.*

Keywords— Mental Disorders. Major Depressive Disorder, Anxiety, Psychological Stress, Epidemiology.

I. INTRODUCTION

According to data from the World Health Organization, in 2015 the estimated prevalence of people with common mental disorders was of 4,4% for depression and 3,6% for anxiety. Representing 322 million of people affected by the morbidities [1,2]. Since many people experience both conditions simultaneously When people experience both conditions simultaneously it is called comorbidities (diseases that coexist in the same subject), that can be more serious versions of the diseases. The prevalence rates vary according to age, with a peak in older adulthood (above 7,5% among women aged 55-75 years and above 5,5% among man the same age group) [1,3].

Common mental disorders can lead to considerable health and organic functioning loses. These functional loses can be quantified at the populational level by multiplying the prevalence of those disorders by the average level of disability associated with them, it is estimated that 50 million years of life are lost because of these disabling morbidities [4,5]. Beyond that, researchers have shown that people with some sort of mental disorder have a higher mortality level than their peers without clinical presentation [6–8].

This is a multifactorial psychosomatic disorder, that needs time to be installed and is therefore considered a chronic disease, without a well-defined etiology, that is more prevalent in adults and the elderly than in children and adolescents [9]. The risk factors are diverse, ranging from socioeconomic background, genetic and

physiological dysfunctions [10] to pre-existing diseases. Directly influencing the onset of mental disorder [11].

These factors add up, leading to a favorable environment to the emergence of mental disorder [12,13]. Its morbidity is perceived at the moment the person is incapable of performing their instrumental activities of daily life, being limited to restricted and inmate environments and little contact with other people, having a direct impact on health and life quality [14, 15].

In view of the above, given the magnitude and impact of mental disorders, this study has the goal of identifying the prevalence of common mental disorders in adults and elderly from the city of Vitória da Conquista, Bahia.

II.   METHODOLOGY

This is a cross-sectional and descriptive epidemiological research, realized in the city of Vitória da Conquista - BA, located in the Southwest of Bahia, Brazil (geographical coordinates latitude -14º 53' and longitude -40º 48'). The city is part of the Southwest economic region and is 509 km away from the capital - Salvador. It has a Gross Domestic Product (GDP) of 3.469 billion and a Human Development Index (HDI) of 0.708. This is a cut from a larger project, entitled "Epidemiological profile of obesity in the city of Vitória da Conquista/BA". The sample consisted of 1356 subjects, of whom 350 were elderly and 1006 were adults, from both genders. All participants were educated about the risks and benefits and all signed the Informed Consent Form (ICF).

To obtain the data the socioeconomic questionnaire was used for the variables: gender, scholarity, type of education, marital status, social class, occupation. It was part of the characterization of the sample and will be presented in table 1 and 2.

Table 1 – Elder Characterization.

Variables		n	%	Total (n)
Gender	Male	108	30,9	350
	Female	242	69,1	
Marital Status	Single	54	15,9	339
	Married	169	49,9	
	Divorced	29	8,6	
	Widower	87	25,7	
Occupation	Yes	49	14	350
	No	301	86	
Social Class	B	1	0,3	288
	C	24	8,3	
	D	164	56,9	
	E	99	34,4	

Scholarity	Incomplete Elementary	151	56,8	
	Complete Elementary	18	6,8	
	Incomplete High School	13	4,9	266
	Complete High School	34	12,8	
	Incomplete College	3	1,1	
	Complete College	12	4,5	
	No scholarity	35	13,2	
Type of education	Public	210	94,2	223
	Private	13	5,8	

Source: Own research 2018.

Table 2 – Adult Characterization.

Variables		n	%	Total (n)
Gender	Male	288	28,6	1006
	Female	718	71,4	
Marital Status	Single	485	48,5	1001
	Married	446	44,6	
	Divorced	59	5,9	
	Windower	11	1,1	
Occupation	Yes	675	67,2	1005
	No	330	32,8	
Social Class	B	49	5,5	901
	C	270	30	
	D	440	48,8	
	E	141	15,6	
Scholarity	Incomplete Elementary	119	12,1	987
	Complete Elementary	32	3,2	
	Incomplete High School	57	5,8	
	Complete High School	234	23,7	
	Incomplete College	302	30,6	
	Complete College	217	22,0	
	No scholarity	26	2,6	
Type of Education	Public	732	75,3	972
	Private	240	24,7	

Source: Own research 2018.

To obtain the evaluation of mental disorders - stress, anxiety and depression - BECK's anxiety inventory questionnaire (BAI - *Beck Anxiety inventory*), BECK's depression inventory (BDI - *Beck Depression*

Inventory) andLipp's stress questionnaire were utilized [16-18].

The BAI is a self-report scale, consisting of 21 items, that measures the intensity of anxiety and contains descriptive claims of anxiety symptoms. The items should be evaluated by the subject with reference to himself, in a scale of 4 points, according to the Portuguese version manual of the Beck Scales, which reflects levels of increasing severity of each symptom as: 1) "Absolutely no"; 2) "Lightly: did not bother me much"; 3) "Moderately: It was very unpleasant, but I could bear it"; 4) "Severely: I could hardly bear it" [19, 20].

The BDI is a self-report scale, consisting of 21 items, each with four alternatives, implying increasing degrees of severity of depression, with scores ranging from 0 to 3. The items were selected based on observations and reports of symptoms and attitudes in psychiatric patients with depressive disorders and weren't chosen to reflect any theory of depression in particular [21].

The Lipp's Inventory of Symptoms of Stress for Adults (ISSL) intends to identify symptoms of stress in a objective manner according to the symptomatology the patient presents, evaluating the types of symptoms (somatic or psychological) and the phase he's in. It presents a four-phase stress model (alert, resistance, near exhaustion and exhaustion) based initially on Selye's three-phase model (alert, resistance and exhaustion), but doesn't invalidate it, being only an improvement of the first proposed model [22].

The treatment and tabulation of the data were realized with the aid of the Excel program and the descriptive analysis, presenting the percentage and the "n" of the sample, was made with the assistance of *Statistical Package for Social Sciences*- SPSS, version 25.0 software. The participants were educated on the utilized methods according to the Resolution 466/12 (National Health Council), which is composed of international research documents that involve human beings. It should be noted that the project was approved by the Research Ethics Committee of the Independent Faculty of the Northeast (Legal Advice n° 1.859.545).

III. RESULTS AND DISCUSSION

In our study, we obtained 1356 individuals, adults and seniors from both genders, some of whom didn't answer all questionings and therefore we had lost in some of the questionings, however, these loses don't diminish the importance of the presented data.

As shown in sample characterization table 1 and 2, in our study the majority of the collected individuals were adults and the female audience was higher in both age categories. The majority were married. Regarding work, the majority of adults claimed to work, which was inversely verified among the elderly, something we predicted, since a good part of the elderly are retired [23]. Both groups have similar social classes, which shows a linearity among the adults who are of classes B, C, D and E in relation to aging. Adults had a higher average scholarly level than the elderly, whose majority had an incomplete elementary school. Most of them also claimed to have studied in public education institutions.

According to the World Health Organization, all the factors that characterize the sample are also considered important risk factors for the onset of chronic diseases and among them, mental disorders (stress, anxiety, depression) [1, 23, 24]. The socioeconomic profile of the subject reflects their basics characteristics, having a strong influence on their way of life [25, 26]. Good health also requires a good educational level, as it is verified in literature that people who have a low level of scholarity are also more likely to have chronic diseases [19, 27]. As well as staying in a lower social class, having only cheaper and high in fat food available. Their leisure is generally reduced either by low economic power or by environmental factors [28–30].

In our samples, the number of adults was higher than that of the elderly, but in relation to mental disorders, the two populations presented similar values in percentage. It was verified that adults are more stressed (64.5%) than the elderly (60.1%). Regarding the anxiety and depression levels, adults had higher diagnostic numbers, with 27% and 17,8%, respectively, against 24,9% and 16,4% among the elderly. The high number of adults compared to those of the elderly may justify the higher prevalence of mental disorders in adults.

Table 3. Prevalence of Stress, Anxiety and Depression in adults and elders.

Variables		Adults		Elders	
		n	%	n	%
Stress	Without	292	35,5	110	39,1
	With	530	64,5	171	60,1

Anxiety	Without	587	73,0	208	75,1
	With	217	27,0	69	24,9
Depression	Without	699	82,2	249	83,6
	With	151	17,8	49	16,4

Source: Own research, 2018.

Linearity in relation to the number of adults and elderly with a mental disorder is evident. However, there is a major difference between mental disorders and mental illness [31]. The use of the term "illness" implies an elaborate etiology in which symptoms arise from a common pathogenic pathway, while the term "mental disorder" refers to a syndromic constellation of symptoms that fit empirically, often for unknown reasons [14,31].

Demonstrating that these psychosomatic symptoms are multifactorial and can lead to greater problems during the course of organic aging [32]. Demonstrating that the care for the reduction of mental disorders must be immediate, always aiming at a better quality of life and healthier habits [31, 33].

The magnitude of these environmental factors and their unequal distribution among the population could provide a unique perspective. Regarding poverty, studies have explored the reversibility of brain changes upon improvements on economic status, unraveling the potential role of relative and absolute poverty and examining how poverty could modulate the underlying biology of mental disorders [3].

Stress from day to day, social and family life, work, financial issues, have been satisfactory bridges to achieve success in correlating with the symptoms of anxiety and also depression, showing how they may intervene in physical and, especially, psychological wellbeing of individuals. Today, mental disorders are being considered as one of the biggest disabling morbidities in the world [1, 34]. Thus, there is a great need for directing attention to these diseases in order to mitigate negative impacts, modeling preventive health actions [15].

IV. FINAL CONSIDERATIONS

Therefore, it's verified that mental disorders don't have simple etiology elucidated. With high global prevalence, being considered a public health problem. It's worth pointing out that in our finding, the highest prevalence was of stress in adult population, however, it was verified in data analysis a linearity in relation to the proportions between adults and the elderly, leading to the understanding that adults with mental disorders tend to be elders with mental disorders. The incentive of healthy habits and a favorable environment for the practice of leisure and social life are responsible factors for the most

effective prevention in order to reduce the morbidity burden of mental disorders.

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Analysis of Correlation between Environmental Factors and Anxiety

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Abstract— *According to the World Health Organization (WHO) the worldwide prevalence of anxiety disorder (AT) is 3.6%. It was estimated that by 2015, 246 million individuals lived with these disorders, which indicates an increase of 14.9% since 2005. Brazil, the country with the highest number of cases of anxiety, with 9.3% of indexes that surpass the neighboring countries. The aim of this study is to analyze the correlation between environmental factors and anxiety among adults aged 20 to 59 years, of both sexes. By means of an analytical and transversal research of descriptive character, with quantitative approach that will be carried out in the city of Vitória da Conquista/BA, in which the sample number was composed of 980 anxious or not. Regarding anxiety and gender, 81.8% of the women said they were anxious, when asked about work 64.1% worked and had anxiety, when asked about tobacco, 11% smoked and are anxious about BMI, 18.4% had low weight, 56.4% were Eutrophic, 19.6% were overweight and 5.6% were obese, and finally, when interviewed about the schooling of those who had anxiety 65.8 % of individuals had incomplete higher education. Checking that anxiety is more prevalent in women and working individuals are more anxious, the variables BMI, smoking, schooling, age, social class, are not significant for the study.*

Keywords— *Anxiety. Environmental Factors. Adults.*

I. INTRODUCTION

In the context of modern society, medicais offices have increased the number of care of individuals with anxiety disorder (1). According to the World Health Organization (WHO), the worldwide prevalence of anxiety disorder (AT) is 3.6%. Estimate that by 2015, 246 million individuals lived with these disorders, which indicates an increase of 14.9% since 2005 (2). Brazil is the country with the highest number of cases of anxiety, with 9.3% of Brazilians, which surpasses the neighboring countries (3).

Anxiety is an emotion considered normal, in response to an adaptive, positive / negative response of the organism against threats or dangers associated with environmental contexts related to reinforcing events (4). Thus, it is a set of physiological, biological, behavioral and cognitive changes that activate brain systems related to the escape / fight system or the cerebral defense system (5).

On the other hand, anxiety becomes pathological only when it ceases to be adaptive, that is, when it is not real or when the period of duration and activation does not match the picture that triggers it, exhibiting a freezing action and the behavior of fight / flight (5,6). From the physiological point of view, activation of the hypothalamic-pituitary-adrenal (HPA) axis is necessary to trigger anxiety (7).

One of the mechanisms for the appearance of anxious symptoms is the amygdala, through the stimuli of punishment or frustration; on the other hand, the activity of the prefrontal cortex is related to the decrease of the anxious symptom, besides, it controls the functionality of the amygdala and acts regulating the anxiety (8). Serotonin, in turn, acts to increase anxiety by regulating defense behavior, where threat warnings would stimulate this system through the amygdala and activate serotonergic neurons and also act as anxiolytic in dorsal periaqueductal gray matter (MCPD) having an adaptive action (5).

Cortisol is released by the adrenal glands through an adrenocorticotrophic hormone (ACTH) stimulus against a threatening situation, and will help promote the mobilization of energy sources of the body to cope with the threatening situation; if the stress is temporary, the hormonal and physiological processes return to normal, otherwise, these will remain increased, which will favor the appearance of anxiety (9). And the inhibition of the GABA receptor (Gamma AminoButyric Acid) helps in the control of neuronal excitability, that is, it acts to reduce excitability and consequently decreases the symptoms related to anxiety (10).

Mental disorders are consequences of exposing the causes of risks, which are established by specific neurais systems, including environmental factors (work, gender, studies) and genetically inherited (8). The International Labor Organization (ILO) and the WHO in the early 2000s predicted an increase in the occurrence of mental health problems and warned of their influence on the working population as a result of the work situation (11).

In this way, the adequate functioning of these systems is important mainly in modern society due to the need of social interactions. Therefore, considering the relevance of research on anxiety correlating them with environmental factors, the need for the study is mainly observed for health professionals.

II.   METHODOLOGY

This is a cross-sectional epidemiological and descriptive study, with a quantitative approach that was carried out in the city of Vitória da Conquista / BA ("latitude: 14º 51 '58" S; "longitude: 40º 50' 22" W) between 2016 and 2018. This study aims to analyze the correlation between environmental factors and anxiety of adults between 20 and 59 years of age, of both sexes. This being a subproject entitled "Epidemiological Profile of Chronic Diseases in the Municipality of Vitória da Conquista / BA".

The sample consisted of 980 individuals in the age group, residents of the city of Vitória da Conquista-BA and / or region. The inclusion criteria were: individuals between 20 and 59 years of age, in which the technique used was the systematic random sampling of individuals with and without anxiety in this municipality and / or region.

This criterion was determined by the Beck Anxiety Inventory (BAI), composed of 21 questions, which measures the intensity of the anxiety symptoms presented in the last weeks (12). They should be evaluated by the subject on a scale of 0 to 3 points, since the sum of the evaluations in the items allows the overall score up to 0-63 points (13).

In addition to this, we used the Elder Abuse questionnaire: A Multinational Prevalence Survey -Abuel on smoking in which the following questions were selected: "Do you smoke? Yes or no; how often? Quit smoking for how long? "(14). Another questionnaire was the socioeconomic one, in which it describes the personal variables of the individuals (age, gender, income, employment, marital status) following the standards of the Brazilian Institute of Geography and Statistics (IBGE) (15).

In relation to the analysis of the nutritional status, it was performed through anthropometric measurements, calculated by the body mass index (BMI) classified according to the World Health Organization (WHO-1995) for adults, which recommends BMI <16 to 18 , 49 (Low Weight) from 18.5 to 24.99 (Eutrophy) 25.0 to 29.99 (Overweight) of> 30.0 (Obesity) (16).

Participants received clarification on the study and signed the Informed Consent Form (TCLE), which contained data pertinent to the ethical and current aspects of the National Health Council (CNS). Statistical analysis was performed using the SPSS (Statistical Package for Social Sciences) version 25.0 using the chi-square test of Pearson. The level of significance was set at <0.05. It should be noted that the project was approved by the Research Ethics Committee of the Faculdade Independente do Nordeste (Opinion No. 1,859,545).

III.   RESULTS

The sample consisted of 980 anxious and non-anxious adults of both sexes. According to table 1, it was observed that 81.8% of the women are anxious and 30.9% of the men do not have anxiety, finding a significance of $p < 0.000$ between the genders. When asked about the work, 64.1% of the individuals worked and suffered from anxiety, compared to 71.5% who worked but did not suffer, demonstrating a significance of $p < 0.053$. Regarding smoking, 11% of people said they were smoking and anxiety, while 20% smoked and had no anxiety ($p < 0.840$).

When analyzing the BMI, it was noticed among the anxious that 18.4% are underweight, 56.4% are eutrophic, 19.6% are overweight and 5.6% are obese. These findings were not significant ($p < 0.263$). Finally, when interviewed about the schooling of those with anxiety, 65.8% of the subjects had incomplete higher education, and 34.2% had already completed higher education ($p < 0.062$).

Table.1: Correlation of anxiety with environmental factors:

Variables		Without		With		p-value
		n	%	n	%	
Genre	Male	177	30,9	38	18,2	0,000
	Female	396	69,1	171	81,8	
works	Yes	409	71,5	134	64,1	0,053
	Not	163	28,5	75	35,9	
Smoking	Yes	26	20,8	11	22,0	0,840
	Not	99	79,2	39	78,0	
BM	Low weight	74	15,0	33	18,4	0,263
	Eutrophic	257	52,1	101	56,4	
	Overweight	124	25,2	35	19,6	
	Obese	38	7,7	10	5,6	
Schooling	Incomplete Supplement	178	56,0	79	65,8	0,062
	Sup. Complete	140	44,0	41	34,2	

Source of Research, 2019

IV. DISCUSSION

It can be seen in Table 1 that the gender that was a significant predictor of anxiety was female, with 81.2%. According to the Diagnostic and Statistical Manual of Mental Disorders (2014), about 55 to 60% of women are diagnosed with anxiety, more frequently than men (17). This result can be explained through biological factors, such as female sex hormones and the overload of demands for women, besides the female being able to express their feelings (18).

The greater motivation for anxiety in women may be due to changes in the endocrine system that occur in the premen- terstrual period, postpartum and menopause, in addition to other factors such as: high rates of violence, economic situation, lifestyle, etc). In a study by Zancan and Habigzang (2018), a very relevant question about anxiety was raised, in which 78% of the women classified as anxious suffered domestic violence; also analyzed the psychopathological symptoms in 17 women in this situation, 94% presented symptoms of anxiety (20).

The present study is ratified by Hiany (2016), Murcho (2016), Souza (2017) who confirmed this prevalence of anxiety versus gender by social and psychological factors (21-23). In addition, women have the mission of educating and providing conditions for the development of their child, which generates concerns and, consequently, anxious symptoms (24).

According to table 1, it was found that the working individuals were more anxious (p <0.053). Competitiveness in the labor market in the face of fear of unemployment are frequent problems that interfere with the mental health of the individual, such as anxiety;

Brazilian studies have reported anxiety disorders as one of the prevalent causes of work leave (1). Other studies show that psychological problems in 2008 were the third most common cause of work-related withdrawal, with 10.7% referring to sickness claims and 8.5% to work-related problems (25).

On the other hand, for Araújo (2018) the most unemployed individuals are in a worrisome condition and, therefore, anxious (26). This can be explained by the lack of self-realizations and dissatisfactions due to the absence of leisure activities (27). The development of anxiety disorder has a higher prevalence in health workers, as they undergo stressful events, face fear, conflicts, coexistence with death, and long working hours (28).

Smoking is an aggregate practice that not only worsens health status, but also interferes with the psychological health of smokers, since there is already a corroborating evidence of the direct relationship between smoking and mental disorders, which include anxiety (29). However, the present article does not agree with these findings, since according to table 1 there was no relation between smoking and anxiety, not showing any significance (p <840).

In addition, there is evidence that depressed smokers are more stimulated to smoke in order to ameliorate negative feelings such as anxiety (30). And other studies prove that nicotine present in tobacco can act stimulatingly when at a low level of activation, and also as a tranquilizer when at high levels of activation, for example, when they are anxious. This relationship occurs through the activation of acetylcholine-nicpinic receptors

in brain cells that are capable of producing relaxation sensation (31).

When it came to the body mass index (BMI), it was verified that there is no correlation between obesity and anxiety, and therefore, it does not present any significance (p <0.263), ie, anxiety does not induce the individual to eat more Table 1). However, according to Hamdan (2017), obesity has been related to anxiety, which can be determined as a body state marked by psychological symptoms, since they influence people to eat even without hunger (32).

Obesity and overweight are classified as an abnormal or excessive accumulation of fat that can lead to health complications, in which psychopathological factors may be the cause of these problems; some evidence shows that anxiety along with depression is more frequent in obese people (29). This study corroborates with Correa (2018), reporting that obesity is associated with mental disorders, and one of the reasons for this is the pattern of beauty imposed by society, causing a fall in the self-esteem of the overweight individual and psychological stress (33).

Finally, according to table 1, schooling was also not relevant to the study (p <0.062), that is, whether or not it is university does not induce the individual to be anxious. However, according to Wahed et al. (2016), psychological health issues are constantly growing in universities, where 60% of university students are unable to complete their studies due to psychological problems such as anxiety and depression (34).

Some studies report that university students, especially in the health area, are more anxious and stressed, which causes damage to quality of life and professional performance (35). Therefore, these findings do not correspond to the results of this research.

V.   FINAL CONSIDERATIONS

Considering the findings of the research, it is possible to verify that anxiety is more prevalent in women compared to men. This can be attributed to the ease of women to demonstrate their feelings, as well as to face the social roles through society. Another factor that has been shown to influence anxiety is work, that is, working individuals are more anxious than the unemployed, this can be due to the concerns, obligations and activities that must be fulfilled.

Regarding the Nutritional Status that was evaluated by BMI, there was no significance, showing that anxiety has no influence on obesity, the anxious individual does not tend to eat more. And the variables smoking and schooling were not related to anxiety, which did not corroborate with the majority of the studies surveyed. Thus, it is necessary to emphasize the importance of this

study to the health areas, so that professionals can diagnose anxiety and treat it correctly.

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Physical-Chemical and Microbiological Evaluation from Domiciliary Reservoirs

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Abstract— *The main constituent of all living being is water, however the threats caused by the improper actions of human beings to this liquid of great importance evidence losses to the humanity, knowing soon the interference of several procedures applied on the water treatment and their influence on the final quality of the product, the present study was executed to verify the influence of the domestic reservoirs on the physical chemical and microbiological properties of the water used for human consumption in the city of Barra do Choça, by means of collections at strategic points for the accomplishment of the aforementioned analyzes, with emphasis on the detection of possible changes caused by incorrect storage. The physical and chemical parameters analyzed were: electrical conductivity, hydrogen potential (hP), turbidity, alkalinity, fluorine, iron and chlorine. The microorganisms analyzed were E. coli, fecal and total coliforms and heterotrophic, recommended by APHA based on the standard methods for the examination of (the) water and wastewater 22nd ed. The data obtained were compared to the values established by Ordinance No. 2914/11. Thus, a descriptive analysis was accomplished and the method of Cluster was applied, that shows an arrangement of the groups that have similarity and in the found results demonstrate discrepancy in the results of Fluorine and electrical conductivity, by having (tendo) as relevance that in the most of the applied parameters are within the accepted normality, in relation to microbiological analysis shows that 33% of the water in the reservoir is out of the standard and that in 50% of the reservoirs the contamination by heterotrophic bacterium, demonstrating that the reservoir without its correct applications is a deteriorating factor of water quality.*

Keywords— *water quality, home reservoir, physical and chemical aspects, microbiological.*

I. INTRODUCTION

Water is the most important substance in nature, depending on it all the forms of life, by being essential for the maintenance of life on earth. For a long time, it has been a key point of the main discussions related to its utilization and by being scarce (Cunha et al, 2010). We temporally understand that water is a colorless, tasteless and odorless liquid besides being the natural liquid that is most part of our daily lives.

For being a universal liquid, it has great importance for living beings, in this way the water needs to be potable and with sufficient quantity to meet the demand of the population (Pereira, 2010). Its properties are related to the crucial needs of the individuals, from the composition of liquids and tissues to the functions prosecuted in metabolic and reproductive activities (Silva et al, 2014).

However, the misuse of water as well as the population increase that according to UNESCO (2012) it is estimated that the world urban population will increase significantly from 3,4 to 6,3 billion people between 2009 and 2050 (Lopes et al, 2014) it has been allowing the reduction of available water resources, by resulting in shortage, since the most part of this good is improper for consumption, 95,1% is salt, 4,7% of glaciers and only 0,147% suitable for consumption (Navarr0 et al, 2014; Barreto &Bitar, 2011).

Moreover, accessible water for human consumption has been becoming inadequate due to pollution that is considered as any peculiar change that occurs in the environment that affects the existence of ecosystems. It occurs by anthropogenic pollution or by natural phenomena such as eruption and it presents a wide range of pollutants.

It is notorious the preoccupation of all countries related to the monitoring of the water destined to the consumption of the society seeking out its quality (Schwarzenbach, R. P. et al, 2010). For suppling the daily demand forwater reservoirs have been used, especially in urban areas due to the exchanges in its supply. It is worth pointing out that the reservoirs must ensure the quality of thedaily required water, but for this it is necessary sanitation with an appropriate frequency.

The absence of minimal care with hygiene and maintenance of specific containers, in other words, the lack of cleaning of the homereservoirsoffer risks to the health of the population, since diseases may be transmitted. In this direction, it is important to explain that the properties of water depend on the purpose to which it refers (Terpstra, P et al, 1998). Therefore, for the preservation of health, it is defined by the competent bodies parameters of potability. Such standards establish the elements that can be tolerated in public water supply as well as their limits. In Brazil, these standards were defined by the Ministry of Health through Ordinance nº 2914 of December 2011.

Some measures are essential to maintain water quality, among them the effectiveness of all phases of the water treatment stationby including the family reservation (Drewes, J. E, Fox P. 2000). By evidencing that all the care in the water distribution network for the achievement of aquality water will be insignificant if the product stock has been improperly executed.

Towards the imminent contamination of water by human waste (Mattioda et al., 2010/ SILVA. Et. al, 2010), the water quality monitoring is recommended through the use of microbiological variables that test the presence of total and fecal coliforms, Enteroccoci and Escherichia coli, as positive, it proves that the water is contaminated with feces and, consequentlyit indicates the probability of propagating waterborne diseases (Vasconcellos, 2006). Byemphasizing that considers the presence of Escherichiacoli an essential indicator for proofing impurities and recent pollution.

Physical and chemical analyzes allow to identify if the water is at ideal levels that are not harmful to the human health and the ecosystem. Through the resolutions and ordinances in force, it is possible to make the comparatives and determine if the samples collected are within the standards stipulated for good quality of water. All the collections are done by respecting analytical techniques of high precision and sensitivity (Parron, 2011).

For measuring the chemical and physical and microbiological characteristics of water, some methodologies elaborated by the American Public Health Association (APHA) are used. Thus, some parameters that determine its potability are required, such as turbidity, temperature, electrical conductivity, hP and dissolved oxygen (Ministry Of Health, 2006).

In order to evaluate the data, it has been useful multivariate statistics with the Analysis of Cluster, which are widely used in water quality monitoring data (Fernandes et al, 2010; Tanrived & Dermikiran et al, 2010; Guedes et al. This kind of analysis reduces the observational data and allows the interpretation of several components individually, because it may indicate associations between simples and / or variables, besides allowing the identification of possible factors and sources that have influenced the water system (Lopes et al, 2014; Bouzadeano et al, 2018; Palácio et al, 2011; Guedes et al, 2012; Varol et al, 2012).

In this sense, the purpose of this work is to evaluate the physical and chemical and microbiological parameters of domestic reservoirs of water have used for human consumption and the possible impacts on human health of the population of Barra do Choça – Ba.

II.   METODOLOGY
PLACE OF STUDY

The research was conducted in the region of Barra do Choça, located in Bahia where the water is transferred from Serra Preta and Biquinha dam located in this city, by serving as a supply zone for other regions and, in general, for the supply of water for residential, agricultural and industrial uses, in which common activities related to human consumption are involved, such as, among others: consumption itself, use for hygiene and preparation of food after treatment.

TYPE OF STUDY

The methods to be used for the research project allow to evidence a qualitative and quantitative approach, whichsearchfor making a subjective analysis for a comprehension of the problem to be debated. By making use of a numerical presentation through statistical analysis through field research.

DATA COLLECTIONS

The collections consisted of a sampling of tap water in randomly selected houses in different

neighborhoods. The points of water collection were determined by the overlap of the city map of Barra do Choça with those ones of the water reservoirs presented by Embasa, the points were selected by taking into account the low and high distribution zones, the location of the treatment unit water and the interferences of the tubings in the quality of the water distributed. It sought the choice of 3 strategically located points, one in the near, intermediate and the other distant, in order to represent a significant sample of the water distributed to the population.

At each point, 6 samples were collected, 2 of each residence coming from the public faucet (Group 1 - control) and another from the faucet previously disinfected with alcohol 70% from the home reservoir (Group 2). The choice of residence has depended on its location and the existence of a home reservoir.

However, the samples destined to the studies for physical and chemical analysis were placed in polyethylene flasks with one liter and a half of capacity and for microbiological analysis in 100 ml plastic bottles properly sterilized and sealed with 0.1 ml of sodium

thiosulphate for neutralizingthe residual chlorine present in the water, according to the literature, they were sealed and packed in styrofoam boxes and taken immediately to the FAINOR chemistry laboratory and the microbiological were taken to the UESB Control and Quality Laboratory. The methods (physical and chemical and microbiological) used in this work are all recommended by the American Public Health Association (Apha, 1998).

STUDY OF VARIABLES

Physical and chemical and microbiological determinations were performed because from the water conveyance and by following the assumptions of current legislation, such as Ordinance MS Nº. 2,914 and MS Decree Nº. 1,469, the water to be consumed cannot offer health risks, and it is necessary to perform procedures concerned to the quality monitoring thereby to ensure the necessary potability.

PHYSICAL AND CHEMICAL DETERMINATIONS

Table 1: Physical and chemical determinations and description of the method used.

DeterminationofhP	The h of the samples was determined by direct reading on a QUIMIS Q400AS benchtop hP meter.
Determination of turbidity	To determine the turbidity, a microprocessor turbidimeter Q279P from QUIMIS was used. Turbiditywasobtainedby direct reading in uT.
Determinationof Alkalinity	The method used was titration with H2SO4 0,2 N and orange methyl as indicator and 1 drop of sodium thiosulfate to neutralize the chlorine.
Determination of fluorine content	The fluorine present in the samples was determined by the SPADNS method with the aid of a Colorimeter.
Determination of free and total residual chlorine content	Following literature data the analysis of free residual chlorine content was performed by reaction with orthotolidine and reading in portable colorimeter (DLH-2000, Dellab).
Determination of iron content	The iron content in the sample was determined by the ortho-phenanthroline method using a Colorimeter.

Source: Own research (2018/2019)

MICROBIOLOGICAL DETERMINATIONS

For determinations of the microbiological analyzes was based on the multitube method, a very useful technique to evaluate total and fecal coliforms and Escherichia coli, by being also known as Probable Number Method (Greghi, 2005; Rattiet al., 2011).

The technique is based on homogenizing aliquots of the product after its dilution and by transferring into test tubes containing lauryl tryptose culture medium and the inverted Durham tube, after that they are incubated, and thereafter, the positive tubes are identified by turbidity of the production of gas in the Durham tube, by the number of positive tubes in the used dilutions, the

NMP is determined, based on the statistical tables have known as the Hoskins table (Apha, 1998).

This method is widely used as a standard, since it is recommended by health surveillance, Funasa and other regulatory agencies. Therefore, the multiple tube method was done in two parts: firstly, a presumptive test in which the sample was used with lauryl tryptose broth,thatis a rich and specific medium for bacterium of the coliform group that is able to cause a turbidity in the medium and by forming gases, which is easily detectable by the Durham tube within 24/48 hours by incubation for $\pm$ 35 ° C (Brazil, 2013; Rattiet al., 2011).

The second stage is realized a confirmatory test by using small amounts of the positive stocks Bile bright green stocks selective 2% for Escherichia coli, by being incubated at 44.5 ° C for 24 hours, by being the turbidity of the Escherichia broth coli in gas by forming tubes if positive for fecal coliforms.

The counting of heterotrophic bacteria was also performed because it is useful in assessing the integrity of the water distributionsystem and home reservoirs, however, it has transferred 1 ml of the sample to a petri dish, added the medium culture, homogenized the contents of the board in circular movements for 10 consecutive times, and after the solidification of the medium, it has incubated the board in an inverted position at 35 ºC, for 48 hours, after that performed the reading by making the counting of the colonies.

DATA ANALYSIS

For the interpretation of the research results, a qualitative and quantitative analysis was performed through a spreadsheet in Excel version 2016, in which a descriptive analysis (mean and standard deviation) of the physical and chemical variables was initially performed. Then, the Analisys of Cluster was performed in SPSS version 25, that is useful for verifying the similarities of the points, demonstrated through groupings in the dendrogram.

The Analisys of Cluster has the purpose of comparing results by joining homogeneous or heterogeneous groups by using for that classification criteria. It should be noted that several types of grouping methods are found in the literature and they are classified into hierarchical and nonhierarchical in what the researcher must determine which is the most appropriate to their design, since the different types of existing techniques direct to different solutions. (Ablbuquerque, M.A. et al., 2006).

For obtaining an agglomeration technique opts for a specific method. In this work the Ward method will be used for the hierarchical agglomeration that is characterized by stipulating a hierarchy or structure in a form of a tree, in which the results will gather by associations, by resulting in a graphic reproduction called dendrogram, in which the similar ones, according to the studied variables, are grouped together (entre si) (Seidel, E.J et al, 2008).

III.   RESULTS AND DISCUSSION

Based on the statistical analysis performed, it is noted that there was considerable divergence among the three collection points delimited in the sector, and there is interference in the quality of the water from the water pipe. Thus, the results in table 1 show that all parameters presented significant variability, by being more prominent in group A (home reservoir), with exception of the free chlorine variable that has showed more accentuatedin group B (public water systemdistribution).

Table 2. Descriptive statistics of the physical and chemical variables of water samples from taps connected to the domestic reservoirs (A) and directly from the water system distribution (B)

Group	Variable	Media	Standard Deviation	Mínimum	Maximum
A	pH	6,628	0,32424	6,19	7,24
	Turbidity	0,6306	0,38519	0,02	1,16
	conductivity	146,19	12,1634	128,8	175,4
	Alkalinity	22,489	5,416117	16	34
	Freechlorine	0,2939	0,04165	0,22	0,36
	Total chlorine	0,335	0,06229	0,22	0,47
	Fluorine	1,0725	0,77495	0	2
	Iron	0,07846	0,07177	0	0,24
	Iron II	0,00167	0,00373	0	0,01
	Iron III	0,077	0,07616	0,01	0,24
B	pH	6,45353	0,14392	5,97	6,87
	Turbidity	0,81118	0,109068	0,54	2,09
	condutivity	149,38	5,975988	139,8	158,6
	Alkalinity	19,1444	3,133905	16	26
	Freechlorine	0,39722	0,14548	0,12	0,61
	Total chlorine	0,57647	0,06542	0,18	0,82
	Fluorine	1,22167	0,22822	0,21	2
	Iron	0,04571	0,008165	0,01	0,14

Iron II	0,00455	0,004714	0	0,15
Iron III	0,03824	0,025218	0,01	0,15

Source: Own research (2018/2019)

Afterwards, the Analysis of Cluster was performed to verify the influence, connection and dissimilarity that one parameter has with another one. The values of hP, electrical conductivity, turbidity, alkalinity and the contents of free chlorine, total chlorine, fluorine, iron, iron II and iron III, measured according to the methodology, wereprocessed by using the grouping method of Ward.

Previously, the values of the aforementioned variables were normalized by means of Z-scores transformation, in order to have a more homogeneous distribution with the same weight. In the initial matrix, the similarity coefficients represent the degree of analogy among the samples, causing a hierarchical arranging, through groupings ordered according to the respective degrees of similarity. (Santos, J. S; Souza, F.M; Santos, M.L.P, 2013)
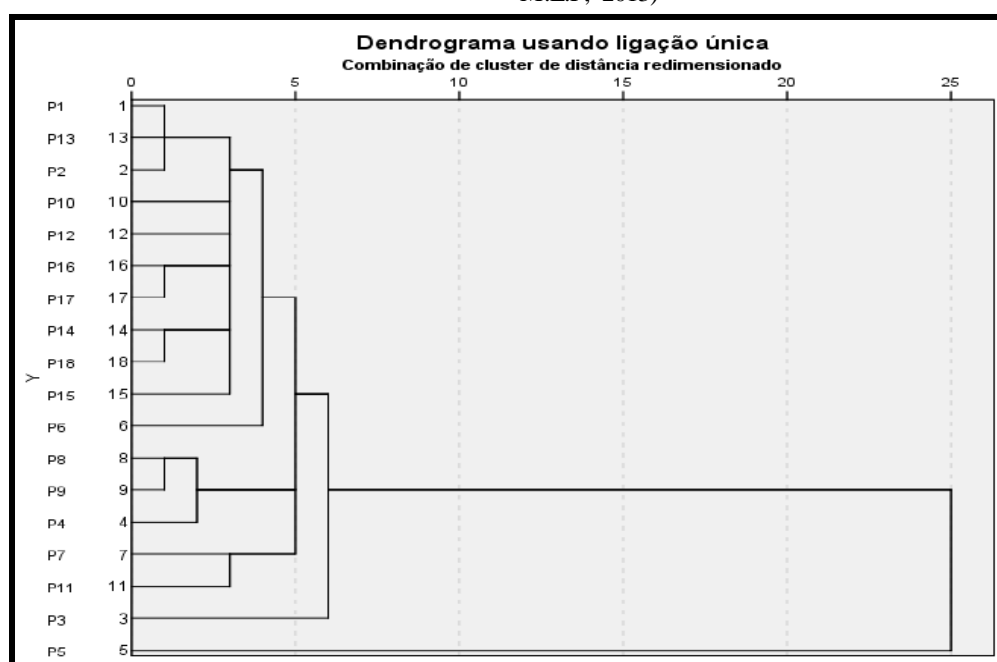
Fig.1: Dendrogram of the Analysis of Cluster grouped by the results of the water samples collected in the domestic reservoirs.

Source: SPSS program version 25.

In the dendrogram of Figure 1, the physical and chemical variables of the collected water grouped distinctly on alevelof distance by 25. Then, it is observed a larger grouping of points P1, P2, P2, P12, P16, P17, P14, P18 and P15 which, except for points 1 and 2, are characterized by being located in the lower part zone of the city that represents the intermediate zone, and the points P6, P8, P9, P4, P7, P11, P3 and P5, with the exception of point 11 constitute the zone nearer and farthest from Embasa and is located in the high zone of the city.

This grouping is explained by the similarity of the samples collected at the intermediate points that are located in the lowest zone of the city, as well as those ones that are at the highest points, because first the water distribution system fills the lower zone,and as this tube is

filled it fills the highest zone of the city which is represented by the farthest points from Embasa and finally the closest points from Embasa.

However, it is possible to verify the existence of possible problems in the distribution and this may be due to the type of water distribution system presented, formation of incrustations in the pipe, type of reservoir used and their influence in the conservation and maintenance of the water received. By emphasizing that the water for domestic supply usually passes through water treatment plants in order to make it suitable for human consumption, however, in spite of the treatment received the water that arrives in the residences can suffer pertinent contaminationsthere is distribution and an expropriated storage in the reservoirs (Bom, 2002).

Soon, not at least, the water distribution system helps on the final stage of a water supply system, by forming the tubing that transports the water to the homes. Having as priority to move the water that has passed through the treatment to the reservoirs and taps byensuring its potability. Thus, according to the arrangement of the main conduits, two types of water distribution system can be basically defined: branched one and spotted one (Brazil, 2006).

The type of water distribution system presented in this work is the branched one that presents as main limitations to its use the almost complete shutdown of almost all of the supply during possible maintenance of the main conduits and also by the significant reduction of residual chlorine concentrations at the ends of the water distribution system.

This is noticeable in the dendogram, since it shows the greater grouping of the low zone, thus demonstrating the similarity between the points since they have pertinent characteristics to the group where the distribution for these points is firstly made, after that the distribution is directed to the high zone that is distributed between the farthest points from the Embasa and the nearest oneby showing a dissimilarity and between the same, that is, groupings more distant from each other.

Among the mentioned complications we have the home reservoirs that may be a deteriorating agent of the water quality distributed to the community, as there is no sanitary process every six months or whenever there is a suspicion of contamination (Lima, 1978; Ministry Of Health, 2016). And also, the time that this water remains stored, that is, the time of detention in the reservoirs can favor the growth of bacterium and in chlorinated waters can represent a fall of residual chlorine (oxidizing agent) by favoring the nitrification (Brazil, 2006).

Conniving with the factors have already mentioned, the reduction of chlorine can alter the quality of the water stored as a result of the contact of the water with the concrete of the walls of the reservoirs, and this is done through the different concentrations of calcium carbonate in the water and the contact surface of the wall of the home reservoir, by statinga deterioration of the concrete, which that causes the formation of a rough surface that favors the adhesion of pathogenic microorganisms and other ones, besides compromising their structure. In this question, points 3 and 5 stand out because the reservoir used is made by concrete, not having similarity to the other ones, by showing through the dendogram a greater distancing compared to the other ones arriving at a distance level 25, the same occurs for the point 11 that although it is from the low zone, does not group the same ones, by having as similarity the same reason of the aforementioned points.

However, through the results obtained in relation to the physical and chemical parameters indicate that most of the collected water is in compliance with the current legislations, except for the fluorine parameters and conductivity that have shown outside of the values standardizedby Ordinance Nº. 2.914 / 11 and Ordinance Nº 518/2004.
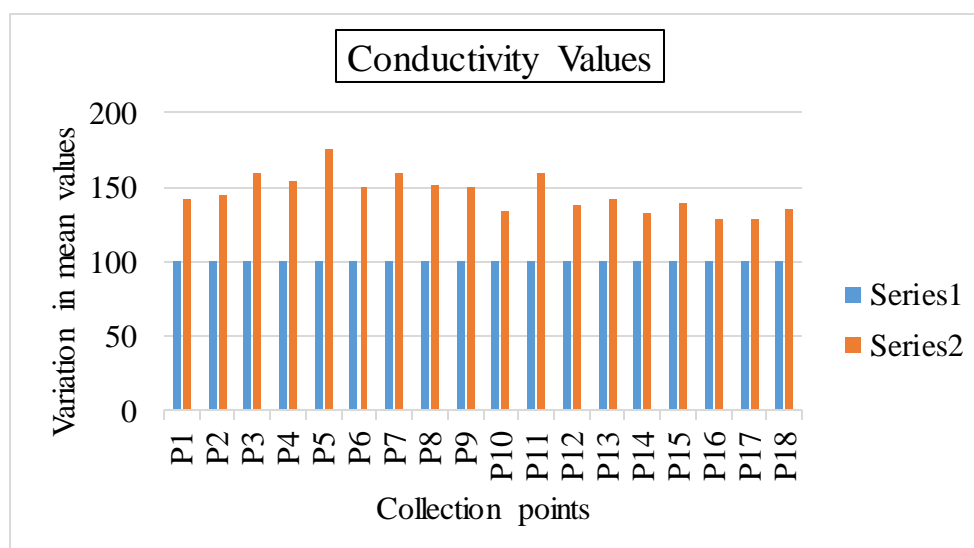
Graph 1: Demonstrating the variations of the electrical conductivity parameter, acceptedvalues (series 1) found values (series 2) in the domestic reservoirs.

According to Santos (2016) the presence of dissolved substances that dissociate it in cations and anions determine the electrical conductivity in the water, by developing the capacity of the water of transmitting electric current. The values indicated to determine the electrical conductivity are above 100 uS / cm, allowed limit, however, according to Sardinha (2008) from the conductivity we obtain information about decomposition (increases the conductivity) and about the primary production (reduces the conductivity), by showing a greater accentuation in points 3, 5, 7 and 11, by emphasizing once again how concrete tanks have a negative influence on water quality.
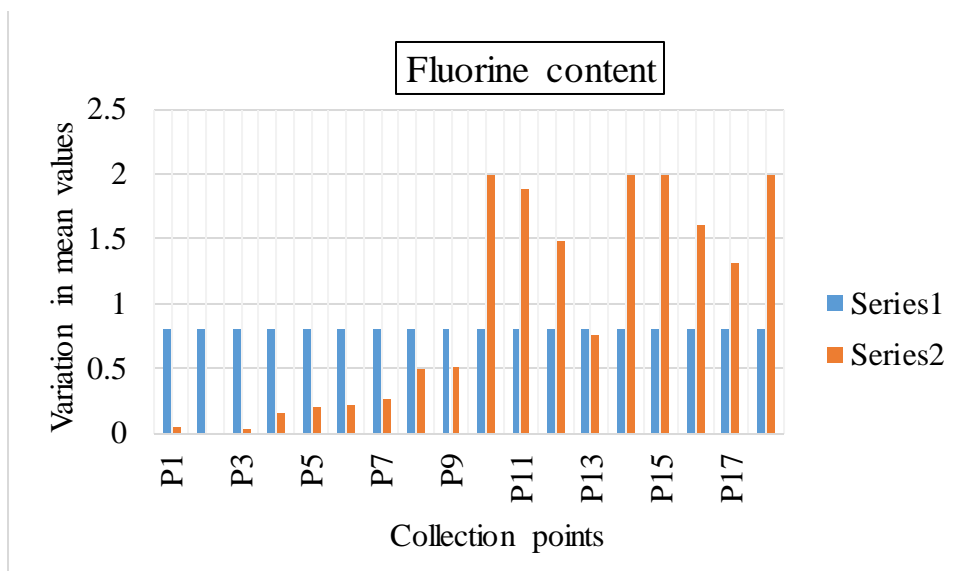
Graph 2: Demonstrating variations in fluorine content, ideal values (Series 1), values found values (series 2) of the home reservoirs.

Fluorine has efficiency in the decline of dental caries, which justifies the importance of additioning it in public water supply, by being employed in Brazil for more than 50 years (Brito et al., 2016). Therefore, considering the climatic characteristics, fluorine concentrations should be appliedin order to ensure the maximum benefit of caries prevention and the minimum risk of doserelated toxicity this onemay trigger offserious health problems such as dental and skeletal fluorosis, reversible gastric disorders and temporary reduction of urinary capacity (Funasa, 2012).
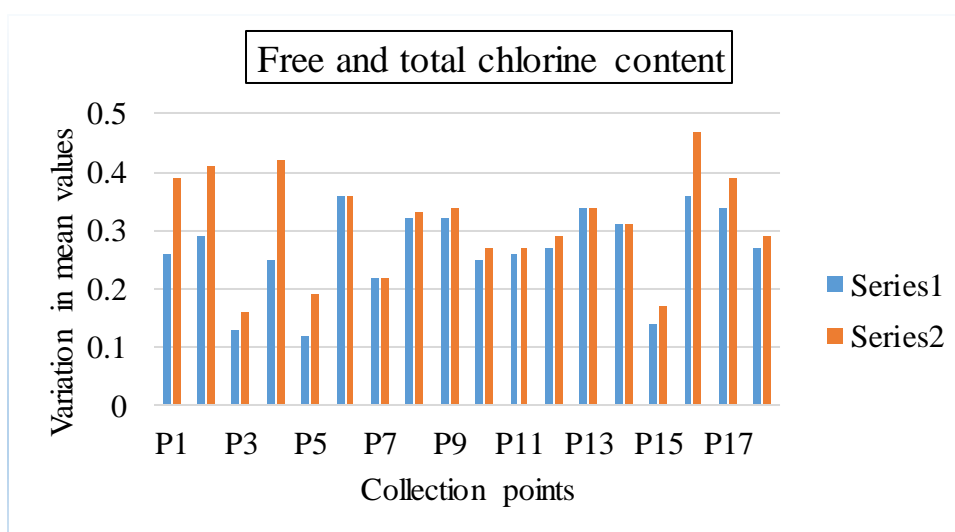
However, it is emphasized that the minimum and maximum allowed values set outin Ordinance MS N° 2,914 / 11, related to fluorine, are 0.5 to 1.5 mg / L, and the ideal for the average daily maximum temperature of city from 21.5 to 26.3 is 0.8. Proving this way that most of the collection points are outside of the established limits, where the high zone is characterized by very low values and may present dental caries outbreaks, and the lower zone presentsmostly values above 1.5, which can lead to severe health problems severe as there is a significant difference between the points suggests that this may be due to the interference in the turbing and the type of water distribution system (fish scale), that characterizes changes in the concentrations of the extremities of the water distribution systems.

Still on the parameters it should be noted that the content of free and total chlorine was mostlywithin quality standards that stablish 0.2 mg / L as the minimum concentration, since it placesdata that put on 83.3% of the water samples from the reservoirs within the proposed minimum limit, as shown in figure.

The chlorination technique is very efficient for the microbiological control, because it is based on eliminationing of the bacterial cells through the oxidation of the free sulfhydrylgroups. Thus, the inadequacy of chlorine levels observed in 16.7% of the samples of group A, thus representing a potential risk for consumer health. In the case of the samples of group B all fit on the potability standard.

Table 3: Distribution of chlorine parameter of the water samples collected from the taps connected to the domestic reservoirs (A) and directly to the water distribution system (B).

Sample				
Chlorine	AbsoluteFrequency (n)		RelativeFrequency (%)	
	A	B	A	B
Down	3	0	16,7	0
Standard	15	18	83,3	100
Total	18	18	100	100

Source: Own research (2018/2019)

In Table 3, there is a demonstration of the absolute and relative frequency arrangement of the samples of groups (A, B) which are in accordance with the established microbiological quality standard and those ones that are out of standard (Brasil, 2004 Apha, 1998). It is noticeable that 33.3% of the samples of the domestic

reservoirs are not within the microbiological standard, that is, it contains total coliforms, noting that 27.8% represents the highzone of the city, in contrast to the samples from the group B, it was not observed presence of total coliforms, by presenting significative dissimilarity that indicates microbiological contamination of the water stored in the domestic reservoirs.

Table 4: Distribution of the total coliform frequency of the water samples collected from the taps connected to the domestic reservoirs (A) and directly in the public watersystem (B).

Sample				
Total coliforms	AbsoluteFrequency (n)		RelativeFrequency (%)	
	A	B	A	B
Standard	12	18	66,7	100
Out of	6	0	33,3	0
Total	18	18	100	100

Source: Own research (2018/2019)

However, the found results agree with Campos, J.A.D.B et.al; Genthe et.al that through the research have verified the absence of bacterium in the water distribution system, and the samples of the domestic reservoir with a significant deterioration, by presenting values higher than those ones allowed by the potability standard.

Ministry of Health Ordinance 2,914 / 11 determinesthat heterotrophic bacterium counts should be

performed for measuring the integrity of the water distribution system (reservoir and system), and therefore it was indispensable its analysis in which the presence of heterotrophic bacterium were found in 50% of the reservoirs, thus demonstrating that it has its compromised integrity.

However, it knows that the water intended for human consumption has a significant number of coliforms

and heterotrophic bacterium by indicating that the treatment has not been effective or that there is contamination in the water distribution system and storage. (Mcdaniels, A. E. et al.) In this case, byanalyzing the results it was verified that in the control group (B) there is no imminence of contamination, so it is notorious that the storage is the deteriorating agent of water quality.

IV. CONCLUSION

Targeting an ideal scenario, cities that offer a water distribution system should provide for the population a good water quality and that one is in accordance with the legislation. It is known that physical and chemical and microbiological parameters are a great ally in waterquality warranty, so it is necessary that they are in accordance with the potability standards recommended by Ministry of Health Ordinance N°. 2,914 / 11, after all whenever that involves the health of the population in general, it demands responsibilities by responsible organs.

Therefore, the results obtained show that the physical and chemical parameters analyzed are within the minimum and maximum values allowed by Ministry of Health Ordinance No. 2,914 / 11, by indicating that the water collected, treated and offered by the municipal water distribution system of the city of Barra do Choça – BA is of good quality based on the portrayed analyzes, not causing health risk but in the domestic reservoirs is a deteriorating factor of the quality of the water stored in it as can be verified by observing the contents of chlorine, fluorine and electrical conductivity, besides the presence of total coliforms in some points collected and the contamination in 50% of the reservoirs by heterotrophic bacterium.

It was also observed faults in the water distribution system because it is characterized as a fishbone system and it was observed a decrease in the values of the parameters used at the extremities of the system (high zone), a factor that justifies the formation of groupings in the dendogram, besides demonstrating a greaterburden of bacterial infection at the higher zone of the city in whichfrom 33.3% of the contaminated reservoirs only 5.5% is at the low zone.

In view of this, corrective measures are necessary in order to ensure the health of the population. However, in order to warranty that the water maintains its properties, it is important to explain that they do not depend only on the treatment phases offered by EMBASA, but as how the way the wateris collected and if the reservoirs receive the due care as hygiene semiannually. Therefore, it is explained that it is indispensable to alert the population about the function of the reservoir and the importance of hygiene and its utility

in maintaining the quality of water intended for human consumption to the health promotion.

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Study of the Prevalence of Helminths and Protozoa in Fruits marketed in Street Markets in a City insideof Bahia

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Abstract— Parasitoses in Brazil represents a serious public health problem, by affecting mainly the poorest population, with little access to education and basic sanitation. It is estimated that millions of people around the world are afflicted with parasitic infections from eating contaminated food. The present study had as objective to evaluate the presence of helminths and protozoa in fruits marketed in open fairs in Vitória da Conquista-Ba. Forty samples were analyzed, by including guava, lemon, apple and grape, by the method of spontaneous sedimentation Hoffman, Pons and Janer (1934). The results showed that 70% of the fruits presented positivity for some type (kind) of parasite, with guava being the most contaminated fruit (90%). The highest prevalence was of helminths (Ascaris lumbicoides (n = 92), Ancylostomideo (n = 18), Taenia sp (n = 8) and Enterobius vermiculaes (n = 2), followed by protozoa (Balantidium coli, Entamoeba coli (n = 11) .The high frequency is associated to the inadequate handling of these fruits, as well as to the inefficiency of the sanitary conditions of the commercialization place, by recommending measures of sanitary education from the merchants and the population consumers.
Keywords— Parasites. Basic sanitation. Infections. Contamination.

I. INTRODUCTION

Parasitoses are infections presents all over the world, by representing a serious public health problem, with higher incidence in poorer communities and unfavorable financial conditions. By contaminating human beings, parasites can cause several health hazards, which can cause significant complications such as malnutrition, severe anemia, intestinal problems, delayed growth, lack of some vitamins, and other ones (Bastien M, Vaniscotte A. et al.). Data from the World Health Organization (WHO) show that more than 1.5 million people have somekindof intestinal parasite, which represents 24% of the world population, with some kind of intestinal parasite (Sales; Nichi, et al. 2017)

Several factors are associated with enteroparasites contamination by including socioeconomic and sociocultural factors, with emphasis in deficient sanitary conditions, bad hygiene habits, improper handling of foods (fruits, vegetables and veggies), which rang from the lack of sanitation of these ones beforeconsumption such as the lack of accessingby potable and / or treated water. The presence of these pathogens may also be associated with the food production process and / or the care of the food handler (Moreira; Cruz; et al, 2017). Education is also another important factor, since people with less knowledge are the ones most affected by parasitic diseases (Hengami M, Hamed Y et al 2018).

Fruits and vegetables are among the foods listed by the Ministry of Health as responsible for the transmission of foodborne diseases, which cause innumerable outbreakscaused by the consumption of fruits, seeds and nuts and vegetables (Ministério Da Saúde, 2010).This way, the WHO (World Health Organization) has listed fruits and vegetables, among other foods as possible sources of disease transmission,

caused by fungi, viruses, bacterium and parasites (BrasiL, 2010b).

Foodborne diseases occur through the ingestion of foods or liquids that have been contaminated with some kind of pathogenic microorganism, which mostly leads to enteric problems for those ones who consume these kind of foods (Allende, Bolton, D. et al.). About 250 kinds of foodborne diseases are responsible for generating public health problems, by causing frequent outbreaks in the population. In this way, the importance of the care with the manipulation of food is underlying, in order to warranty food security (Melo, 2018).

Fruits are foods rich in vitamins and minerals, which provide innumerable health benefits to those ones who consume them. Due to the increasing incentive to a healthy and balanced diet, fruit consumption has been increasing every day (Punsawad, C, Phasuk, N et al, 2018). The facilityon the preparation of these foods whichare consumed in most of time in their raw form is another factor that contributes to the appearance of enteroparasite infections (Andrade; Teodoro et al., 2017). However, despite this, studies directed to the investigation of fruits as vehicles for transmission of parasites are still limited. Thus, it is necessaryto investigate the presence of enteroparasites in these foods, in order to contribute to the scientific knowledge about enteroparasitoses, as well as to collaborate for the adoption of sanitary education measures about the possible risks and the appropriate ways of preventing transmission of these agents.

By considering the importance of this problem, this study aims to identify the prevalence of eggs and larvae of helminths and protozoa cistys present in fruits marketed in street markets of Vitória da Conquista-BA, by presenting the impact that their presence may cause to health of the population.

II. METHODOLOGY

The study has been conducted in the city of Vitória da Conquista-BA from October 2018 to December 2018, where samples of the following species were collected: guava (Psidium guajava), lemon (Citrus limon), apple (Malussilvestres) and grape Vitisvinifera). The samples were obtained through the purchase in two street markets located in this city, where in each street market five samples of each species of fruit were collected, thus totaling 40 samples evaluated. The choice for analysis of these ones was due to the facility of finding them in the street markets and because they are fruits very marketed in this region.

The samples were evaluated by means through the spontaneous sedimentation method Hoffman, Pons and Janer (1934), in charge of identifying eggs and larvae of helminths, cysts and protozoa cysts (Rey, 2001),which besides good effectiveness also presents a good relation cost benefit.

The fruits were collected and stored in clean and new plastic bagsfor avoiding contamination, then they were sent to the parasitology laboratory of the Faculdade Independente do Nordeste (FAINOR), where the analyzes were performed.

The beakers and conical chalices used in the process of analysis were washed by using detergent and running water, then it was done alcohol asepsis 70%, and they were washed with distilled water and dried by room temperature. Each fruit was individually placed in 100 ml glass beakers and washed with 30 ml of distilled water.

By adding a soft bristle brush, a careful washing of each fruit was done, bypassing the brush over its surface for five minutes in circular movements. After that the fruits were submerged in the distilled water for 10 minutes and soon after the washing liquid was distributed in conical chalices.

The calyces were capped for avoiding contamination and left for 24 hours for spontaneous sedimentation of the material to be analyzed from the liquid. After this time, the supernatant was discarded and an aliquot of the sediment was placed on the sheetstained with lugol for visualization by a microscope.

The optical microscopy was used to read the sediment, that was done in triplicate with 10x and 40x objective, by allowing the identification of parasitic structures. All the results obtained through the optical reading were annotated and later used for the production of tables, thus facilitating their demonstration and understandingof these ones. Emphasizing that the confidentiality of the sampling places has been preserved.

III. RESULTS AND DISCUSSION

The present study has analyzed the presence of parasites in fruits: guava (Psidium guajava), lemon (Citrus limon), apple (Malussilvestres) and grape (Vitisvinifera) obtained through random purchase in two distinct fairs at the city of Vitória da Conquista -Ba, by totaling 40 samples evaluated. The results showed that 70% (n = 28) presented positivity for some kind of parasite, byrevealing a high percentage of contamination as compared to the study by Bozzetti et al. (2013), that also evaluated the presence of parasites in fruits collected at fairs , supermarkets and slaughterhouses and it has identified 14.5% of positivity on the samples analyzed.

The prevalence of parasites in foods from plant origin and they are consumed, most often in theirin natura form, it makes an object of study withgreat relevance, since the ingestion of contaminated food by helminths and

protozoa is one of the main forms of transmission of enteroparasitoses (Neres, 2011). Pebsworth, and colaborators (2012), reaffirm that this kind of contamination brings a warning that these foods(natural) as contaminated with eggs, larvae and / or cyst of parasites, and once consumed by humans, characterize a source of risk for the transmission of intestinal parasitoses.

The occurrence of foodborne diseaseshas been increasing considerably all over the world (Saleh, F, Gad, M, et al., 2018). Data from the Ministry of Health, foods are one of the main means of contamination by microorganisms in humans. This occurrence is justified by the increase in the demand for food of easily prepare, such as fruits and vegetables, by the inadequate sanitation of these ones or by the lack of sanitary structure of the sale places and by the lack of care of the handlers of these foods (Brasil, 2010).

The diseases caused byingestion of parasites are called enteroparasitoses, with a high incidence in developing countries, thus constituting a global relevance problem in the tangent to the public health sphere. The consumption of foods in natura increases the risk of enteroparasites, since eggs, cysts and larvae of parasites may remain viable on their surface for long periods, even in adverse conditions(Barros, 2018).

Although the interest about the presence of parasites in foods, there are few studies about parasitic contamination in fruits, with most publications have been directed to vegetables. A possible explanation for this observation may be related to the fact that most of leafy trees are cultivated in direct contact with the soil, a fact that represents a potential source of contamination, since the soil may contain parasites that as they enter in contactwith the vegetable, these ones use it as a shelter (Chijioke; U. Onyemelukwe et al., 2018). Unlikefrom most fruits that are grown in the aerial parts of plants, without direct contact with the soil (Dueholm B, Bruce.D, et al, 2016).

A study by Brauer et al., (2016) in which samples of lettuce and salsas collected at street markets and supermarkets in São Mateus-ES were analyzed, it was foundthat 86.8% of the vegetables were positive for some kind of parasite. Pinto (2018) has analyzed 26 samples of lettuce collected at a street market in the city of Jardim-CE and he has found that 80% of these lettuces were contaminated by parasites, by reaffirming the high levels of contamination in vegetables in Brazil.

The results of the present study have showed that guava (Psidium guajava) presented the highest incidence of parasitological contamination in relation to the other species of fruits analyzed, by totaling 90% (n = 9) of positive samples. The positivity of the apple (Malussilvestres) and lemon (Citrus limon) was similar, by representing 70% (n = 7) of the analyzed samples, followed by grape (Vitisvinifera) with 50% (n = 5) of contaminated samples Table 1).

Table.1: Positivity of contamination of the samples obtained.

Local	Fruits			
	Apple	Grape	Guava	Lemon
Fair A	30%	30%	40%	40%
Fair B	40%	20%	50%	30%
Total	**70%**	**50%**	**90%**	**70%**

Source: Research, 2019.

The amount of parasites found in each kind of fruit was also evaluated and it is shown in Table 2, in which shows that Ascaris lumbricoides was the specie located in all positive samples (n = 92/28). byconcentrating its largest distribution in guava (Psidium guajava) (n = 27) and in lemon (Citrus limon) (n = 24).

The prevalence of A. lumbricoides in the present study may be related to the fact that this nematode is considered of wide distribution. The female of this parasite hasthe capacity of producing about 200,000 eggs daily in the intestine of the human being that eliminates it through the feces. As in contact with the external environment, these eggs can contaminate the soil, water and foods (Yang, Wang, Y et al, 2018). According to Costa (2012), the outer membrane of the A. lumbricoides eggs presents good adhesion, that may justify the large number of eggs found in the fruits analyzed by this study, as well as the fact that guava and lemon, fruits that have irregular shell show a bigger quantity, since the presence of these parasites may also occur due to the morphology of the plant, which even in the washing process, the complete removal of all the infective agents may not occur efficiently (Ferreira, 2016).

Besides the high number of Ascaris eggs in fruits, the presence of Ascaris lumbricoides larvae (n = 16) was also identified. Although the presentation of these larvae

does not represent a form of transmission of the disease, its presence in the samples confirms the prevalence of contamination by these species.

The disease caused in humans by A. lumbricoides is called ascaridiasis and it includes the symptoms such as diarrhea, vomiting, abdominal distension and pain, reduced absorption of vitamins, etc (Costa, 2012). According to(WHO, 2019), the Áscaris lumbricoides represents one of the main soil contaminant parasites in areas in which sanitation is poor and / or deficient. All over the world, approximately 1.5 billion people are infected with soiltransmitted helminths, by including A.lumbricoides and more than 267 million of preschool children and 568 million of schoolaged children live in areas with intense transmission of this parasite.

Another helminth prevalent in the analyzed fruits was confirmed bythe presence of Ancylostomides eggs (n = 18). Silva et al. (2018) as they analyze lettuces in supermarkets in Betim-MG, they have verified that the Ancylostomidae was the most common parasite in the samples (33.3%), that characterizes the fact that these parasites are frequently contaminating in natura foods.

Protozoa were also found in theanalyzed fruitsby this study, with the presence of cysts of Balantidium coli (n = 31) and Entamoeba coli (n = 11). Santos et al. (2017) in their study, as they evaluate vegetables marketed in supermarkets in Maceió-AL, have observed that 61.98% of the samples had presented Balantidium coli cysts. Another study performed by Vidgal. T; Landivar. E. et al. (2018) as he analyzes lettuce samples in restaurants in São Miguel do Oeste - SC, they have found with a higher incidence of Balantidium presence coli present in 81.5% of the samples.

Table.2: Quantity of Helminths and Protozoa found.

Hoffman's Method (Spontaneous Sedimentation)

Helminths					
	Apple	**Grape**	**Guava**	**Lemon**	**Total**
Eggs of Ascaris lumbricoides	19	22	27	24	92
Hatching eggs	4	3	7	4	18
Eggs of Taenia sp.	0	8	0	0	8
Eggs of Enterobius vermicularis	0	0	2	0	2
Larva of *Ascaris lumbricoides*	5	1	6	4	16
Protozoa					
	Apple	**Grape**	**Guava**	**Lemon**	**Total**
Balantidium coli cyst	10	7	9	5	31
Entamoeba colicyst	5	0	0	6	11

Source: Research, 2019.

From 40 fruit samples collected at the two street markets, 70% hadsome kind of parasite, by characterizing a contamination of more than half of the fruits under analysis. The study has observed little discrepancy among the kind of parasites found in the two fairs surveyed. In this way, both ones presented the significant occurrence of six kinds of parasitological agents.

Although it is not possible to affirm the way of contamination of the samples analyzed by the present study, it was observed during the research poor conditions of basic sanitation by vicinity of the sale place of these foods and with little hygienic control. It is known that these factors can favor the contamination of the fruits andbecome them possible vehicles of parasitoses transmission p, whichmay entail risks to the health of those who consume these fruits (Alhabba, T. 2014).

According to Ferreira (2012) the contamination can occur both in the cultivation process, as well as the transport and / or storage, that is, from planting to the commercialization of the fruits. Several factors are directly related to this fact, and may be due to the contamination of the water, used for irrigation of the plants, with animal or human feces containing eggs or cysts of parasites; contaminated soil; or even fertilizers containing fecal matter, as well as the incorrect handling

of the sameones and the transport made by a wrong way that exposes these foods to the risk of contamination.

Besides that, it is knownthat the food handler, that individual who is directly or indirectly in contact with foods (Wingert And Araújo, 2009), may be represent a source of risk for the contamination by parasites in these ones, especially for the fresh food. This contamination occurs due to the improper handling of these foods, which may occur from the time of harvest to its commercialization (Silva et al., 2005). A study performed by Capuano et al. (2008) show that the lack of hand sanitationand improper handling with the foods by handlers, as well as inefficient sanitation conditions, are directly related to the increase in cases of contamination of the. foods.

Another relevant factor is that fruits that are infected by parasites do not present altered taste or color, which makes it difficult their visualization, thusgoing unnoticedby the eyes of consumers, especially those ones that have little clarification about this subject (Bozzetti; Alves; *et al*. 2013).

The relevance of health education is stressed here. Theinformation about the severity that enteroparasites can cause in humans should be constantly practiced and explored. The lack ofknowledge by part of the population contributes to the increasing incidence of these infections, which could be reduced with necessary prevention andcare information.

IV.   CONCLUSION

The prevalence of 70% of positivity, besides the diversity of the parasites found in the present study, indicates low sanitary conditions of the fruits marketed in the street markets. It was also observed that the morphology of some fruits favors the presence of some parasites in the outer part (shell), which requires attention on the sanitation process of theseones. The results suggest that at some time, from cultivation to commercialization, there was contamination by human and / or animal feces, since the helminths and protozoa found in the fruits come from these intestinal sediments.

Although parasites can be transmitted by foods for people everyday, it is still a great challenge to promote actions and measures that control the occurrence of intestinal parasite infections. Despite the great incidence and the impact of this problem nowadays, the prevalence of these enteroparasites in fruits has not been described yet. Thus, it is necessary to promote educational campaigns to raise awareness among both food handlers as consumers, thus contributing to the prevention and reduction of parasitic contamination.

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Evaluation of the Water Quality of the River Basin of São João River in the Municipality of Porto Nacional - Tocantins

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Abstract — *Water is an essential natural resource for the maintenance of the life of man and the numerous ecosystems present on the planet Earth, besides enabling several activities that generate income for civilizations. The main objective of this work is to analyze the water quality of the São João River basin in the city of Porto Nacional - Tocantins, by determining the Water Quality Index (WQI). For the development of this work, it was established three research points, located downstream of the São JoãoRiver. The samples were collected monthly and, for six months, from August 2018 to January 2019. The results obtained demonstrated that the water from São João River can be classified as regular according to NSF, although some parameters compared to environmental legislation were in disagreement with the standards determined by CONAMA resolution 357/2005 for freshwater class two.*
Keyword— *WQI; Water Resources; Hydrographic basin.*

I. INTRODUCTION

The Earth is known as planet water, this is due to the fact that 70% of its surface is covered by this essential liquid to life, which makes it one of the most abundant resources of the planet. However, most of the water of the planet is not available for use by humans beings. For this reason, it is mistakenly thought that water is an inexhaustible resource, but in fact it constitutes a finite resource that must be used without waste (BARROS; AMIN, 2008).

The authors observe that population and economic growth lead to water degradation and consequently its pollution and contamination. This shows that human actions cause environmental degradation that reflects the misuse of this water resource so important to human life.

One of the main natural resources for the existence of the human being is the water. Any way of life needs water to survive. Water is a natural resource that is closely related to all aspects of human civilization, since the agricultural and industrial development to cultural and religious values rooted in the society.

There are large river basins in the world but, unfortunately, drinking water for human consumption is in small proportion, it does not meanit is becoming scarce, but there is a lack of water to meet certain demands that are associated with a minimum quality, taking into account their local availability. Although public awareness policies are carried out, the society is not aware to future consequences and ends up wasting and polluting unnecessarily (NOGUEIRA, 2017).

The monitoring of the quality of a water body is based on the analysis of parameters established by the water quality indicators that aggregate the variables analyzed in a given numerical value related to the concept of quality, verifying the condition and evolution of water quality in the time and space.

The analysis of the Water Quality Index (WQI) according to the criteria established by standards that are used by the State Company of Basic Sanitation Technology (CETESB), makes use of nine water quality parameters, since these properties must have conditions minimum, because its main purpose is public supply.

For these reasons, the aim of this work is to analyze the water quality of the São João River basin in the city of Porto Nacional - Tocantins, by determining the Water Quality Index -WQI.

II. MATERIAL E METHODS

2.1 – Location of the Experiment

The basin of SãoJoão River has its source in the rural area, within the limits of Pilões Farm (coordinates S 10º46'08 "and W 48º15'57"), with direction to the municipality of Porto Nacional, crossing several rural properties in some representative neighborhoods, such as JardimQuerido, JardimUmuarama, Santa Helena and Vila

Nova, with its mouth (coordinates S 10º42'10 "and W 48º23'47") in lake Lajeado.

The climate is typically tropical, with an annual average temperature of 26.1ºC and an annual rainfall of 1,667.9 mm, referring to the periods 1961-1990 (MINISTRY OF AGRICULTURE AND AGRARIAN REFORM, 1992).

The monitoring was carried out in August, September, October, November and December of 2018 to January 2019, at three collection points distributed along this water body, which they were marked with a global positioning system (GPS navigation model GARMIN-60CSx).

For the definition of water collection points, bibliographical studies, field visits and interviews with the community were carried out. **The location of the points is shown in Table 1.**
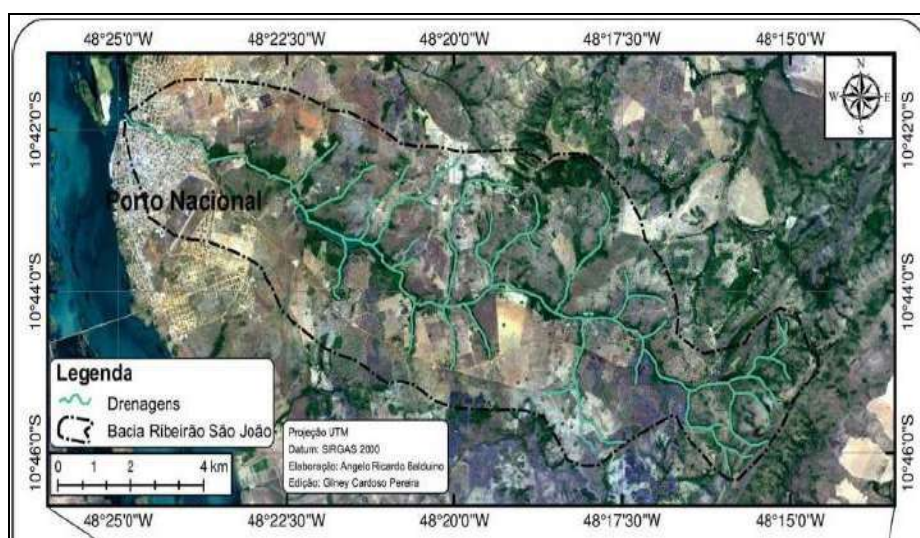
Fig.1 – Map of the location of the São João Rive Basin

Source: Balduíno e Carvalho (2016).

Tradução das palavras da figura:

Legenda - Legend
Drenagens – Drainage
Bacia Ribeirão São João – São João River basin
Datum – Datum
Elaboração- Elaboration
Edição – Edition

Table 1 –Location of the water collection points of São João River in Porto Nacional, Tocantins, in the months of August, September, October, November and December 2018 to January 2019.

Point	Latitude (S)	Longitude (W)	Reference Site
PI	**10°46'08"**	**48°15'57"**	**Next to the source (FazendaPilão);**
PII	**10°43'02"**	**48°22'21"**	**DamofBRK/SANEATINS;**
PIII	**10°42'10"**	**48°23'47"**	**Formigueiro Beach in**

			the Jardim Querido sector.

2.2 – Water analyses

The water quality parameters studied in this work were: temperature, dissolved oxygen (saturation percentage), pH, total nitrogen, total phosphorus, electrical conductivity, total coliforms, total solids and turbidity.

The samples were collected monthly from August, September, October, November and December 2018 to January 2019. The methodology adopted was divided and exposed in two parts according to the parameters, in the following order: first the field methodology and then the laboratory methodology.

2.2.1 – Field Methodology

conductivity parameter was analyzed with the CD-840 The field collections were made with river collector, and in situ measurements performed with specific portable devices for each parameter. The water temperature and dissolved oxygen were determined in

locus with YK 22DO oximeter model, and the electrical digital conductivity meter and the pH with the phmeter model TEC-3P, according to the protocols of these devices.

2.2.2 – Laboratory Methodology

The samples were collected in a 1000 ml flask and then packed in ice-containing thermal boxes and then taken to the Laboratory of Environmental Microbiology - Limonology Sector (LAPEQ) Laboratory of Research in Environmental Chemistry, Federal University of Tocantins (UFT) - Campus Palmas - TO.

Fecal coliforms (FC) were analyzed according to the colilert technique according to the methodology described by Standard Methods (APHA, 2005); Total Nitrogen: it was analyzed by the micro Kjeldahl method (APHA, 2005); Total Phosphorus: it was analized by the ascorbic acid method after digestion with ammonium persulfate (APHA, 2005); Total Solids: were analyzed by the porcelain capsule method (APHA, 2005); Turbidity: determined by the nephelometric method (APHA, 2005); Biochemical Oxygen Demand (BDO): was determined by the standard method A (APHA, 2005).

2.3 – Calculation of the Water Quality Index (WQI)

The WQI was calculated by the multiplicative weighted mathematical form of water quality corresponding to the parameters: sample temperature, pH, dissolved oxygen saturation percentage, biochemical oxygen demand (5 days, 20 ° C), fecal coliforms, total nitrogen, phosphorus total solids and turbidity. Being exposed by the equation:

$$IQA = \prod_{i=1}^{n} q_i^{w_i}$$
(Equation 2)
TRADUÇÃO da palavra da equação :
IQA – WQI

At where:

WQI: Water Quality Index, a number between 0 and 100;

qi: quality of the i-th parameter, a number between 0 and 100, obtained from the respective average curve of quality variation for each parameter, depending on its concentration or measure;

wi: correspondingweight to the ith parameter or sub-level, a number between 0 and 1 (Table 2), attributed as a function of its importance to the overall conformation of quality, wherein:

$$\sum_{i=1}^{n} w_i = 1$$

on what:

n: number of parameters that is used theWQI calculation.

Table 2: Parameters and weights for calculation of WQI - NSF.

PARAMETERS	UNIT	WEIGHT (wi)
CF	NMP/100ml	0.15
pH	-	0.12
DBO	Mg/L	0.10
Total Nitrogen	Mgn/L	0.10
Total phosphate	MgPO$_4$/L	0.10
Temperature	°C	0.10
Turbidity	NTU	0.08
Total solids	Mg/L	0.08
OD	%saturation	0.17

Source: Yisaet al. (2012).

The quality of the water is identified as a function of the value of WQI obtained, which can be terrible (WQI<25), bad (26 <WQI<50), regular (51 <WQI<70), good (71 <WQI<90) or excellent quality (91 <WQI ≤ 100) (ANA, 2015).

III.   RESULTS AND DISCUSSIONS

3.1 – Water Quality Index (WQI)

The results of the physical, chemical and bacteriological parameters of the surface waters of São JoãoRiver were used in the calculation of the WQI for the period of August, September, October, November and December of 2018 to January 2019. The classification of the quality of the waters of São João River was made from the values recommended by the NSF.

In Table 3, which shows the temporal and spatial behavior of theWQI, there is little variation between the values obtained in the rainy season (November to January) along the water body at points I and III (66.02 in PI and 68.24 in the PIII)in the dry period (August to October) the values obtained greater variations in relation to the rainy season for the same points, but with few variations for the dry season (61.92 in the PI and 62.73 in the PIII), different from point II that is slightly lower in the rainy season (from 65.85 to 68.46) and also in the dry period (from 71 to 71.73). In the dry period, there is little variation between the values obtained in points I and II (average of 70.52 in the PI and 67.86 in the PII), explaining that, according to this index, for the period studied the water quality may to be classified in the regular category (51 <WQI <70), the average of the three points analyzed PI, PII and PII was (68.61), and that despite some variations in specific points, it presents homogeneity among the three collection points.

It is highlightedthat of the nine parameters, four (OD, total phosphorus, total nitrogen and fecal coliforms) were in disagreement with the values established by the

CONAMA resolutions, however the variations presented showed that they were not significant to reflect in the final results, demonstrating that such variations were absorbed by other parameters.

It is concluded that it is essential to use the WQI for monitoring water resources, due to their low costs, as well as the importance for decision-making. In the case of SãoJoão River, it is observed that the WQI proposed by the NSF does not satisfactorily describe the quality, since in some uses, such as bathing, this index has limitations, since the coliform parameter is absorbed by the other parameters, diluting its effect, which may lead to overestimation of the quality of this water.

Table.3: Water Quality Index (WQI NSF) at the three points of collection.

Points / Month	PI	PII	PIII
August/2018	74.77	71	69.01
September/2018	74.89	71.73	70.66
October/2018	61.92	60.87	62.73
November/2018	66.02	65.85	68.24
December/2018	72.78	68.94	68.41
January/2019	73.12	68.46	69.82

IV. CONCLUSIONS

The results allowed us a better spatial visualization of the water quality of São João River. The temporal analysis of the water quality was extremely important, because it was able to detect small oscillations in the WQI values at the three sampling points.

When analyzing separately the results of the parameters considered in the WQI with the limits established by CONAMA Resolution 357/2005, it was possible to observe that most of them (OD, total phosphorus, total nitrogen and fecal coliforms),were presentedin disagreement with these legal instruments . Therefore, the results obtained indicate that the preventive and preservation measures must be adopted in the management of the water resources of this basin, avoiding that in a short time the WQI, currently classified as "regular", is not classified in another class of inferior quality.

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Identification of the Erosive Processes on the Banks of Ribeirão São João Porto Nacional - TO

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Abstract— *The objective of this study was to map the erosions that are occurring on the banks of Ribeirão São João in Porto Nacional - TO, these erosive processes come from the detachment and transportation of the soil particles, which can be deposited in the watercourse of the stream, causing the increasing of the load in the streambed. Two erosions were the biggest. Soil characterization tests were done in each erosion. Monitoring its progress was made by pins erosion method, which were installed on the banks of those erosions. The accomplishment of monitoring made it possible to create graphs comparing precipitation and erosion. With this study it was achievable to check that the precipitation acts directly on the surface, increasing the erosive process, verifying that the soil type exerts a big influence on the process.*
Keywords— *Erosion. Erosion pins. Ribeirão São João.*

I. INTRODUCTION

Silva et al. (2007) define that the soil consists of organic and minerals particles with different dimensions, formed from physical, chemical and biological processes. The most common agents for soil formation are climate, the place's topography and the biotic community. Soil erosion is understood as a process of detachment, transport and deposition of soil particles. Erosion at the riverbanks may promote the degradation of the watercourse, due to the large accumulation of sediments carried by the streams to the riverbed. Among the main environmental impacts problem caused we can mention the reduction of the flow, change in the course of rivers and in very serious cases can cause the extinction of the watercourse (ALVES, 2007). This study delineated itself in collecting important information on the erosive processes that are occurring on the banks of Ribeirão São João in Porto National - TO. The objective of this study was to map erosion along the river, identifying and monitoring the development of major erosions. The purpose of this study was to obtain a survey of the

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erosions that are occurring on the banks of Ribeirão São João, it was also very relevant monitoring the progress of the biggest erosions located in the watershed that supplies the city..

II. MATERIALS AND METHODS

2.1 CHARACTERIZATION OF THE STUDIED AREA

The studied place is located southeast of the city of Porto Nacional-TO, in the basin of drainage of Ribeirão São João that has a total area, according to Silva (2010) of 82km². The basin is located between the meridians 48 ° 14'16 "and 48 ° 24'51" longitude west and between the parallels 10 ° 4 6'43 "and 10 ° 41'20" with South latitude as shown in figure 1. Its mouth is located within the urban area of Porto Nacional, contributing directly to the Tocantins River. According to Tocantins (2012), the are present in the region are the Oxisols and a small portion of Neosols. The natural vegetation that prevails in the region is the cerrado. In Porto Nacional - TO the climate is typically tropical. The annual average rainfall is 1622mm, and the average temperature is about 26.1 ° C. The month of September is the hottest month, with an average of 27.9 ° C, and the month with the lowest is July, averaging 24.9 ° C. The largest part of the precipitation is between October and April, which is the rainy season, and drought period is between May and September (CLIMATE-DATA, 2018).

2.2 CREATING THE MAP

The process of creating the map began with the identification of erosions, and later the points were collected by a geodetic GPS. The creation of the map was through the Google Earth tool, a software that has several functions, and among them is the visualization of satellite images and the creation of themed maps. The locations are given through the geographical coordinates, the identification occurred from 10 ° 42'54.92 "S, 48 ° 22'17.93" W to 10 ° 44'21.52 "S, 48 ° 17'32.24" in the city of Porto Nacional-TO, as it is shown in figure 2.
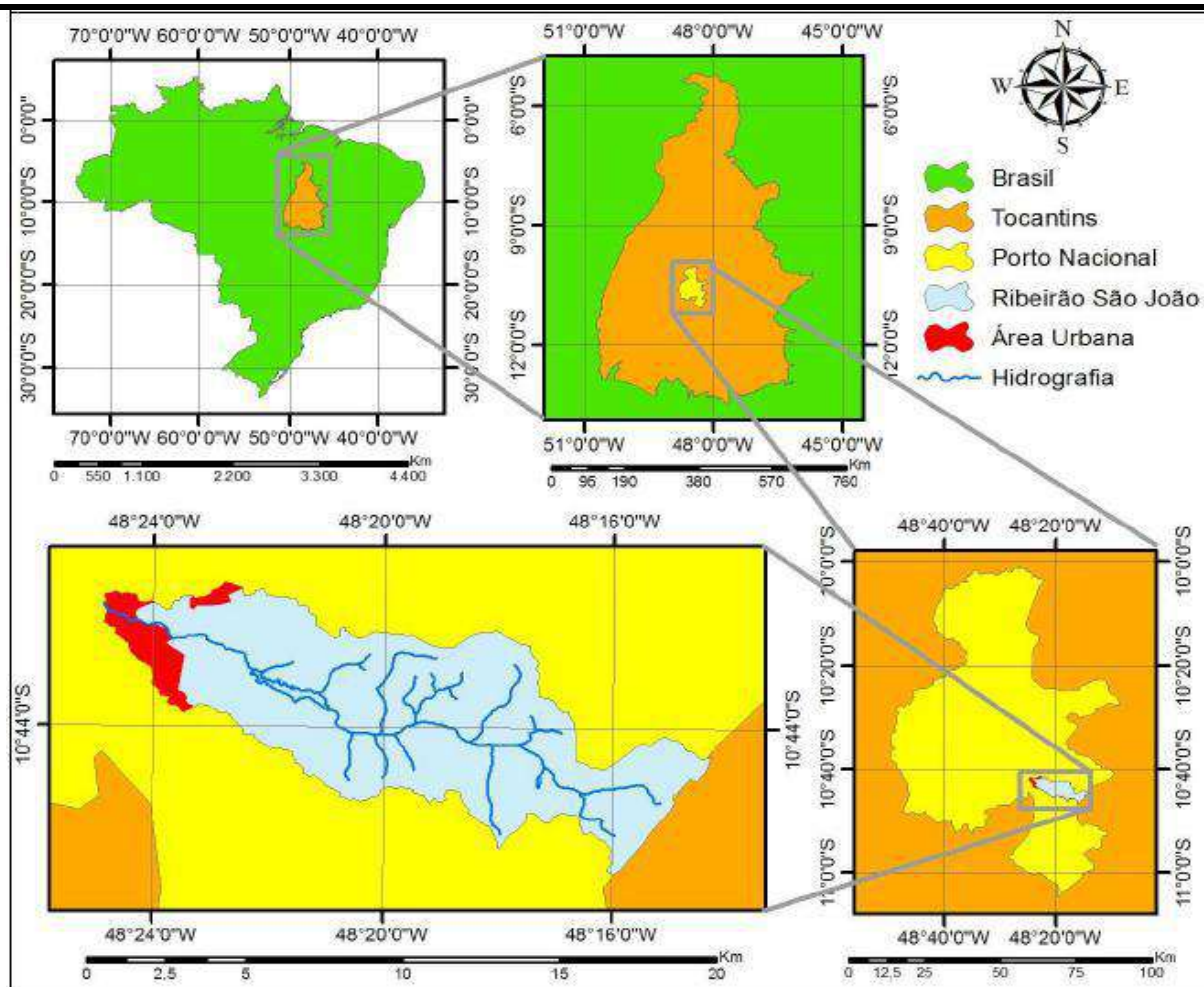
Fig.1 - Location map of the studied area
Source: Silva (2010)

(Green: Brazil, Orange: Tocantins, Yellow: Porto Nacional, Light blue: Ribeirão São João, Red: UrbanArea, Blue line: Hydrography.)
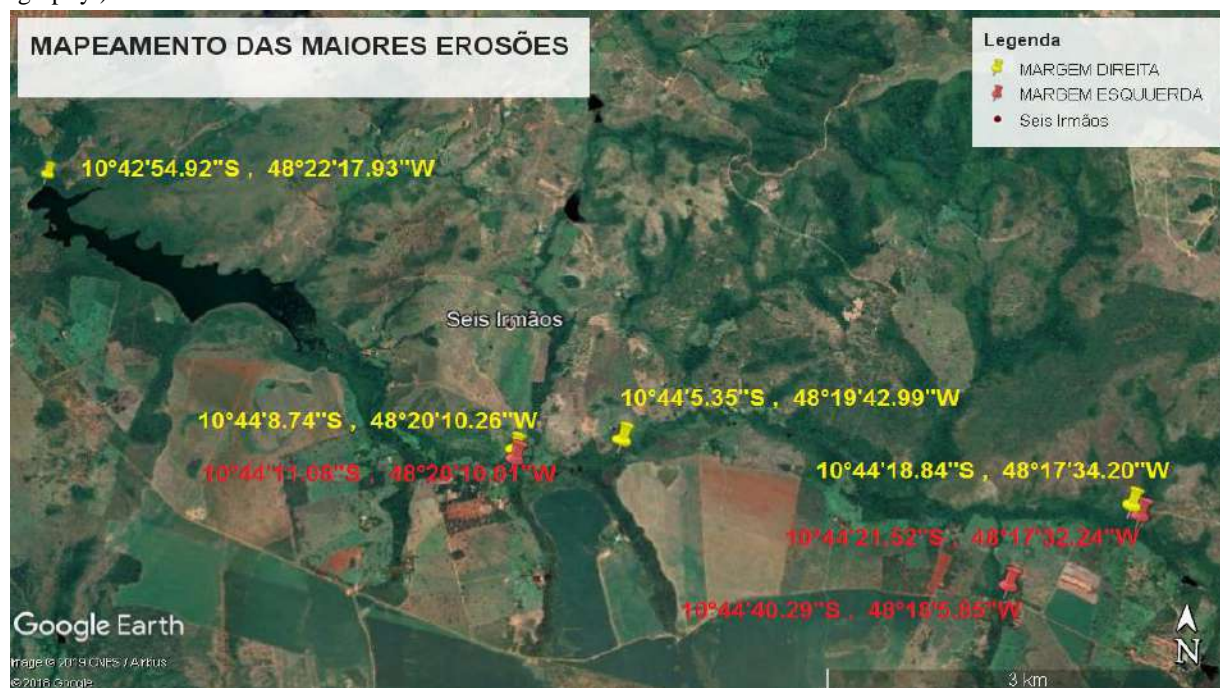
Fig.2- Location of most erosions
Source: Prepared by the author (Yellow pin: Right riverbank, Red pin: Left riverbank, Red dot: City of Seisirmãos)

2.3 EROSION PINS

There were selected two erosions to monitor, the first one at 10 ° 44'18.84 "S, 48 ° 17'34.20" W and the second at 10 ° 44'40.29 "S, 48 ° 18'5.85 ° W. Based on the Leal (2008) methodology, the procedure of the study was developed by monitoring the edges of the erosion, from the installation of rebars with 20cm of size, where they were spiked 15cm and 5cm remained out. The number of pins varied according to the size of the erosion, in the first one were placed eleven points, and the second were placed nine points. They were put perpendicular to the erosion, two rebar per point, the first at a distance of one meter from the edge and the second at two meters. The lateral distance between the points was one meter. The checks happened fortnightly, with the help of a measuring tape. The information was stored and compared with rainfall data of the region.

Fig.3- Distance from the edges to the stakes

Source: Adapted from Leal (2008) (A stake – 1meter; B stake – 2meters)

2.4 SOIL CHARACTERIZATION

The soil was collected near the erosion, and prepared according to the NBR 6457 (2016), laboratory tests were executed and the characteristics and mechanical properties of the soil were determined. The tests were done according to the technical standards listed below.

2.4.1 Granulometric analysis

The methodology for granulometric analysis and the execution of the test was made according to NBR 7181 (2016), performing a combination of sedimentation and sieving. The test was divided into two parts, and each case has a different goal. With the acquired results, it was possible to make the granulometric curve for soil classification. The sieving was used to determine the largest fractions as sand and gravel, and the sedimentation, which was made with fine materials such as clay or silt, measuring the speed that the material decant in the water. The determination of was based on the Stokes law, where it relates the velocity that the particle sediments. The larger the particle, the faster it'll be deposited in the bottom of the test tube.

2.4.2 Specific soil mass

According to the NBR 6508 (1984) standard, it has been determined the specific mass of the soil that was passed in the 4,8mm sieve through the pycnometer. The specific mass was determined by the relationship between mass and solid volume. The pycnometer was calibrated and the air of the soil water composition taken according to the standard and so that air would not interfere in the search results.

2.4.3 Atterberg boundaries

In accordance with NBR 6459 (2016), the liquidity limit (LL) determines the moisture content which is the passage from the liquid state to plastic. For determination of this limit was made test in the Casagrande's equipment that measures the moisture content by closing the lower edges of a stem pitting made by a standardized chisel that is open in the soil mass, requiring 25 strokes for its closure. The result of several repetitions changing the moisture of the same soil generated a graph showing the flow line that relates the number of strokes with moisture.

According to NBR 7180 (2016), the plasticity limit (LP) shows the amount of moisture needed for the

soil to be molded. The execution of the procedure consisted in the formation of rods of 3mm in diameter and 10cm to 15cm long on a glass plate. The procedure was repeated three times to determine the moisture and was calculated the mean to find the plasticity limit.

III.   RESULTS AND DISCUSSIONS

3.1 EROSION PINS

Even erosions were considered the larger overall, where two of them were selected to perform the monitoring from December until April, months with the highest level of precipitation during the year. Field

analysis provided strong data on erosive processes; it can be verified that they evolve faster in the period of the year where precipitation reaches a greater volume. It was noticed that the active erosive processes are due to the action of precipitation water and the predominance of material removal is where the flow of the flash flood is larger, this predominance was seen in the highest graduation of the pins in that flow place. There was the development of vegetation which, it was also affected. It was also observed that the sedimented materials are being carried directly to the streambed.

Table 1 - Evolutionary data of the first erosion (Distance from cutting to edge oferosion)

DATAS	DADOS EVOLUTIVOS DA PRIMEIRA EROSÃO (EROSÃO DAS BORDAS)- POR ESTAQUEAMENTO								
	2018		2019						
	15/dez	30/dez	15/jan	30/jan	15/fev	02/mar	17/mar	01/abr	15/abr
PONTOS	DIST. EST. A BORDA	DIST. EST. A BORDA	DIST. EST. A BORDA	DIST. EST. A BORDA	DIST. EST. A BORDA	DIST. EST. A BORDA	DIST. EST. A BORDA	DIST. EST. A BORDA	DIST. EST. A BORDA
P1	196	194	192	186	183	182	178	177	177
P2	195	193	190	187	180	179	175	174	173
P3	194	188	185	179	176	172	166	164	163
P4	195	187	184	176	173	169	164	162	160
P5	193	186	182	178	174	170	165	161	159
P6	193	186	182	174	170	168	163	160	158
P7	194	185	181	175	171	167	162	159	158
P8	192	186	185	178	174	171	163	160	159
P9	194	187	186	180	179	177	175	174	173
P10	196	191	190	188	188	186	179	178	178
P11	197	193	193	192	192	190	188	185	185

Source: Prepared by the author.(Evolutional data of the first bank erosion – by staking. From December 15th to April 15th, P1 1st pin to 11th and its distance from the banks)

The points 3,4,5,6,7,8 presented a higher rate of evolution, the other points 1, 2, 9, 10, 11 have had less degradation, this may be due to several factors, the highest rate of erosion may be related to the flow of the flash floods, and the points that were less affected may be related to the presence of vegetation which is an important factor, because it gives protection to the soil avoiding the impacts of raindrops directly hitting the soil, reducing the kinetics energy of the drops and reducing the possible erosive processes. Points 6 and 7 were the most affected in this period, in the month of December, during the rainy season, they were found at a distance of 120 cm of the border of the erosion, in the month of April they found at 158 cm of the edge, meaning 42 cm of evolution in these points, associating a direct relation with precipitation.

Through precipitation and the monthly average evolution rate, it was possible to monitor and compare the relationship between rate of evolution and precipitation. To understand the results, it is important to comprehend how the rain cycle occurred so they can be compared with

erosion pins. Monitoring the hydrological cycle was done with the data provided by INMET- National Institute of Meteorology, from December 2018 to April 2019. These data have been transformed into a line graph demonstrating monthly rainfall, as shown in Figures 4 and 5. Cumulative rainfall in this period was 1110.0 mm, the months of December and March had higher volume, accumulating 56.3% of the total.

The graph depicted in figure 4 demonstrates the comparison between the erosion and the rainfall that occurred during that period. It was observed that evolution is not directly proportional, in the first month the evolution rate and rainfall are almost close, in the following months the variables distance themselves, while the volume of precipitations in some moments reached 300 mm monthly and the evolution rate of the erosive process was around 4 to 6 cm, as shown in the graph. This variation of erosion rate may be related to the amount of rain per day. Thus, superficial erosions are related to the intensity of rainfall in this place, and the volume of flash flood that these rains cause in the region.
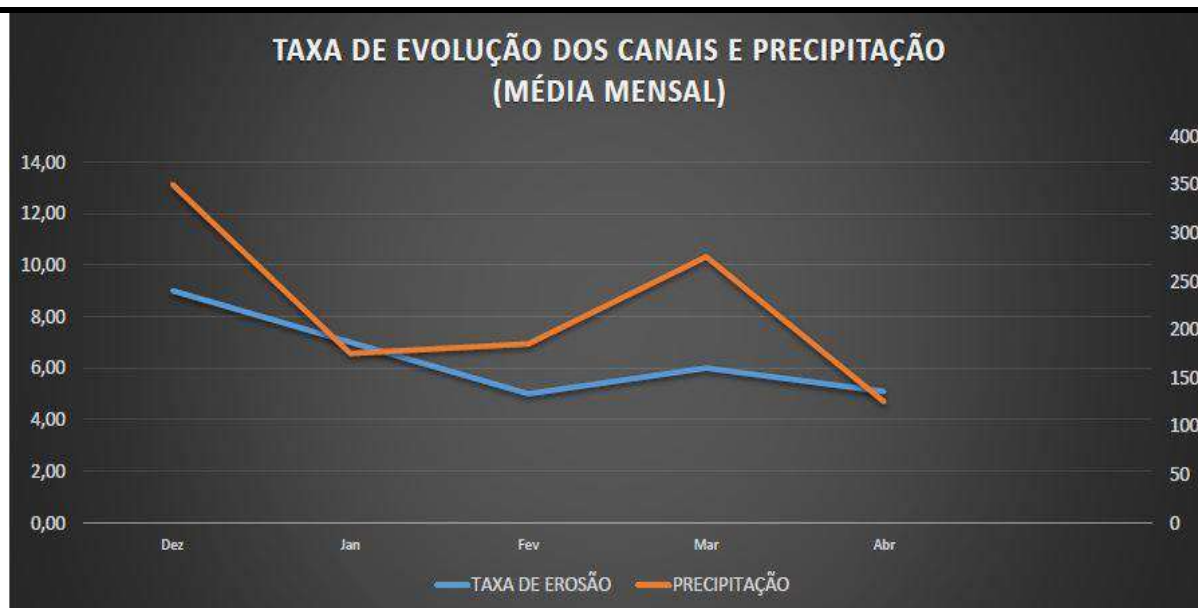
Fig.4 - Chart of the rate of evolution of the channels and precipitation (monthly average)

Source - Prepared by the author. (Rate Evolution of the channel and precipitation, on blue: erosion rate, orange: precipitation, monthly average)

The data of the table 2 presented below refers to the second erosion, demonstrating its attendance. It is at the point 10 ° 44'40.29 ° S, 48 ° 18.5 ° W. With the monitoring of this erosion a comparison was made between this and the first erosion that is located in a place far away.

Table 2 - Evolutionary data of second erosion (Distance from cutting to the edge oferosion)

DATAS	DADOS EVOLUTIVOS DA PRIMEIRA EROSÃO (EROSÃO DAS BORDAS)- POR ESTAQUEAMENTO								
	2018		2019						
	15/dez	30/dez	15/jan	30/jan	15/fev	02/mar	17/mar	01/abr	15/abr
PONTOS	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)	DIST. EST. A BORDA (CM)
P1	198	196	195	194	191	189	186	186	185
P2	196	194	193	191	189	186	184	183	181
P3	196	192	191	189	185	183	180	178	177
P4	195	191	189	188	186	180	179	177	175
P5	197	188	187	186	185	182	177	175	173
P6	196	189	188	187	185	181	178	175	172
P7	194	190	189	189	187	186	186	183	180
P8	196	189	189	189	185	184	181	180	178
P9	197	196	196	196	194	193	193	192	191

Source: Prepared by the author.(Evolutional data of the second bank erosion – by staking. From December 15th to April 15th, P1 1st pin to 9th and its distance from the banks)

In comparison with the first erosion monitored with erosion pins , this onet behaves in a similar way, presenting similar characteristics, as it can be seen in points 3,4,5,6, which had a higher scale, showing that the superficial water flow from intense rainfall and lack of vegetation can be considered the one of the biggest reasons of these erosions. Leal (2008) reports a similar behavior in a study which was observed that the evolution of erosion occurs basically from one side of the gull, demonstrating that the flow of the rainfall has influence on erosion.

The graph presented in figure 5 represents the comparison between the precipitation and erosion rate. In comparison with the first one, the graph shows similarities, with lower erosion rates. The development of this erosion, as in the first, for instance, the erosion rate

followed the precipitation volume, but in the following months there was a variation between the precipitation line and the erosion rate, showing that the evolution is not proportional to the precipitation volume. Those results are similar to those observed by de Casado et al (2002), in

which it was verified that the evolution is not continual and it is related to climatic events, such as the intensity of the hydrological events, the winds and the speed of the flow.
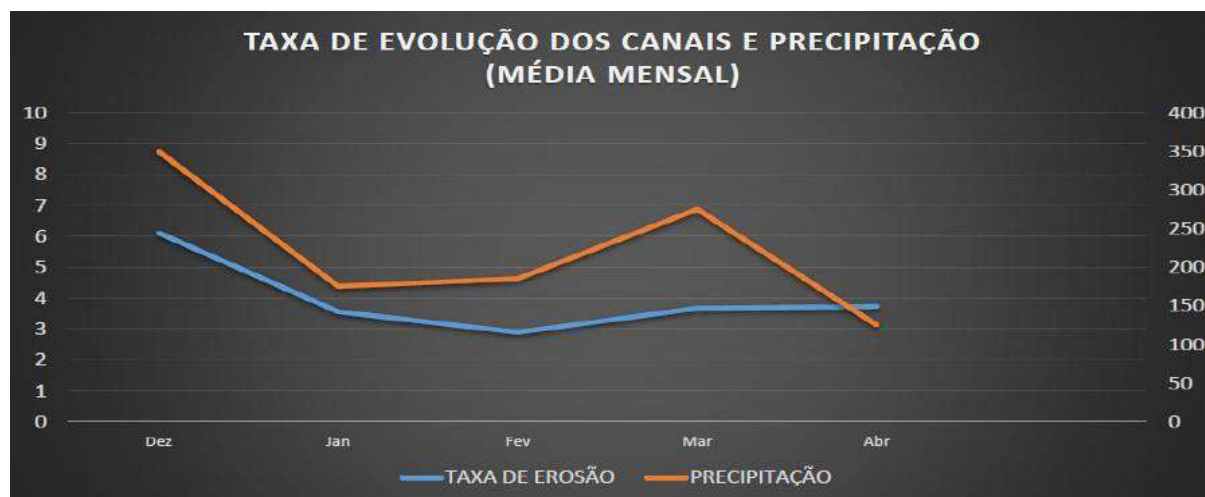
Fig.5- Chart of the rate of evolution of the channels and precipitation (monthly average)
Source- Elaborated by the author.(Rate Evolution of the channel and precipitation, on blue: erosion rate, orange: precipitation, monthly average)

3.2 SOIL CHARACTERIZATION

The plasticity index is the ability of the soil to remain in a plastic form without passing to the liquid state, therefore the lower the plasticity index the more common will be the erosion to happen due to the breaking of soil particles, and the higher the index, the more soil will resist the erosion. The plasticity index found in both soils are different. The soil of the first erosion has a

plasticity index equal to 7.5 and the second had a plasticity index of 10.7 analyzing the data, the first one had a greater evolution when compared to the second. According to the theory proposed by Jenkins, the soil having $7 < IP < 15$ is considered as medium plastic (CAPUTO, 1988). In this way, plasticity of both soils are in this parameter (Table 3). However, the second one showed greater resistance against erosion.

Table 3- Atterberg Boundaries

	LL	LP	IP
PONTO 1	30,6	23,1	7,5
PONTO 2	36	25,3	10,7
LL-Limite de Liquidez		LP-Limite de Plasticidade	
IP- Índice de Plasticidade			

Source: Prepared by the author. Ponto 1: 1st point, Ponto 2: 2nd point, LL: liquidity limit: LP: plasticity limit, IP: plasticity index)

The Granulometric analysis performed showed the most stable features as the percentages of the particles that constitute the soil. With data referring to the first erosion, it was possible to classify as a sandy-loam soil, as it can be observed in Figure 6. The soil has 28% fine sand, 20% sand coarse, 10% fine sand, 22% clay and 19% silt. According to Bertoni and Lombardi Neto (2014), when the soil has a large amount of sandy material, it

makes it more susceptible to erosion. Comparing the monitoring of the erosion pins we can notice that there was a bigger variaton in the first monitored erosion. According to Casado et al (2002), the presence of sandy material contributes significantly to the increase in erosion rates due to its lack of cohesion, the soil becomes more susceptible to erosion.
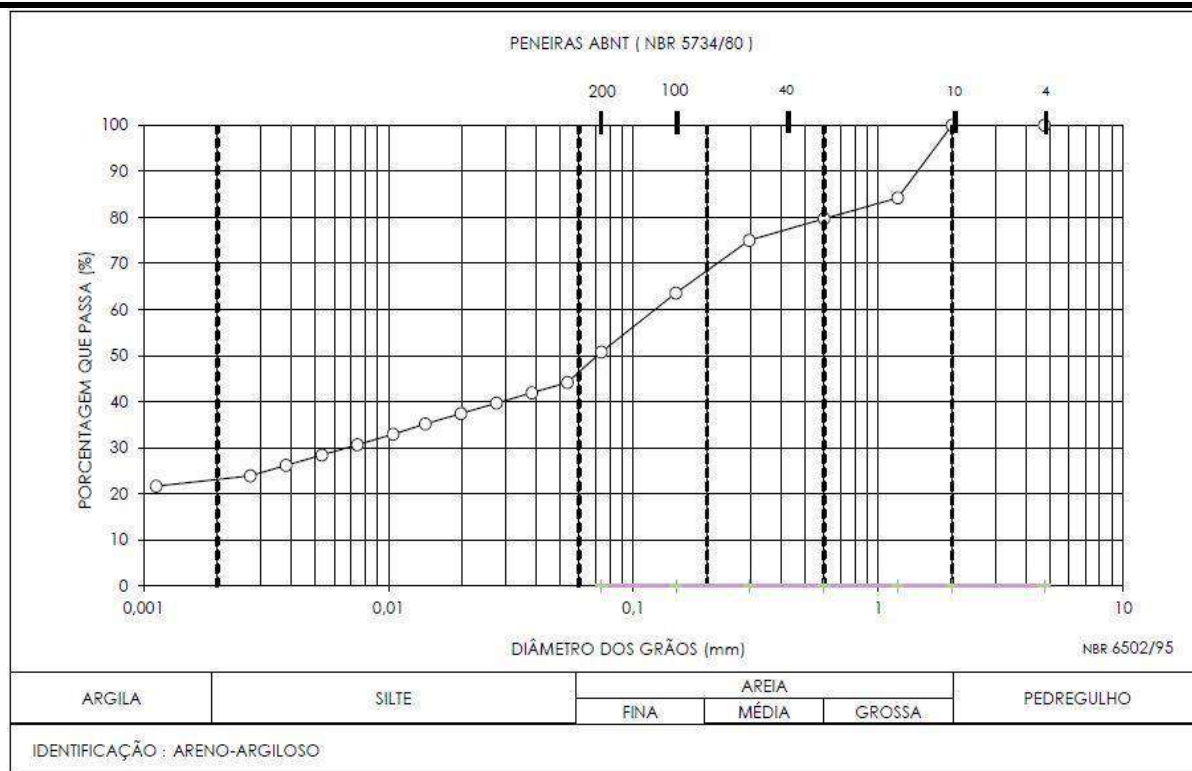
Fig.6 - Granulometric analysis of the first erosion

Source: Prepared by the author (ABNT's sieve, Vertical: percentage that goes through the sieve(%), horizontal: grains' size (mm))
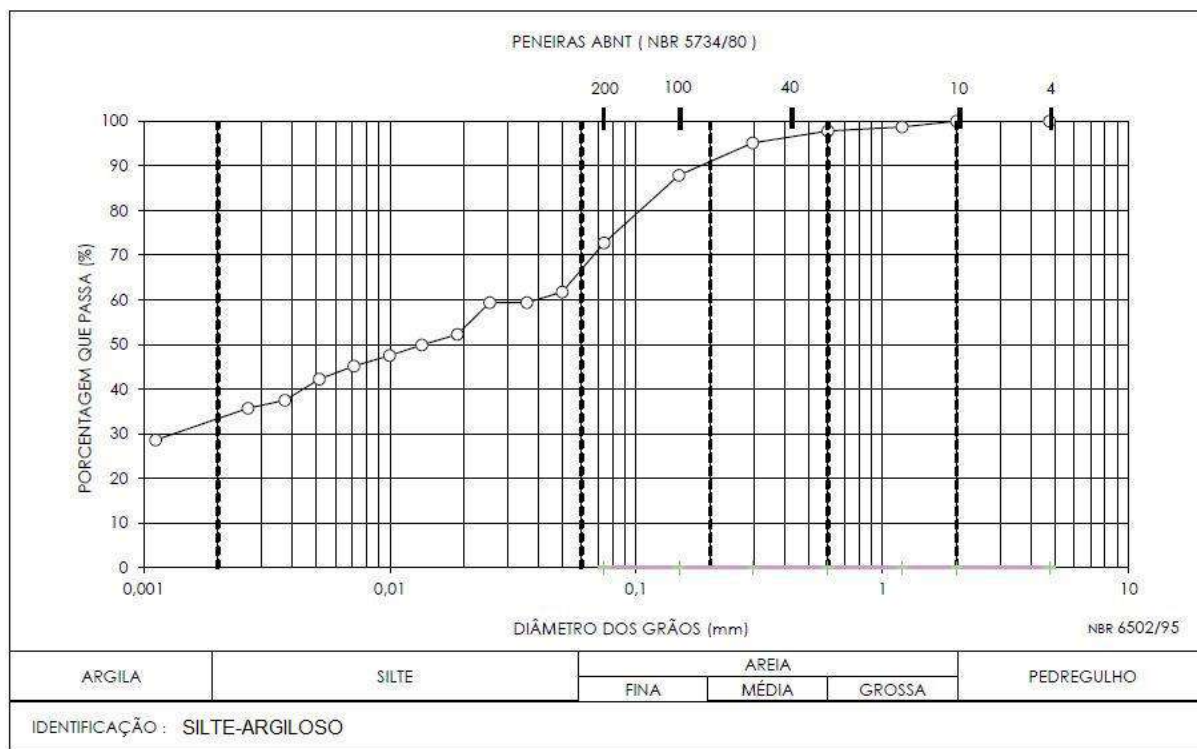
Fig.7 - Granulometric analysis of the second erosion.

Source- Prepared by the author.(ABNT's sieve, Vertical: percentage that goes through the sieve(%), horizontal: grains' size (mm))

The granulometric analysis of the second erosion is shown in figure 7. The present soil had a silt percentage of 38%, followed by 32% of clay, classifying this soil in silt-clayey, having more ability to keep the connections and in consequence, presenting greater cohesion. O sum of the percentages of fine, medium and coarse sand were around 29% of the total. In comparison with the methodology of erosion pins, it can be confirmed that the erosion which has a soil with greater cohesion, is less susceptible of appearing and developing erosions. The second monitored erosion had less progress than the first one, being able to notice that the type of soil also has a great influence in the development of erosions.

IV. CONCLUSION

At the end of this study it was possible to notice that the methodologies applied were effective. The results allowed us to understand how the precipitation factor influences the acceleration of erosive processes, acting directly on the surface, causing the erosion process to increase, generating a big loss of sediments, which are released by the kinetic energy of the water drop and the power of the flash flood. The incline of the land is also a contributing factor, since it affects the speed flow of the water. The higher the incline the faster will be the flow and consequently will have more power transporting the particles. The first erosion had sandy material and plasticity index smaller than the second one, consequently, a smaller cohesion, which explains a higher erosion rate over that time. The technique used in this study is considered cheap and easy to keep up with, and it may be used by the competent bodies to monitor other erosions that may offer some environmental or social risk. It was possible to understand how important the works that contribute to this type of objective are. Having access to a mapping with the identified erosions and their monitoring would facilitate and help to locate them, and for a future monitoring, giving the right containment treatment so these erosions will not keep growing..

V. RECOGNITION

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Delayed in the Psychomotor Development of a Premature born Mother with Malaria failed in the Western Amazon, Brazil

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Abstract— Objective: *To report the case of a young man born of premature birth, whose mother contracted Plasmodium infection falc i one pair in gestation.* **Case report:** *Young male, born at 32 weeks of gestation's, vaginally, Apgar 7 and 8, the first and fifth minute, respectively, weighed 1100 g. He sat down at age two. He spoke at the age of three. He was 4 years old. His mother, primiparous, had malaria in a falciparum in the first trimester of gestation, made quinine tablet 500 mg, in the dose of 1 tablet of 8/8 h for ten days. At the examination: 17 years and 10 months, presented Weight: 39 Kg, Height: 1,51 cm, PA: 80/60 mmHg. He presented good state of nutrition, active attitude, normocorado, normohidratado, acyanotic, eupnéico, without alteration of the cardiovascular and respiratory apparatus, without secondary sexual characters , does not have axillary or pubic hair, penis and testes of infantile aspect, with little increase in its overall size, but with a slight change in its appearance, without intonation of speech, that is, the vocal mute has not yet occurred.* **Conclusion:** *Premature born to mothers who hadplasmodium falciparum infection, presented delayed neuropsychomotor development and secondary sexual characteristics. It recommends the improvement of diagnosis and treatment programs in the services of assistance to pregnant women, perinatology and rehabilitation, aiming at the appropriate and timely treatment and regular outpatient follow-up to prevent or minimize the sequelae of these preterm infants.*
Keywords— Malaria. Plasmodium falciparum. Pregnant women.

I. INTRODUCTION

Neuropsychomotor Development Delay (DNPM) in the first year of life may be related to different risk factors, including genetic, biological, psychological and environmental factors, and there may be interactions between them[1]. There vist to that multifactorial traits are involved in the development of children, and that there is a cumulative effect on the risk of the child present

delays [2,] we see malaria in pregnancy, especially that caused by *Plasmodium falciparum* as responsible for a high morbidity rate - maternal and fetal mortality in the north of our country, particularly in the states of Pará, Rondônia and Mato Grosso [3].

Malaria is one of the main Brazilian endemic diseases, caused by the *Plasmodium* protozoan vector transmission, occurring predominantly in the Amazon Region, with more than 500,000 new cases of malaria per year [4]. The occurrence of malaria in pregnancy is common in endemic areas, where several factors are related to the severity of the disease, such as maternal iron deficiency anemia, low socioeconomic power and deficiency of prenatal services, leading to malicious effects on the concept. Malaria in pregnancy can lead to miscarriage, prematurity, low birth weight, megaloblastic anemia, perinatal and maternal mortality. Complications are more important in primigravidae, in cases with exacerbated clinical symptoms and elevated parasitemia [5].

Given the above, and This article reports a case of a young man born of premature birth, whose mother contracted malaria *falcipar one* in the gestation, and presented delay in its neuropsychomotor development and in the secondary sexual characters and it proposes to comment the controversies of the literature in relation to the findings.

II.   CASE REPORT

TCN, 17 years old, male, single, native of Porto Velho - Rondônia, Brazilian Amazon, resident in line 8 of the Transpurus Project, in the municipality of Canutama - State of Amazonas, 5th grade student (4th grade) of Youth and Adult - EJA. He was born in the Base Hospital Dr. Ary Pinheiro (HBAP), 32 weeks of gestation, of vaginal delivery, with APGAR 7 and 8, in the first and fifth minutes of life, respectively, weighed 1100 g. His mother (MJC), primipara presented *falcipar* malaria *one* in the first trimester of pregnancy, made use of quinine 500 mg tablet at a dose of 1 tablet 8/8 h for ten days, prescribed by a doctor specializing in the infectologi of the Center of Tropical Medicine of Rondônia - CEMETRON. The newborn infant was hospitalized in the HBAP nursery, where he stayed in the incubator and then in a warm crib, around 60 (sixty) days. She was followed *up* for 6 months in the outpatient clinic of the *folio up* of preterm infants, Policlínica Osvaldo Cruz - POC. He did all his own childhood vaccination in POC. He sat down at age two. He spoke at the age of three. He was 4 years old.

At the examination: 17 years and 10 months, presented Weight: 39 Kg, Height: 1,51 cm, PA: 80/60 mmHg. He presented good state of nutrition, active

attitude, normocorado, normohidratado, acianótico, eupnéico, without alteration of the cardiovascular and respiratory apparatus, without secondary sexual characters: it does not have axillary or pubic hair, the penis and the testes of infantile aspect, with little increase in its overall size, but with a slight change in its appearance, without intonation of speech, that is, the vocal mute has not yet occurred.

III.   RESULTS AND DISCUSSIONS

This article reports the complexity of the delay in the DNPM of preterm infants of mothers with *falcipara* malaria during pregnancy, since malaria is considered a serious public health problem, due to its etiological agents, the plasmodia, being found in areas where almost half the population lives world. In the Americas, 21 countries are endemic and 357 million (38.6%) of inhabitants are at risk of becoming ill. Brazil accounts for one-third of malaria reported cases [6]. About 40% of the population in more than 90 countries are living with the risk of malaria contagion. Across the world, among infectious diseases, only Acquired Deficiency Syndrome (AIDS) outnumbers malaria in number of deaths (WHO).

Reports of modern - day (WHO) [7,] 2016 discloses rams were estimated 216 million cases of malaria, an increase of nearly 5 million cases in relation to 2015. The deaths reached 445. 000, a number similar to the previous year.

The pregnant woman is more vulnerable to malaria, and this is due to altered immunity leaving the susceptible ma laity infection, making it risk pregnancy that can at it even lead to fetal death.

The Amazon region is an endemic area in malaria, so it is to be expected that the subject was born and still lives in a vulnerable area.

Du Rante management malaria parasites can penetrate the fetal circulation through the placenta, although it is rare congenital transmission. According to Viggiano [8] in his study of placentas in malaria, it was shown that, although 23% of the cases had placentas parasitized, no parasites were found in any newborn in the first 24 hours of birth. No cases had parasites in umbilical cord blood.

According to Suguitan *et al* [9,] malaria is responsible for microscopic changes in the placenta, such as: deposition of malaric pigment and infiltration of the intervillous space by skin lesions, and may be associated with the presence of the parasite intervilliary fibrinoid deposit, ischemic changes in the syncytotrophoblast and thickening of the membrane basal trophoblast that together with the changes in the intervillous space are

responsible for the Restriction of Intrauterine Growth, prematurity and perinatal morbi-mortality.

A study published by p esearchers [10] of the Institute of Biomedical Sciences (ICB) at USP identified the main structure of the placenta responsible for the inflammatory process caused by malaria during pregnancy, the TLR4 receptor, the study results indicate that in the future, a drug blocking the action of TLR4 may be used in treatment to reduce the effects of malaria on the mother and fetus , such as maternal anemia, decreased fetal viability, and delayed intrauterine growth and motor development implications .

Corroborating with the findings above research [11] recent study , states that malaria in pregnancy is a major cause of mortality and morbidity in tropical regions, causing maternal anemia, intrauterine growth retardation, preterm birth and low birth weight .

Prematurity due to malaria *falcipar one* contracted by the mother during pregnancy, early exposure to extra-uterine environment, which can lead to impaired fast and whole development of the central nervous system [12,] the drug that was used in the treatment of malaria, quinine, these factors associated with neonatal hypoxia, low birth weight and neonatal disorders of the newborn, according to the intensity and duration of these risks, the child may present delays or permanent disturbances in their development [13] .

According to Miranda *et al* [14,] can occur several risk factors in changing the child's neurodevelopment. This definition, although didactic, is not always easily used in daily practice, since in many situations there is a superposition of biological and environmental factors, resulting in a greater probability of damages. *Plasmodium falciparum* infection during pregnancy can be considered as a prenatal biological factor, prematurity and low birth weight as perinatal biological factors and environmental factors such as socioeconomic conditions and unfavorable environment.

In the first years of life, 20-30% of extremely low birth weight preterm infants present some degree of impairment in their motor skills. Neurosensory deficiencies occur in 7-17% of cases. But the most frequent problem at this time is the delay in cognitive development, detected in 30-40% of these children [15] . In this case the subject presented a delay in the psychomotor development, since he sat at 2 years and walked at 4 years, and in cognitive development, therefore, he spoke at 3 years.

A cohort [16] held in Thailand considered an endemic country for malaria, revealed that infection can affect cognitive function and lead to impairment of memory and language functions.

Studies on preterm infants show that health problems decline after the first years of life. At preschool age, 5-30% have some functional limitations in their motor, communication or self-care activities. At school age, many preterm infants are able to perform normally, however, as the intellectual challenges at school increase, new neuropsychological, behavioral, and learning problems may arise. Rates of neurosensory and cognitive disability, psychological and behavioral disorders are high school in preterm infants and especially very low birth weight (<1000 g) [17,18,19.] At age 17 the subject still attended the 5th grade (4th grade) of the EJA, demonstrating a learning delay in school age.

Among the main determinants of poor quality of life of premature infants, we highlight the neurosensory and cognitive deficiencies. In this sense, there is concern in several studies that problems in the development of preterm infants detected at preschool and school age persist through adolescence, and although some may be attenuated over time, others may be underdiagnosed at younger ages precocious [17] .

In a cohort of 79 EBP preterm infants born in the late 1970s and followed up to 14 years of age, only 46% of the adolescents were fully normal in adolescence, 14% had severe motor, visual or intellectual sequelae , moderate deficiencies occurred in 15%, and mild in 25% of the cases. However, it should be considered that these figures may be different for premature infants born in more recent decades [20] . The school performance of adolescents born less than 29 weeks of gestational age, evaluated through questionnaires answered by adolescents, their parents and teachers, showed that most of them attended regular school, had good health status, performed well their academic challenges and had an optimistic outlook for his future. However, one in six of these adolescents presented a motor, sensory, intellectual or behavioral sequel, necessitating a special school [21] .

Puberty is a set of somatic transformations that occur in adolescence and fundamentally involves growth (skeletal, muscular, visceral and other development) and sexual maturation (development of gonads, reproductive organs and secondary sexual characters).

In this case, the young man did not present secondary sexual characters, that is, he did not have axillary or pubic hair, he is in stage 1 of the classification of Tanner [22] , penises and testes of infantile aspect, with little increase in its global size, but with a slight change in their appearance, without speech intonation, that is, the vocal mute has not yet occurred, with a height of 1.51 m. Puberty in boys starts in 98% of cases between 9.5 and 13.8 years of age, and the average is 11.5 years [23] . Looking at studies and charts comparing the development of adolescents, it was verified that in boys

the highest linear growth comprised the stages 3 (13 years) and 4 (14 years) of Tanner [22], which also coincides with the onset of onset of the axillary hair, facial and with some modification of the voice (vocal mute) [23, 24]. After the onset of puberty, the penis enlargement will occur within 12 to 18 months, and the puberty spurt between 24 and 30 months [23].

The vocal muda is a natural process in the life of every adolescent, in both sexes and occurs due to organic maturation, being that in males the changes are more noticeable. This process lasts for a few months and the voice may change. The development of vocal mute may in some individuals delay, prolong or become incomplete. This can be due to hormonal, anatomical, physiological and emotional problems [25]. In males the molt occurs around 13-15 years, while in females around 12-14 years. The changes of the vocal muda are: hoarseness, alteration of the fundamental frequency, changes of intensity and resonance.

IV. FINAL CONSIDERATIONS

Neurodevelopment is related more to gestational age than to birth weight and is influenced by several factors (biological, established, and environmental). Some problems occur early and are definitive, others may arise later and progress, but most disorders disappear or diminish over time. Severe sensorineural sequelae, represented by cerebral palsy, blindness and deafness, are identified in the first 2 years of life and involve predominantly the most immature children, born with less than 26 weeks of gestational age. Delay in cognitive development is the most frequent change in the first years of life, and in school age, with predominance of educational and behavioral problems. It is expected that from adolescence, the problems will be attenuated, allowing good social integration in adult life. Premature infants are at-risk children presenting psychomotor development problems, and associated with complications caused by malaria in pregnancy may be related to the changes found in delayed psychomotor, cognitive, school and pubertal development. What is recommended is the improvement of diagnosis and treatment programs in the services of assistance to pregnant women, perinatology and rehabilitation, aiming at the appropriate and timely treatment through regular outpatient follow-up to prevent or minimize the sequelae of these preterm infants.

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Morphological Description of Blue Shark Liver, *Prionace glauca* (Linnaeus, 1758), Elasmobranchii, Carcharhiniformes

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Abstract— *The liver is the largest gland in the body and plays a central role in metabolic and immune homeostasis. This body is responsible for more than 200 functions such as detoxification, storage, energy production, nutrient conversion, hormonal balance and coagulation. A study of the morphology of the liver of the blue shark (Prionace glauca) during the development phase was carried out. To describe it was used light microscopy, scanning electron and counting of liver cells in this species. The liver occupies 20% of the size of the animal. Fat is gradually accumulated in the liver tissue with the development of the animal, reaching almost 60% of the liver in animals ready to be born.*

Keywords— *Liver. Microscopy. Morphology. Lipids.*

I. INTRODUCTION

In fish, the liver has a function very similar to terrestrial vertebrates as an important role in the metabolism of lactate in pyruvate [1]. This organ can store up to one-eighth of the total glycogen reserves that are consumed during some physical exercise, being used as a source of energy, or even in food when there is a shortage of food [2].

In the marine environment, the blue shark (*Prionace glauca*) is a species of shark that is present in tropical and subtropical waters and is easily captured [3][4][1][5][6]. This species is widely used in culinary consumption and has been decreasing marine stocks bringing ecological concern [7]. Replacement of this species becomes very difficult because it is K-strategist, that is, low level of fecundity and late sexual maturation [8].

To understand the liver of the *Prionace glauca* focus of the study, we begin by understanding the embryonic development of the liver in sharks and bone fish that forms a ventral evagination of the floor of the digestive tract behind the stomach, the more caudal evagination forms the gallbladder and the evagination cranial, being even in most fish, it branches and expands to give rise to the liver [9]. The mesenchyme found in the coelomic cavity induces the hepatic evagination endoderm to proliferate, branch out and differentiate into hepatocytes, liver glandular cells [10][11][12].

Still in these species it presents the format of a horseshoe. The right and left lobes are the same and are connected by an isthmus. The gallbladder is elongated and usually included in the right lobe [13]. They are formed by right and left lobe presenting microscopically lobes formed by hepatic cords, vascularization anastomosed with the central lobular vein [12]. It appears as in all other vertebrates, a key organ that will control many vital functions and play a prominent role in fish physiology, both in anabolism (proteins, lipids and carbohydrates) and in catabolism (nitrogen, glycogenolysis and detoxification). important role in vitellogenesis [14]. On the other hand, it should be considered as a target organ of different physical and environmental aggressions leading to structural and metabolic modification, causing death of the animal [15]. The liver can be considered the starting point for comparative and phylogenetic studies among vertebrates [14][16].

The differences in the organization of the fish liver are due to the complexity of the liver organization that requires a three-dimensional approach, taking into account the plans of histological cuts.

II.   MATERIAL AND METHODS

The 18 specimens of blue shark were 6 (six) of 13 cm, 6 (six) of 26 cm, 6 (six) of 45 cm, were found in the department of Anatomy of the Tuberculos and wild of the Faculty. of Veterinary Medicine and Animal Science at the University of São Paulo. Animals were measured according to Sadowsky [17], and divided into different sizes of embryos and fetuses.

For the collection of the liver, the tubers were opened to the alva line, cranial-cranial direction, breaking the pelvic girdle until the rupture of the scapular waist, located ventrally between the pectorals.

The histochemical analyzes were performed on the samples of the medial lobe D and E of the liver, fixed in 10% and dehydrated in the increasing series of ethanols (70 to 100%), diaphanized in xylol, including paraffin. 5 μm cuts were performed on microtome (Leika, German) and stained with hematoxylin-eosin (HE).

Part of the samples were prepared for semifinished cuts, as they were dehydrated in series with increasing growths (50 to 100%), placed in propylene oxide, embedded in Spurr resin. The blocks were sectioned in a glass knife 300nm thick and stained with toluidine blue. All microscopes of light microscopes of microscopes of light Nikon Eclipse E- 800 of the Advanced Center of Diagnostic by Image - CADI-FMVZ-USP.

For scanning electron microscopy (SEM), the islands were dehydrated in increasing series of humidity of 50% to 100%, with low sulfuric acid content (FMVZ-USP) and carbon colonies in metallic (stub) and metallic bases (*Sputtering*) with silver on the EMITECH K550 metallizer (FMVZ-USP), analyzed and photographed using a scanning electron microscope LEO 435VP (FMVZ-USP).

Quantitative analysis of hepatic cells was performed on 13cm, 26cm and 45cm size tubes, evaluating 18 random photos by capturing computerized images, positioned in a point system containing 1148 points equidistant to 0.5cm. Determination of hepatocyte areas, hepatic nucleus, intracytoplasmic vacuoles, lobular center vein. Statistical analysis was performed by the ANOVA, TUKEY and Pearson correlates. The level of significance was set at $p < 0.05$.

III.   RESULTS AND DISCUSSION

In all samples, the liver of *P. glauca*, located ventrally in the celoma cavity, consists of two long, pointed lobes with a half-moon shape, yellowish and connected by the isthmus. in touch. The liver corresponds to 20% of the total size of the animal. The gallbladder is inserted into the more cranial portion of the right lobe with elongated shape (Figure 1A).

Sharks, like cartilaginous fish, do not have a swimming bladder and are forced to remain in constant motion to avoid sinking [18]. The mean density of the liver is related to the amount of lipids contained therein, and the high oil content allows these animals to float more easily in the water column, acting as a hydrostatic organ [19], corroborating with the where the liver presented 20% of the size of the animal, macroscopically, the size, shape and disposition of its evident liver filling the space available in the celoma cavity of the shark.

Microscopically the liver presented hepatocytes with its central nucleus and hepatocytes with different sizes of vacuoles inserted into the cells displacing their nucleus to the periphery (figure 1B).

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In the six 13cm embryos he observed in the liver a disorganized cellular arrangement without dividing the liver into lobules and some vacuolated hepatocytes of translucent staining and small denominated of microgoticulares (figure 1C, D, E).

In the 26cm animals, there was an increase of the intracytoplasmic vacuoles in all the hepatocyte cells, even with the presence of vacuoles, he observed an organized cellular arrangement evidencing the hepatic cords (Figure 1F, G, H).

In fetuses of 45 cm, it is observed a better organization, when compared to the smaller animals, in hepatic cords with large intracytoplasmic translucent vacuoles denominated of macrogoticulares occupying all hepatic cells and displacing the nucleus to the cellular periphery, causing a balloon format in the hepatocytes (figure 1I, J, K).

In mammals the fat accumulation disorder within liver cells, hepatocytes, is characteristic of a pathological condition, hepatic steatosis, and when there is excess fat and for a long time, the liver cells may suffer damage, becoming inflamed [20]. In sharks, it is a healthy and necessary condition, since sharks use this stock of fat as an adaptation to aid in their buoyancy, as well as serve as a stock of glycogen to transform into glucose for energy, since they are animals that have a great energy expenditure. Another function of the fat of your liver is the importance during vitellogenesis, where the females use this fat for the

maintenance and nutrition of the puppies. Thus, over time, this accumulation of fat pushes the hepatocyte nucleus to the periphery of the membrane, a characteristic action of hepatic steatosis [20].

In the morpho-quantitative analysis, in the counting of the points of the test system, there was a significant increase of intracytoplasmic vacuoles micro and macrogoticulares, according to the growth of the animal. The analysis of variance (*** p <0.001, ** p <0.01, * p <0.05), observed in figure 1.L.
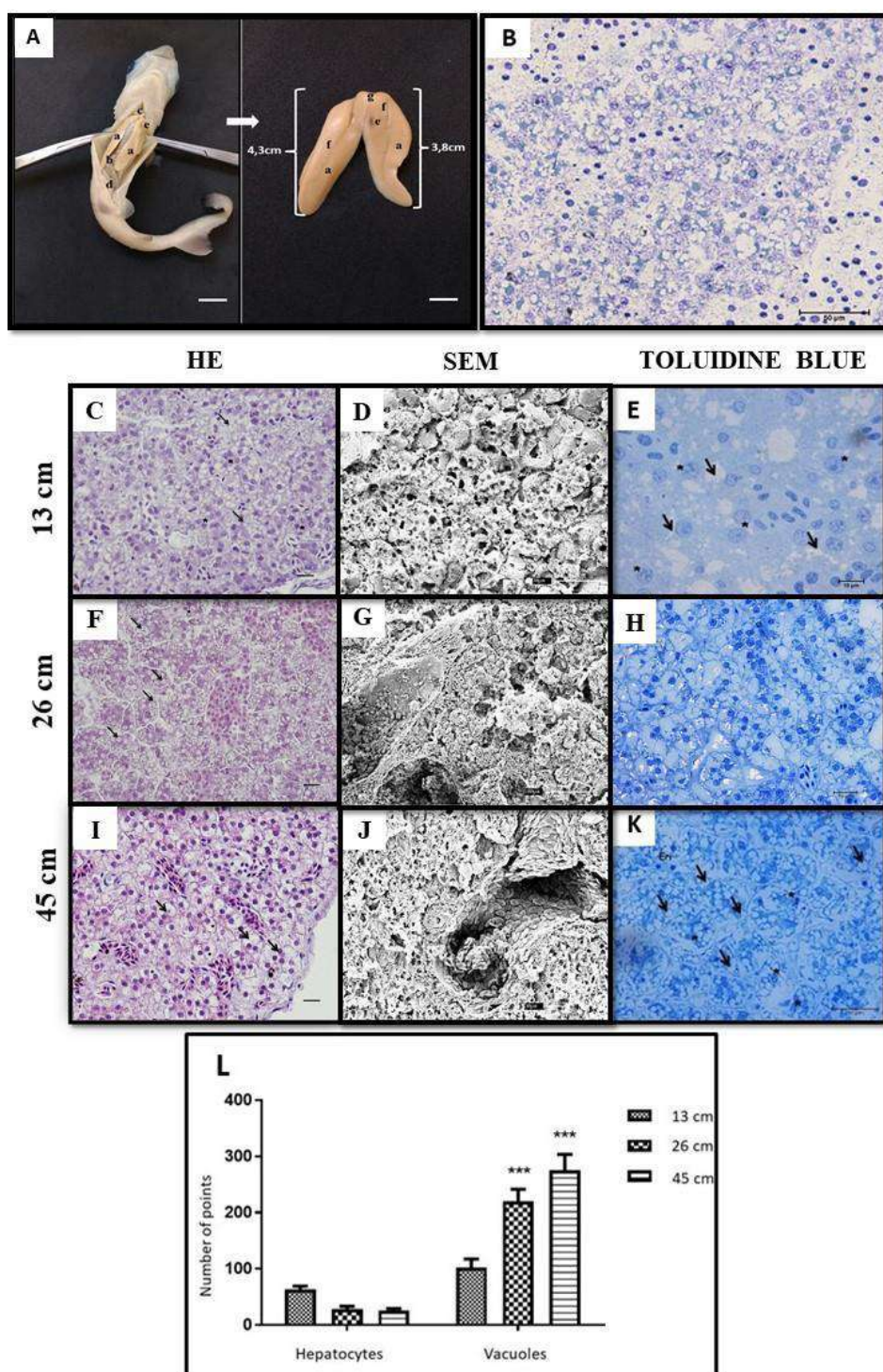
Fig.1: Morphology of P. glauca. In A - Opening of the cavity for access to the liver, ventrally located to the (b) stomach and intestine, caudally to (c) heart and cranially to (d) rectal gland. Connected by (g) isthmus, with (e) adhered gallbladder and (f) impressions of nearby organs. In B microscopy of the liver. Plank from C to K divided by size and staining techniques - (arrows) hepatocytes, (*) micro-articular vacuoles. Bar: 1cm. In L statistical analysis of the results.

Liver size and weight vary according to species, age and season, but almost always correspond to a fifth of their total weight and can accumulate up to 90% in oil [21]. According to BRUSLÉ and ANADON [14], there are differences in liver structures between females and males, as well as between mature and immature fish, but in our work, we could notice a nonsignificant difference between the livers of male and female embryos.

Sharks have a huge concentration of fat in their liver, in an oleic state called squalene [22]. Where in this study we could observe that this stocking of fat begins from the beginning of its embryonic stage, the hepatocytes accumulate fat in its cytoplasm according to the growth of the embryo, statistically proved by the analysis of variance where $p < 0.001$.

IV. CONCLUSION

The liver occupies 20% of the size of the animal. Fat is gradually accumulated in the liver tissue with the development of the animal, reaching almost 60% of the liver in animals ready to be born.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

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Morphological Description of the Green Turtle Tongue (*Chelonia mydas*)

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Abstract – *In chelonians, the gastrointestinal tract is anatomically diverse among the large variety of reptiles, and this fact requires further studies to understand their particularities. For that, four green turtles were used to find beached dead, for macroscopic and microscopic analysis using light and scanning microscopy in search of the description of their morphology. The tongue presented as a non-protuberant organ, with a rigid and highly keratinized aspect. Concluding that the morphological structure of the turtle's tongue is adapted according to its abrasive feeding during capture and swallowing of the food.*

Keywords— microscopy, morphology, chelonians, keratin.

I. INTRODUCTION

Sea turtles are reptiles belonging to the Reptilia class of the order Chelonia and suborder Cryptodira (1), and there are only representatives of the families Dermochelydae (1) and Cheloniidae (3). Physiological, anatomical and behavioral adaptations allowed sea turtles to inhabit both marine and estuarine environments (4).

The green turtle (*Chelonia mydas*) belongs to the Cheloniidae family and inhabits the tropical and subtropical oceans (5). Using estuaries of rivers and lakes (6), they make use of the Brazilian coast for feeding and spawning (7). Its name is due to the greenish coloration of its fat, but that is not related to the external appearance (8)(6).

The diet of *C. mydas* varies throughout its life. In their early years they have omnivorous eating habits, with a carnivorous tendency, guaranteeing a fast growth, allowing them to avoid predators (9) (10). When reaching the juvenile stage, from 25 to 35 cm of Curvilinear Length of Carapace (CCC), the green turtle becomes preferentially herbivorous, the only species of marine turtle to present

this type of diet (2)(11)(12)(13). At this stage, *C. mydas* generally uses shallow areas to feed, while preferring deeper areas to rest (14). The dietary habits of C. mydas are largely associated with on-site food availability, turtle selectivity and /or habitat type (13)(15)(16)(17).

The green turtle is the only turtle that feeds on sea grass, being its largest consumer in tropical and subtropical waters (15). Marine grasses are angiosperms that grow only in marine environments (18)(19). These angiosperms play a key role in coastal ecosystems: they have high primary production, capture carbon from the atmosphere, participate in nutrient cycling, feed on coastal food webs and serve as habitat for microbes, invertebrates and vertebrates. Currently marine grasses are threatened by factors directly related to human practices, such as fishing, aquaculture, coastal area constructions, as well as indirect human impacts, such as changes in global temperatures and sea level rise (19). causing these animals to seek other means of feeding.

The juvenile green turtles also have a diet composed of animal material, and it may be occasional with the animal adhering to seaweed and sea grass (20). Invertebrate consumption can be considered to occur due to the opportunities present at the feeding site when they are abundant, and invertebrates in their diet are supplemented by their diet to obtain vitamins, minerals and essential amino acids (20)(21)(22). Live turtles and jellyfish are also widely consumed by green turtles (20)(23), and since the movement of these items is similar to plastic debris in the water, green turtles can often accidentally ingest such waste and confuse it with their usual food (24)(25).

In chelonians, the gastrointestinal tract is anatomically diverse among the large variety of reptiles, and this fact requires further studies to understand their anatomical specificities (26). Traumatic lesions in the oral

cavity, tongue and esophagus, may progress to secondary bacterial infection.

Thus, as described above, the green turtle's diet is highly diversified and abrasive, making it necessary to perform work with a description of its gastrointestinal tract to assist in filling in and updating existing gaps in the literature, providing subsidies for new work involving their macro and microscopic anatomy, morphological changes during a pathological process, as well as help in the attempt to trace new mitigating strategies

II. Material and Methods

Four marine turtle specimens were used, found dead on Guaraú beach, Peruíbe - SP and obtained with authorization and licenses approved by ICMBio / SISBio: 50132-1 and CEUA-IBIMM: 005/18. For histological analysis, samples of the tongue were collected and fixed in 10% formaldehyde for 48 hours, in the sequence dehydrated in increasing series of ethanols (70 to 100%) and diaphanized in xylol, with subsequent inclusion in paraffin. 5 μm thick cuts were performed on the microtome (Leika and German 1988) and stained with hematoxylin -

eosin, and Mallory staining. The images were obtained through the Nikon Eclipse E-800 light microscope.

Part of the material was prepared for scanning electron microscopy. After 10% formaldehyde fixation were dehydrated in increasing series of alcohols in concentrations of 70%, 80%, 90% and 100%, dried in a LEICA EM CPD 300 critical point apparatus, glued with carbon paste in metallic aluminum bases (stub) and silver (sputtering) in the EMITECH K550 metallizer, and analyzed and photodocumented in LEO 435VP scanning electron microscope (SEM).

III. Results and Discussion

Macroscopically, the tongue of the green turtle is attached to the oral floor and not projectable, thick and wider in breadth than length, with red-whitish color and rigid appearance and rough surface. The glottis is located in the final portion of the tongue, as an opening opening function to close the airways. The esophagus begins at the basal portion of the tongue, presenting itself as a muscular tube through which food passes to the stomach (Figure 1).
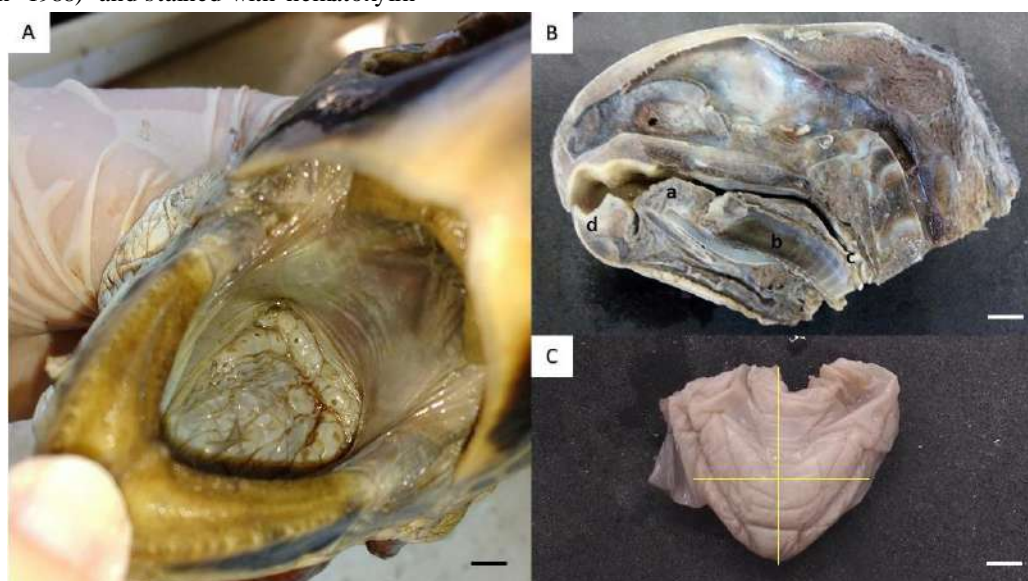
Fig.1: A: oral cavity of the green turtle (Chelonia mydas). B: sagittal cranial cut of C. mydas, demonstrating the organization of the organs arranged in the oral cavity, serigraphy (d), non-projectile tongue, trachea (b), esophagus (c). C: Language removed from the turtle. Bar 1cm.

According to Ovalle and Nahirney (27), in mammals language participates in the chewing, tasting and swallowing processes. It is covered by stratified squamous epithelium, and the dorsal surface, which is in contact with the hard palate in swallowing, in speech and at rest, is keratinized. The upper face of the tongue is irregular, due to protrusions of the epithelium and underlying loose connective tissue: the papillae (28)(29).

Despite being a group with growing interest in the study, the gastrointestinal tract of the chelonians is anatomically diversified, due to its great variety of species,

adaptations and food customs, and still little described in the literature. According to Wyneken (30) the tongue of the tortoise is fixed to the floor of the mouth and not protuberant, corroborating with our findings. However, in his studies, it is described that the glottis occurs in the medial portion of the tongue, whereas in our specimens we describe that the glottis is present in the final portion of the tongue, next to the portion of the frenulum of the tongue where the muscular tube begins. esophagus.

In the microscopic analyzes of light and scanning electron, the tongue of the green turtle is covered by a

squamous keratinized stratified squamous epithelium from its apical to basal portion, presenting germinative extract with presence of keratinocytes, stratum spinosum, dense

and loose connective tissue and a large layer of skeletal striated muscle. The epithelium is covered by small short projections and flattened throughout its length (Figure 2).
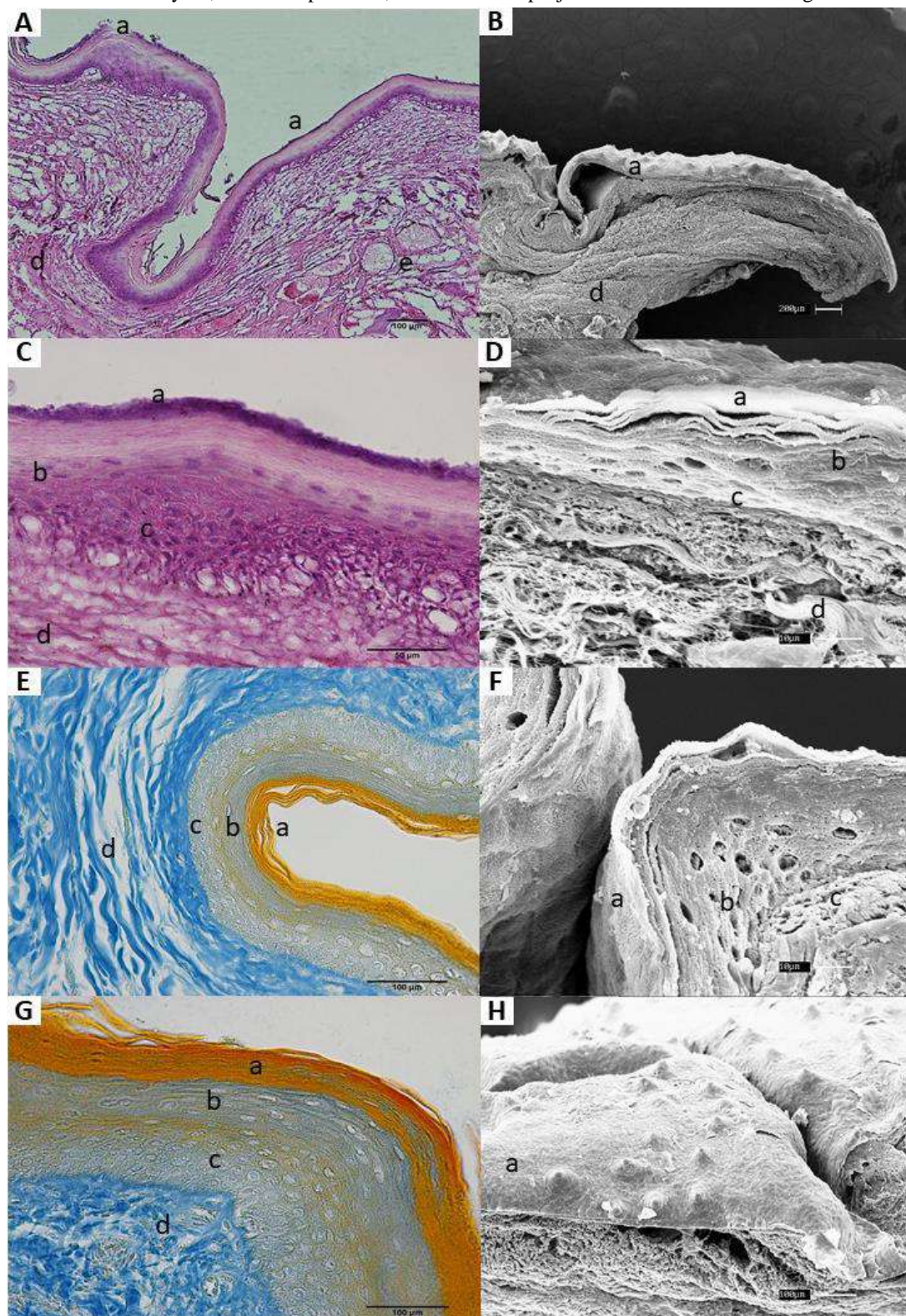
Fig.2: Green-tongue photomicroscopy (Chelonia mydas), by light and scanning microscopy, showing squamous keratinized stratified squamous epithelium, divided into a layer of keratin (a), stratum spinosus (b), germ stratum (c) where keratinocytes are matured. Below muscle tissue (d) richly vascularized by small venules (e) with presence of nucleated erythrocytes. A and C: light microscopy with HE staining. E and G: Mallory coloring, blushing keratin in orange. B: Scanning electron microscopy, sagittal cut of the tongue of the tortoise, with a scaly layer of keratin with small protuberances of keratin. D and

F: scanning image of the keratinized pavement epithelial tissue. H: scanning image of the rough surface of the turtle's tongue, evidencing the thick layer of keratin with varied short and flattened keratin projections.

In the work of Silveira (31) where they studied the oral cavity of *Podocnemis expansa*, the Amazonian turtle, although they are different species with different eating habits and environments, there are some similarities in their characteristics.

Silveira (31) describes the tongue as a muscular structure, with rhombus shape with different colorations in its regions, with papillae scattered on the surface of the epithelium, with the presence of taste buds attached to the coating epithelium. Regularly covered by cylindrical pseudo-lamellar epithelium, with non-keratinized goblet cells and with considerable presence of mucous cells. In our study with *C. mydas*, the tongue also presented a rhombus shape, but with only one coloration throughout its length. Width larger than length, its surface is covered by projections of the epithelium being formed only by keratin, without any presence of papillae or buds attached to the palate. Its epithelium is pavement keratinized and without presence of mucous cells. The entire floor is covered by a thick scaly layer of keratin with projections of keratin for all its extension only with mechanical function, its morphology indicates adaptation to the abrasive feeding and protection of the oral cavity.

Junqueira and Carneiro (32) describe filiform papillae with a pointed and keratinized shape that have mechanical paper helping to scrape the food increasing the friction in the mastication (27)(28)(29)(33) that despite a different shape from that in the C. mydas described in our results, they are also formed from keratin, thus attributing the same mechanical function aiding in the rubbing and scraping of the food during swallowing of the turtle.

IV. CONCLUSION

The morphological structure of the turtle's tongue is adapted according to its abrasive feeding during food capture and swallowing, using the thick layer of keratin to protect its oral cavity and also serving as the basis for new studies to identify pathological alterations advising with conservation.

V. ACKNOWLEDGEMENTS

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

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Analysis Management of oil Company Logistics Supplier

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Abstract: The evolution of markets, technology and transport has reconfigured the way companies relate to each other and the market. Basically, nowadays all companies operating in any market participates in a Supply Chain (or network), which facilitates the agility of responses in the face of market changes. This work aims to verify the level of Supplier Management, specifically Logistics, in a company in the oil and gas segment. A bibliographical research was carried out on the themes chosen and subsequently a case study with qualitative bias in depth. The results showed that the reduction of the supplier base constitutes an important factor to assist the company both in the management of its suppliers and in the improvement of services rendered

Keywords*— Suppliers; Petroleum Sector; Management.*

I. INTRODUCTION

The search best distribution of supplies dates from ancient wars, when the soldiers went out for long battles, in places distant from their origin and lasting months. In These truly epic battles, the capacity to supply the resources needed to combat and maintain the troop in the medium/long term were factors that could define the outcome of a battle more than strategies used during the battle in Si (SILVA and MUSETTI, 2003).

The Second World War, the first oil crisis in the decade of 70 and the later profound depression, also of oil, in the mid-80, forced companies to change the market perception of a scenario where the company defined what was sold – production Pushed – to what is observed after the decade of 70, where the market begins to pull the demand for goods and services. This change in the way the company is positioned before the market, or is forced to position itself, can be observed through the formula sales price = Production cost + Profit for the formula Profit = Sales price – production cost (ANTUNES, 1998).

Despite being a seemingly subtle change, the fact that companies no longer imposed the final value of the product has triggered a series of internal changes to organizations in order to lower their internal costs in order to increase profitability. Tools such as Kanban, Kaizen, Total Quality Control and a procedural and transactional view accompany iteratively this need to reduce internal costs.

The Logistics stands out in this medium, then, as an activity of 1) cost reduction and increase of internal efficiency, not perceived directly by the client (Inventory control, point of order, physical arrangement of material etc.) and as 2) factor that adds value As a service directly connected to the customer (product delivery time, availability, distribution at physical points of sale, etc.) (BALLOU, 2004).

Also in the decade of 70, another movement was observed that would form a new model of business management.

Moura (2009) explains that companies were extremely verticalized, they manage to develop internally everything, or as much as possible inputs used in their production line.

According to Marinho and Neto (1997), the Japanese model of management was a major driver for the change of this paradigm. Focused on production management, companies began to work in their main business, generating a change of strategy denominated "de-verticalization" (MOURA, 2009).

The "Deverticalization" has been called in the literature, Vertical Disintegration, means the change of the extremely centralized modus operandi, for a model where the company starts to acquire, in an increasingly increasing way, materials and services of Other supplier Companies (ABRAMCZUK, 2001).

The Strengthening of this new configuration, where the company starts to focus increasingly on its product (core business) and depending on the supply chain which is inserted, that is, of its suppliers, has caused companies to develop new techniques for Maintenance of the quality of the products/services purchased (MARINHO and NETO, 1997).

In This context, the research carried out in this work aims to understand the company's relationship with its suppliers and to identify whether the practices are aligned with what is proposed in its Norms. In this way, we intend to answer the question: can the volume of logistics suppliers be optimized for better management?

II.   SUPPLIER MANAGEMENT

The growing internationalization of markets has imposed a scenario of fierce competition between companies, demanding a high degree of agility and adaptation. The paradigm of verticalization that had been present, under the idea that the company should produce, as far as it was capable, its own material of consumption, had worked until the present moment. However, the centralization of production imposed many needs to which the dynamics of the new market did not fit: high inventory levels; coverage of materials produced; hierarchization (MOURA, 2009).

Abramczuk (2001) cites a passage where Henry Ford says the iron ore barges, the port that receives it, the railroad that it uses and the coal mines used by them were all of its property, which consistent with the maximum

vertical paradigm in force early twentieth century. This logic of operation made sense in a market where the supply was less than demand – production pushed – and the final consumer assumed the cost of internal inefficiency of the company (ANTUNES, 1998).

Already Moura (2009) exposes systematization for decision making in order to produce or buy – make or hire – determined well or service. Regardless of the systematic adopted in the decision to make or contract, several authors agree that the final result of disintegration should include, to a greater or lesser degree, depending on the company's strategy, elements such as: cost reduction; Increased profitability; Increased specialization in its area of expertise (core business); Increase in quality; Increased agility to change; Reduction of stocks (MARINHO E NETO, 1997) (LAMBERT, 2008) (MOURA, 2009) (MELO, 2012) (SILVA And ALVES, 2012).

In this way, Abramczuk (2001) ponders that Vertical Disintegration is initially "a reconfiguration of the boundaries between the internal structure of a company and its external environment", raising an environment of cooperation between companies Supplier and customer through the conjugate of actions and culminating efforts in a common goal.
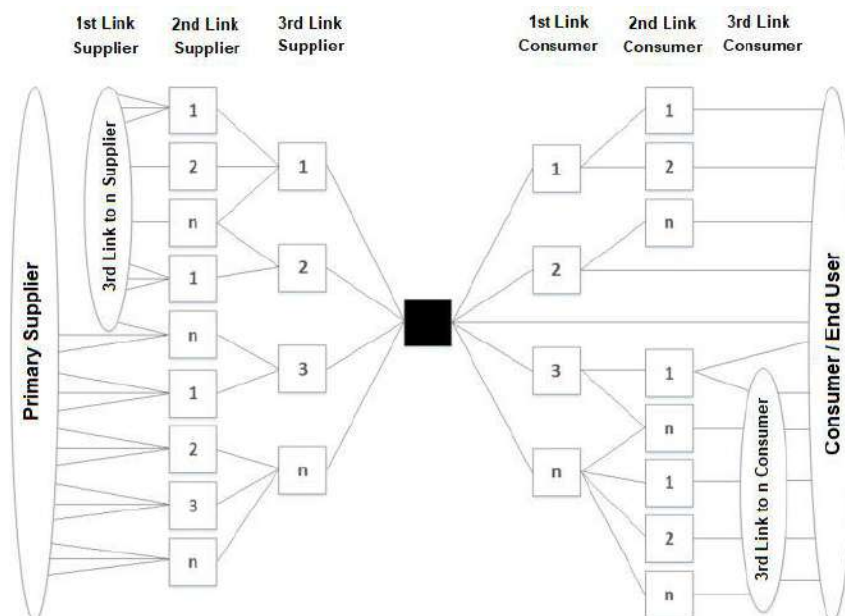
Fig. 1: Structure of Supply Chain connections. Source: An Executive Summary of Supply Chain Management - Processes, Partnerships, Performance. Source: Adapted from LAMBERT, 2008

This new configuration companies that operate a growing cooperation, form network and with common objectives, will be named Supply Chain, or Supply Chain.

Lambert (2008) draws up a discussion on the term Supply Chain Management, pointing out that many have confusing the term with Logistics, including Customers and Suppliers, or the combination of Operations and Purchases, and even the combination of Operations, Procurement and Logistics. However, it defines the term as being responsible for managing the entire network (its key processes), not just the chain, as the name suggests, from vendors and customers, from beginning to end of the process. Figure 1 Highlights companies in middle of a Supply Chain (network).

For Moura (2009), the relationship between the Members belonging to this supply chain occurs through a close relationship with related businesses. Companies immediately after before certain process, is given the name of customers and supplier.

Lambert (2008), citing the eight pillars for good supply chain management, points out that supplier management must act in a way to develop and maintain a long-term relationship with key suppliers. For him, a good acquisition does not depend solely on the lowest price, but of a partnership that, in the long term, will benefit the company customer, supplier and the whole chain.

Silva and Alves (2012) commented that understanding the management of suppliers and the flow of information resulting from this process "gives the organization the possibility to act strategically (...) [resulting in] meeting the demands of customers with adequate quality, prices and deadlines and reduced cost to the organization."

In This way, the company must seek to identify and rearrange its supplier base through a specific process geared towards the purpose of maintaining supplier management. In This process, the company must measure its needs and seek to verify that the supplier can meet reasonably, taking into account its ability to adjust against market changes. In a dynamic environment, characterized by interdependence among companies, the agility of the client company is related to the flexibility of its suppliers (FORKMANN et al. 2016).

Garcia et al. (2015), when analyzing the phases of the relationship with the supplier, highlight 7 steps that encompass this process: 1) Search and selection/segmentation of suppliers; 2) Negotiation of contracts or agreements with suppliers; 3) Management of information flow with suppliers and use of Information Technology (IT); 4) Coordination of supply scheduling with suppliers; 5) Realization of the purchase/acquisition of materials, components or products; 6) Transportation, receipt, inspection, storage and handling of materials, components or products; and 7) Evaluation of suppliers ' performance.

During this rearrangement of the supplier base, Christopher (2007) states that there may be a tendency to decrease the number of supplier companies, through a partnership bias between the buyer and the supplier. This reduction can be accomplished in order to restrict the number of critical suppliers from the perspective of the client company, celebrating few contracts, but together with suppliers with expected service capacity.

Despite the degree of risk restricting supply to a single supplier, demand consolidation in a few vendors can mean gain for the company. (GARCIA et al., 2015). Melo (2012) talks about the importance of being a reliable company to be part of the supply chain. For this, in the client company's point of view, the supplying company must undergo a process of qualification, approval and evaluation, which will indicate the possible suppliers to its base (RAMBO et al., 2006). Figure 2. Strategic supplier management.
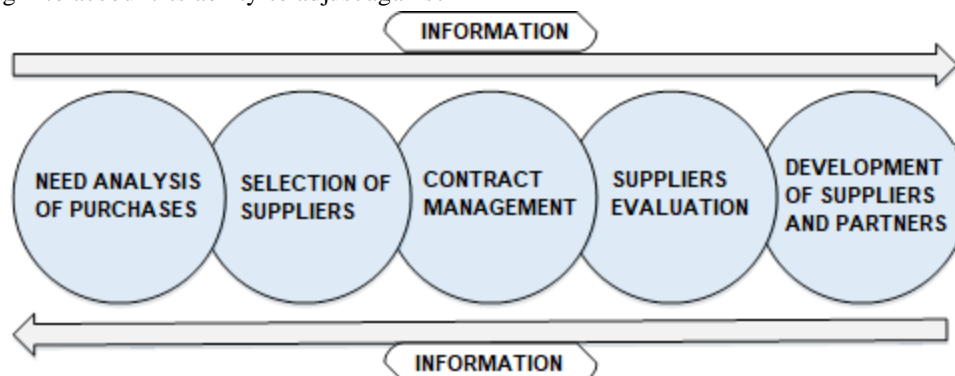
Fig. 2: Processes of Strategic Supplier Management. Source: Strategic Management of Suppliers. Source: Adapted from SILVA and ALVES, 2012

Finally, the Purchasing function is no longer seen as a routine of bureaucratic and repetitive activities, and takes the role of strategic role in supplier management. Since it is in direct contact with the market and the suppliers (current and potential), the Buyer today is ahead of the role of understanding the company's demand, from an interfunctional perspective (between functions), and is able to analyze, select, manage, to evaluate and develop partnerships with suppliers. (SILVA and ALVES, 2012) (RAMBO et al., 2006).

III. METHODOLOGY

Meall Tte research methodology used in this study consists in the bibliographic analysis of exploratory nature and case study with qualitative bias in depth.

According to Oliveira e Martins (2010), this method "allows to survey the theoretical and methodological aspects necessary to achieve the established objective.

"This way, the research methodology involves the three types: Review, Case Study and Qualitative in Depth Study – is the type of interview" that presents greater flexibility, allowing the interviewee to build their answers without getting stuck to a stricter level of directivity and mediation on the part of the interagency. " (OLIVEIRA, MARTINS et al., 2010).

IV. CASE STUDY

Object of the present case study, the ABC Company is a service provider in the field of large oil and gas, founded in 1927 in France. It Operates in more than 85 countries and has around 100 (one hundred) thousand employees worldwide. It has revenues exceeding US $45 billion, according to data from 2013. In Brazil, it offers services related to the Oil and Gas industry broadly covering the oil extraction process, from the identification of oil potential, through the analysis of the fluid to the delivery of the well for operation.

Its service network is offered throughout the national territory, performing services both on land (on-shore) and at sea (offshore) and has several fixed operations bases installed close to the largest outlets. The size of the company, the specificity of the service and the range of materials and equipment mobilized for an operation can vary in such a way that a number of few containers up to approximately 60 containers may be needed to service at services, with high added value materials.

It is Emphasized the complexity in the treatment of some materials, namely, equipments that require high pressure testing and need specialized centers for certification; Radioactive material that requires license and special equipment for protection and handling; and

explosives, army-controlled material that has no free movement.

All these items integrate a problem in the assembly of an operational base, whether temporary or fixed, because they require the installation of structures of high added value. In This sense, the solution found is in transporting these materials, whenever necessary, between the smaller operating bases to the place where the service can be carried out, or the material stocked.

To meet the need for its operations, seeking excellence, quality and safety in its activities, the company currently has 23 (twenty-three) regulatory standards that meet the external specifications to the company as local and federal government, and internal standards, which together perform the basis of their operations. These standards are seen in such a way that they are presented in a comprehensive manner in the week of induction of new employees and serve as pillars for each activity performed, characterizing themselves impassable guidelines of orientation to their employees , where each exception must be expressly authorized in specific cases.

All 23 standards are available on the company's intranet and have at least two files: 1) Standard 2) Standard Guide and user Manual. Other supporting files may be included within each standard, such as a liability matrix and risk identification matrix. The rules can or do not cite each other, as in the case of items relating to the QHSE, which is exhaustively taken into account in the drafting of these standards.

In order to maintain the level of operational failures close to zero, the company encourages employees to report potential risk, incident or accident activities on the intranet constantly. Depending on their nature, these reports may be part of existing standards, or even the drafting of a new standard.

It can then be said that the norms are: 1) object of orientation to the employees; 2) regulating items; 3) periodic update target; 4) Once a standard has been established, it must be followed, except in a specific case, with the need for express authorization; and 5) Living document, since it can be altered in order to improve its process (s). In this sense, the three standards, which this work is supported, were presented in a more detailed manner below.

4.1. Audit

A norma que rege o processo de auditoria na empresa foi elaborada para fins de verificação da implementação dos padrões de conformidade na companhia e é regido de acordo com a legislação, políticas e protocolos locais, acrescido de observações dos funcionários sobre potencial

perda, seja de funcionário, dinheiro, ativo tangível e/ou intangível, processo (tempo) e/ou imagem.

According to the document, "Audits are carried out to verify the level of conformity of a given operation in an entity, according to the requirement (s) established in the norms that integrate the Quality Management System", having as Objective: a) to help management to identify areas of improvement; b) Development of an internal culture aimed at self-audits, regularly and with

confidence; c) stimulate continuous improvement; d) Facilitating the standardization of the company's operations at a global level; e) identify and share best practices observed during the audit; f) The consolidation of ideas and good practices among the various groups created for auditing; g) assist in the development of Corrective Work Plans; and h) Validate or dispute the current practice adopts. Figure 3 synthesizes the flow of activities related to the audit process.
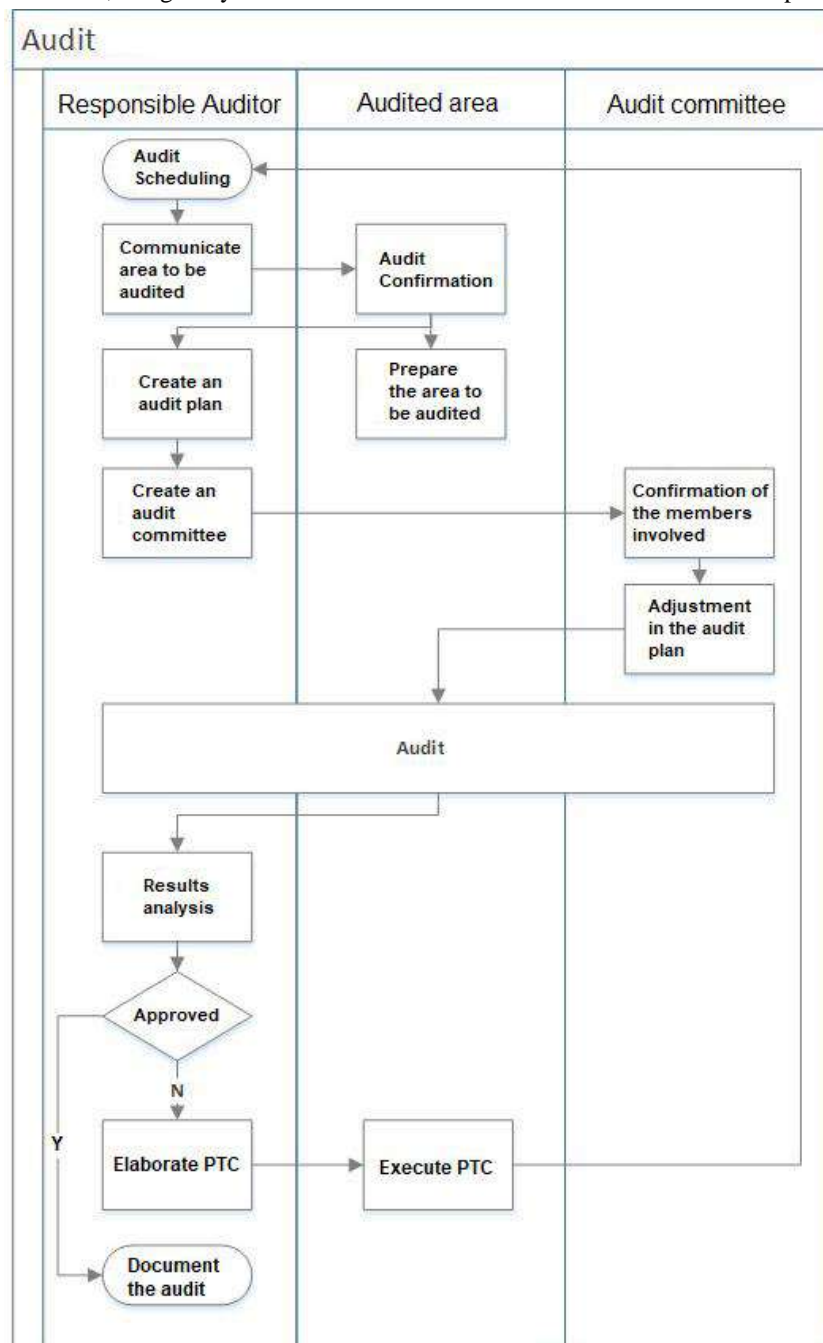
Fig. 3: Audit Process; Source: Own

These audits must be carried out at a maximum interval of three years, and the annual audit is considered

good practice. Areas considered as high-risk should be audited in a maximum interval of two years.

4.2. Contract

The norm governing the hiring process, whether with a customer or a supplier, aims to establish the fulfillment of QHSE policies and other standards established by the company. These policies should be considered in all parts of the hiring process, either in the 1) planning, in the 2) quotation, in the 3) selection and hiring, 4) mobilization and management, as in the 5) demobilization and termination of the contract, because it is considered that A customer/vendor failure directly impacts the company. In This Way, the document shows that "the whole process of hiring (...) should be conducted in such a way as to ensure that the risks of QHSE and its obligations are identified, evaluated and adequately managed".

Figure 4 demonstrates the contract model selection flow.
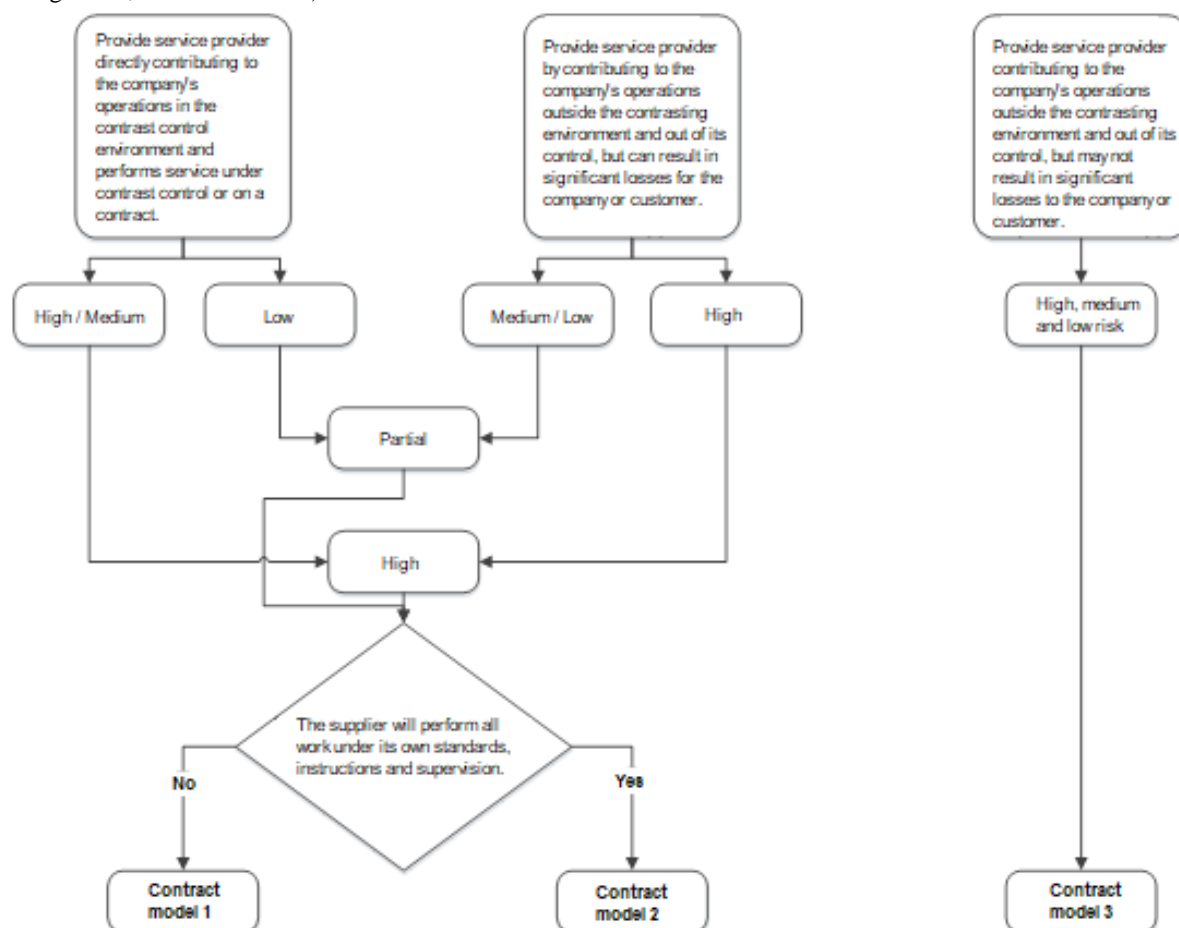
Fig, 4: Selection of the Contract Model. Source: Adapted

4.3. Management

The purpose of carrying out its activities in the most varied locations in the world, the company recognizes the need to transport both materials and people and points out that this need, intrinsic to its business, has a high degree of risk of accident with Potential for death and/or injury involving employees, relatives, suppliers or third parties and/or damage to their equipment. In This sense, this standard aims to establish standards for accident mitigation, and must be followed by all its employees and contractors, as defined in the category of management risk.

The data is extracted from several sources, but based, necessarily, obeying this order of relevance: Site of the Global Health Observatory/Injuries & Violence/Road Safety; Global Status Reporton Road Safety; United Nations Economic Commission; IRTAD Road Safety Annual Report; World Life Expectancy; Research elaborated by employees of the company; Independent organ reports; and reports made by the country itself.

This analysis should be updated annually by each country and will serve as a basis for the training policies of the drivers and the usurers of the service in each locality, allowing the greatest deficiencies in a given country to be identified and, through training, Mitigated.

In This phase, Risk Analysis and Hazard Control (HARC) are also carried out on the type of material transported in the locality, which will have a direct impact on the requirements of: 1) Induction Training; 2) Frequency of Recycling Trainings; 3) Travel

Management; 4) Steering Monitoring; and 5) Vehicle Specifications. Figure 5 points to the items that must be

checked in the drafting of the HARC.

Regulation and Laws	Operating conditions
Traffic regulations	Type of vehicle used
Licenses and Permission	Special vehicles
Vehicle Inspection	Transport of dangerous material
Transport regulations and dangerous cargo	Type of cargo
Consequence of non-compliance	Need for escort
Licenses / Permission for foreigners	Time of travel
Specific steering rules	Check the type of road and its conditions
Weather	Communication
Climate assessment (seasonal)	Safety
Climate assessment (non-seasonal)	**Driving the night**
Customer requirements	Limitations
Customer rules and regulations at your facility	Rules
	Exceptions

Fig. 5: Classification of Categories considered in the HARC. Source: Adapted

V. RESULTS OBTAINED

Over the years, the company has developed several process management software (ERP) capable of generating a large volume of data and information. However, the freedom to develop and acquire these tools, coupled with the lack of expertise to do so, has caused several ERPs, although useful, not to communicate with each other directly.

Another important factor in the data analysis was the perception, by the users, in the lack of adherence between what was in the system and what the real world represented. Part of this problem was justified by the need to expedite the process of registering new suppliers; By high turnover, which included staff not yet well suited to industry practices in the process; And the difficulty of establishing metrics for suppliers framing.

Regardless of the real cause in the lack of adherence of the registers, it was necessary to analyze and segmentation of all the active companies in the Sourcing system, since these, once active, are visible by the Procurement team and thus can be used to Procurement of goods and services. Likewise, the correct segmentation provides greater accuracy to the analysis of Sourcing, because they are responsible for identifying and creating negotiation strategies with suppliers.

Thus, it was necessary to search for data in two company ERPs: The Sourcing, with the list of active suppliers in the system as well as various data related to them, including level of criticality and segment; And in the Financial, where we searched for data regarding the value spent by supplier between January/2015 and August/2016.

Thus, the first part of the data analysis was to identify the active suppliers in the company. To do this, a report with the status list of each vendor was extracted from the system used by the Sourcing team. The same was done in the system used by the Financial. Subsequently, the two databases were crossed, allowing the visualization of the value spent by an active supplier in the aforementioned period.

At This Point, it was possible to observe the total value spent by a supplier, however, two key factors for the analysis were still considered incongruent: the segmentation of suppliers and their criticality. To identify the first, the entire list of suppliers was revised and reclassified according to the nature of its operation, allowing the supplier to segment the suppliers correctly and, therefore, identify the logistics suppliers.

Figure 6 shows the dispersion of logistics providers based on the value spent between January and august/2016:
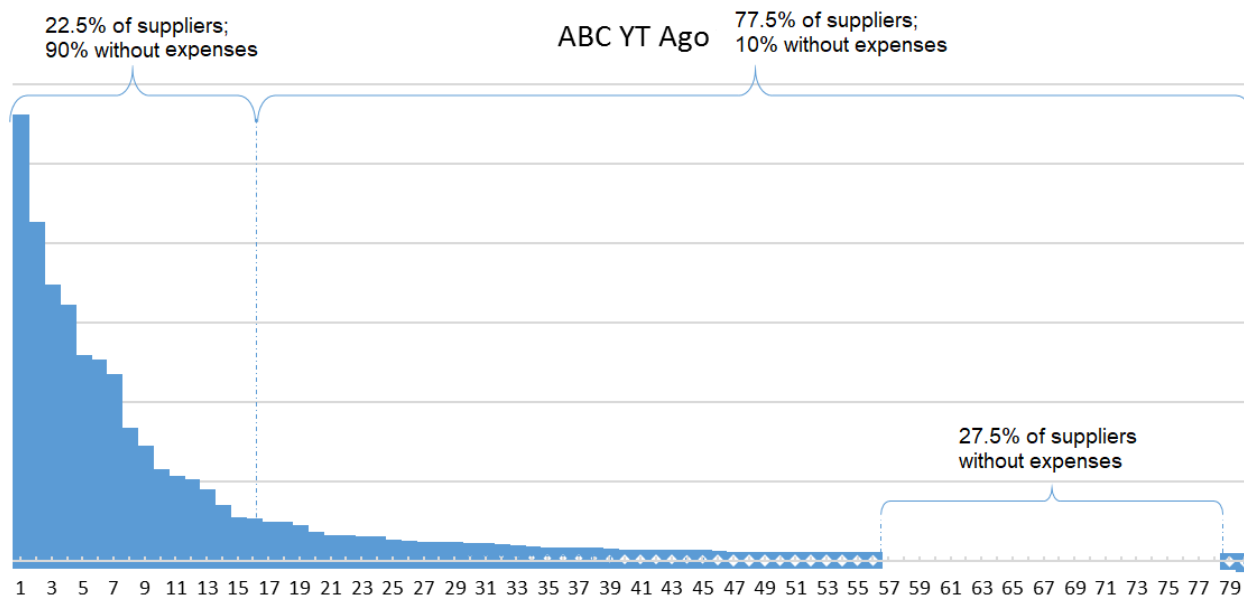
Fig. 6: Dispersion of Logistics Suppliers based on the value spent. Source: Own

After segmentation, it was possible to visualize in a clearer way how the expense with the logistics vendors was being distributed.

It is noteworthy that there was no expense with 27.50% (22) of 80 suppliers of this segment in the year 2016 until the month of August.

The last two suppliers of the chart are listed as a negative balance by applying a contract fine, that is, they are being used, but the company still has credit with them. Figure 7 and 8 show the evolution of spending with active suppliers in the system:
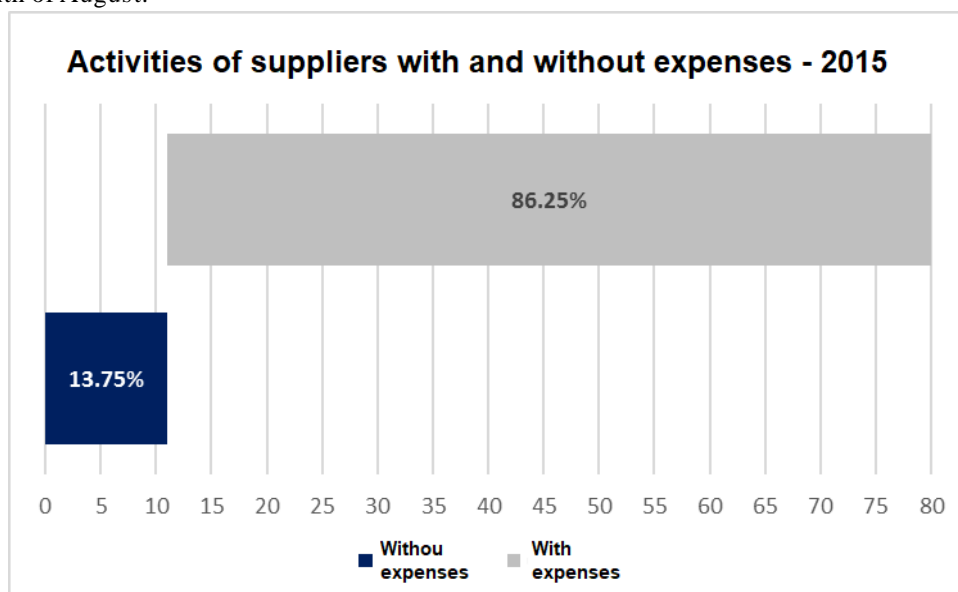
Fig. 7: Supplier Activity with and without expense 2015. Source: own
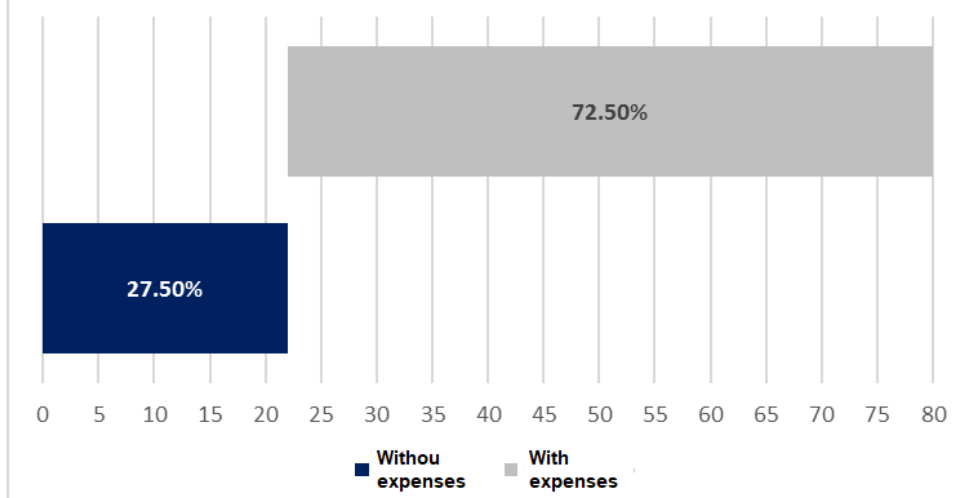
Fig. 8: Supplier Activity with and without expense until Aug/2015; Source: Own

Despite the discontinuity of services having doubled between 2015 and 2016, the fact that the vendors are active in the system is characterized by a problem situation for the audit team, since they need to create an audit plan at the beginning of each year. Thus, as there is no confidence in the data presented by the ERP, nourished by the Sourcing team, and then problems of redundancies are subject to appear.

In fact, difficulties were reported regarding the effectiveness of the annual audit plan. In addition to being included companies that were no longer part of the supplier base, but which are listed as active in the system, the auditors pointed out that the criticality classification was not consistent. Thus, vendors who did not need to be audited were included in the plan and critical suppliers stayed out. In Figure 9 can view the generic flow of information about the vendor data:
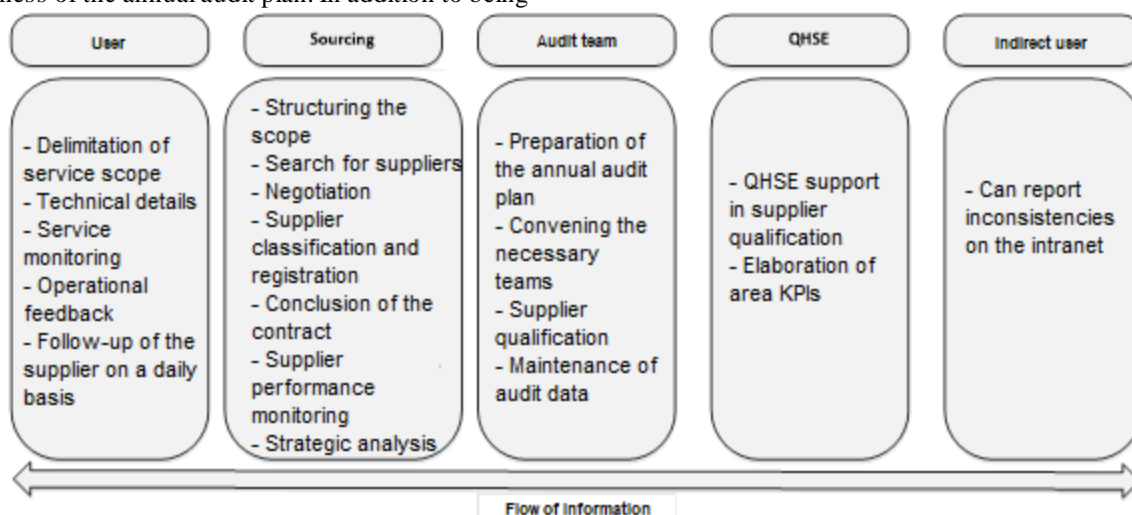
Fig. 9: Information Flow that integralizes Supplier Management. Source: Own

It was observed that due to the engagement of several areas of the company, regarding the quality of suppliers, it makes its management maintain high levels. However, inconsistencies in the classification of suppliers implies that part of this management occurs in a reactive manner. To some degree, a large part of the suppliers that need to be audited goes through the audit process, but escapes the control of the Sourcing team the broad view of its supplier base to develop proactive strategies for identification, qualification, Selection and development of suppliers.

Through the review of segmentation and criticality of suppliers, it is possible to have a full overview of the suppliers that the audit team should stick to during the

programming of the annual audit plan. Figure 10 shows the total number of critical vendors after reclassification,

without discontinued vendors:
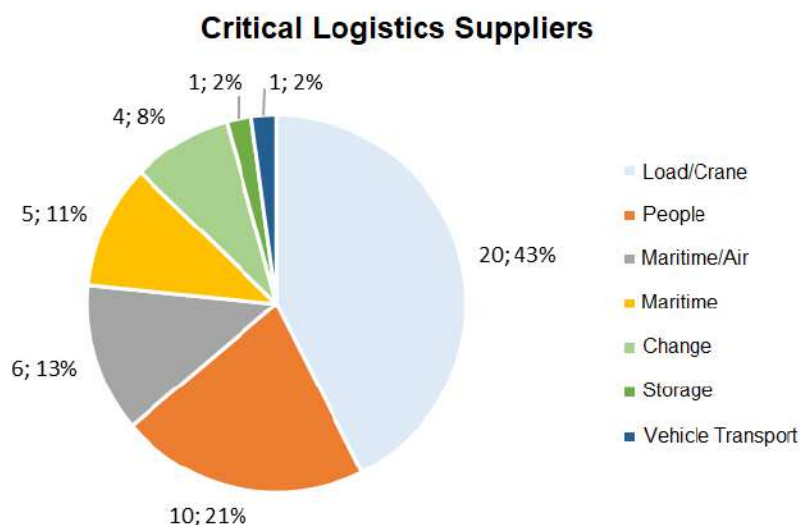
Fig. 10: Critical Logistics Suppliers Active and spent in 2016 after reclassification. Source: Own

It is evidenced that the correct classification of suppliers regarding segmentation and criticality, in the memento of the register, makes the activity of sourcing more practical. In this way, the team manages to obtain more accurate data and more agility to play its strategic role in the development and relationship with suppliers.

VI. FINAL CONSIDERATIONS

Through the discussion of the Supplier Management theme, we sought to answer the problem question: can the volume of logistics suppliers be optimized for better management?

The problem related to the question posed is based on the high complexity that the logistic suppliers who provide or intend to provide services to the company studied are subject.

Thus, it was understood that the reduction of the supplier base could be a factor to assist the company both in the management of its suppliers and in the improvement of services rendered.

One of the factors analyzed to achieve the answer to the problem question was the analysis of the suppliers ' registers. According to the users ' perception of the system, the registers presented inconsistencies of character to interfere in the routine of the agents participating in the supplier management process.

Based on this assumption, data were collected and elaborated verification metrics that corroborated the users ' perception: part of the registers did not fully reflect the real universe of the contracted and practiced services. The analysis and therefore reclassification of suppliers made possible to see the entire frame of active suppliers in the

system, with and without expense, according to their segment and criticality. A sub-segmentation of the suppliers was also conducted in order to differentiate the types of service that each one performed.

The sum of these efforts allowed the elaboration of the answer to the problem question, being positive the answer, because: 22 suppliers were identified with discontinuity of service in the year 2016 that could be listed as inactive, decreasing the range of suppliers In the management step called auditing.

In addition, the sub-segmentation of the services showed that there may be strategic synergies in the Sourcing stage, by joining the suppliers of Cargo, Crane and People Transport, because there are large companies in the market that offer the three types of service.

The same occurs with the subsegment with the second and third largest number of vendors, respectively. Maritime suppliers could integrate Maritime/Air Suppliers.

As the company studied carries out several operations with hazardous materials, logistics was chosen by embarking on the handling and transport of all dangerous content, besides presenting a competitive factor in itself.

For this reason, the need to monitor their logistic suppliers becomes quite urgent.

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Physical Training Coupled with Non-Invasive Brain Stimulation Modulates Cortical Waves Decreasing the Likelihood of Falls in Adults Elderly with Fragility

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Abstract— Background: Falls have been implicated as the second highest cause of disability and death in the old population across the world. Some studies have shown that physical exercise applied alone and/or combined with non-invasive brain stimulation (NIBS) may improve mental activity and motor functions reducing the frail and the likelihood of falls. In this research was investigated whether physical and mental exercises training (PMET) combined with the NIBS procedure would reduce better the likelihood of falls in adult's elderly as compared to the PMET by itself.

Methods: A rigorous previous selective procedure was used for selecting 57 frail elderly subjects who were later randomly separated into two groups one of which nominated as experimental (FEG) and the other the control group (FCG). The FEG group practiced physical and mental exercises adjointly to a method of non-invasive brain stimulation. The FCG group received the same physical and mental exercises program as the FEG group practiced, but did not pass by the non-invasive brain stimulation procedure. Electroencephalographic data, propensity for falls and reaction time were evaluated in a version of pre and post intervention comparisons. The obtained data were treated using ANOVA ONE WAY with Tukey's posterior test, Kruskal-Wallis followed by Dunn's and Spearman's correlation, all with a significance of 5%.

Results: The conjugation of the NIBS to physical and mental training promoted decrease of the propensity for falls, enhance the reaction time, and modulated, both, Alpha and SMR bands. If taken together, it can be assumed that this program, moreover, was also efficient to reduce the adult's elderly of the experimental group their physical and mental frailty as indicated by their frailty test scores taken comparatively between the pre to the post intervention performances.

Conclusion: It was concluded that the intervention program here proposed decreased the probability of falls in the adults elderly and being this benefit clearly correlated with cortical modulation of the Alpha and SMR waves and was also efficient to promote the enhancement of those individual's capability to executive functions performance.
Keywords— Brain stimulation, Physical Exercises, Mental Exercises, EEG, Frailty, Falls, Aging.

I. INTRODUCTION

Falls which many times occur with elderly adults have been implicated as the second highest cause of disability and death in this age group [1]. In part, these events derive from the aging process which is accompanied by structural and functional organic changes that restrict the effectiveness of most of daily actions which many elderlies are subject on their common life, including an ample class of motor activities [2].

In Brazil, as in many other countries, the aging rate is increasing quickly, leading one to believe that in the very near future the difficulties and even the incapacities of most elderlies to keep a moderate independence will increase exponentially [3]. When afflicted with frailty, a syndrome that tends to increase the range of cognitive, motor and psychophysical morbidities in elderly individuals, the probability of falls to them considerably increases, reaching the level of 59% higher when compared to non-frail individuals, even considering elderlies in the same age range [3].

The fall rate in old people above 65 years old in the North American population reached 28.2% in 1998 and increased to 36.3% in 2010 [4], and recent data reported a range of 3%–85% for prevalence but a much narrower range (21%–39%) for incidence rates of newly formed FOF after a fall event. Even with no fall during follow-up, 11.6%–23.3% of older persons reported new concerns about falls [5] suggesting a big trouble. These increasing percentages proportionally increased the amount of the resources intended to treat the consequences of these undesirable events [6] as it can be evidenced by the fact that in 2012 the associated medical costs for fatal fall accidents approached $616.5 million and $30.3 billion for non-fatal accidents, being that those values raised, in 2015, from $637.5 million for fatal falls and $31.3 billion for non-fatal cases. It was also verified that the incidence of falls and the total cost for falls associated treatments increased with age and had higher costs for women [7].

Data related to the alarming costs of treatment for falls and the growth of the elderly population in the world has raised debates about preventive solutions to ensure sufficient physical and functional conditions to minimize the range of incapacities that in parallel affects the human aging process. Upon this view, therapeutics programs including physical exercises applied alone and/or combined with other activities have been mentioned as indicated to minimize a variety of serious morbidities which affect millions of elderlies in the world [7,8].

Specifically related to falls, the evidences of exercise benefits are many, including fall prevention and rehabilitation of those [8–10]. However, not all interventions by use of exercises are capable of producing changes, such as for example, when mediated by low-intensity exercises to which the frail elderly person does not respond well. By the other side, as precaution against possible accidents, they normally do not do well with this exercises type or avoid engagement in these.

In case of difficulties for implementing exercises program which do not reaches an appropriate benefits to specific individuals as frail older adults, the use of the NIBS may be an appropriate resource to make the brain more efficient for the performance of certain neural functions impaired by the ageing and thus creating a proper dimension to respond well to the demands of certain exercises and benefiting from its execution. Research has shown the effects of NIBS on cognitive and motor functional gains in children, adults, and elderly people, being such gains usually associated to adequate modulation of specific brain waves [11,12].

The reference commonly sought out in NIBS modulatory effects for motor control events is that of an EEG characteristic of the Alpha rhythm (7-11 Hz) for events of a cognitive nature, whereas for the motor domain, the Alpha rhythm integrates with the sensory-motor rhythm (SMR) on a spontaneous EEG associated with general motor activity events and spinal motoneuronal activities during tonic motor contraction tasks [13,14].

Our considerations about the already know (1) benefic effects of the Alpha and SMR waves modulation upon human cortical functions (2) the range of benefits that physical and mental exercises can promote on the brain and (3) also upon the corporal functionality of people who practice exercises regularly were the literature evidence that provided us the theoretical basis to hypothesis here that the group of elderly adults that will receives the NIBS techniques conjunctly with the PMET will show higher decreases in the index of falls probability than the group that will receive only the PMET. Also, that the higher predicted improvement to this same group will be proportionally associated to the levels of the Alpha and SMR modulations this group will achieve.

II. METHODS

Research Ethics

The study was approved by the Ethics Committee of the Federal University of Rondônia, according to CAAE number 2.631.588, and all volunteers or their respective legal guardian read and signed the Free and Informed Consent Form. By signing the consent form the volunteer agreed to voluntarily participate in this investigation. All doubts about the study, the tasks involved and the subjects' rights were clarified prior to the consent form being signed.

Study design

This study is experimental since it was composed by an experimental and control group and included a random selection of these groups to verify the effects of a physical and mental exercise program conjugated to the technique of non-invasive brain stimulation aiming at reducing the risk of falls in frail elderly people.

Volunteers

The volunteers were recruited from a population of elderly people living in two cohabitation centers for this type of individual, one of them being linked to the Health Department (CCI) and the other an independent Foundation (SESC), both located in Porto Velho-RO, Brazil. Initially, 308 elderly people of both sexes were recruited and submitted to the following inclusion criteria:

(i) Minimum age of 65 years old and maximum of 80 years old; (II) desire to voluntarily participate in the entire study.

In order to define the groups of interest for the study, these 308 volunteers answered a questionnaire which was applied to identify who among them had suffer at least one fall in the 6 months prior to that moment of the selection procedure. This part of the total scrutinous defined the exclusion of 110 older adults. The 198 reminiscent volunteers were then examined by the use of the Mini Mental State Examination (MMSE) and the Edmonton Fragility Scale (EFS). The MMSE had it cut off for the volunteers' exclusion defined as being 20 points and the EFS cut-off score set at 7 to 10 points.

After the two above described sequential evaluations, only 59 elderly people remained being that 28 were classified as suffering from moderate fragility and 34 with light fragility. With the desistence of 02 of these initially classified individuals, the remaining 57 were randomly divided into a Fragile Experimental Group (FEG) and a Fragile Control Group (FCG), with 28 and 29 elderly adult individuals, respectively.

Figure 1 shows schematically the methodology for selection, classification and separation of the control and experimental groups for the present study.
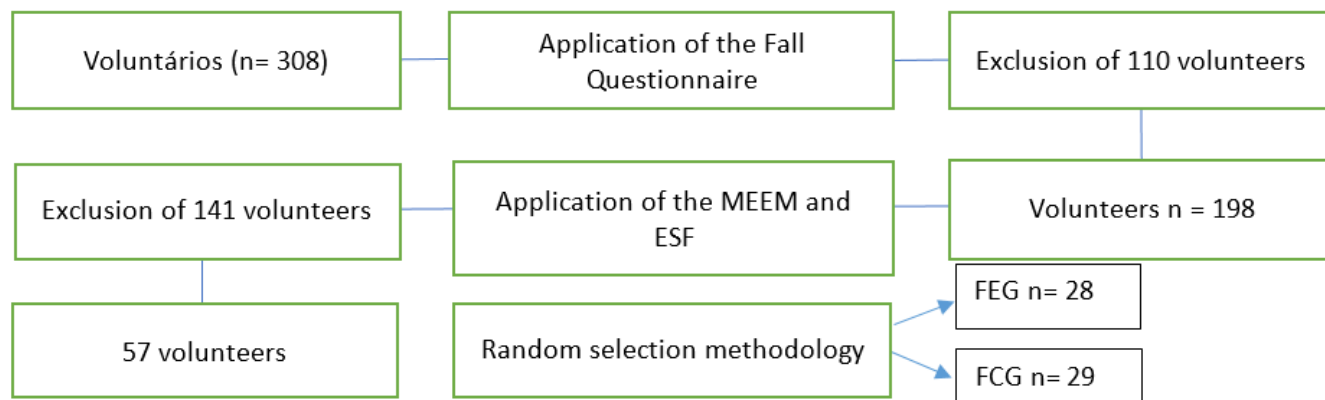
Fig.1: Sample Selection Methodology. Three hundred and eight elderly volunteers attended the call for the study, and after applying all the inclusion, exclusion and testing criteria for the sample selection, 57 volunteers were randomly divided into 2 groups, being a nominated as Fragile Experimental Group (n=28) and the other as Fragile Control Group (n=29).

The scores of the diagnostic evaluations that guided the formation of the experimental (FEG) and control groups (FCG) and the respective comparisons to verify homogeneity between them are presented in Table 1.

Table.1: Descriptive measurements of age, the MEEM and of the EFS identifying the statistics for comparison of distribution homogeneity for these variables between the groups, in association with inclusion/exclusion criteria. The p-values are related to the Mann-Whitney Test, with a significance index referring to p <or = 0.05.

Variables	FCG (n=29)	FEG (n=28)	*P* Values
Age	74.36$\pm$5.47	74$\pm$5.3	0.457
MEEM	23.5$\pm$2.82	23.0$\pm$2.71	0.508
EFE	8$\pm$1.24	8$\pm$1.16	0.913

As for the demographic profile of the groups, the age group of> 76 years of age was predominant followed by lower percentages for the age groups of 65 to 70 years old and 71 to 75 years old, respectively, with defined distribution equivalence between them. With regard to marital status, the majority are married individuals. The

number of widows and widowers as well as unmarried and others is small in both groups. Other variables that constituted the demographic profile of the sample were sex, social income, marital status, education level and the number of falls occurring in the six months prior to this study.

Table.2: Data from the socio-demographic questionnaire. Responses from 57 elderly people who constituted the research groups and who answered the applied socio-demographic questionnaire. Items such as age, sex, marital status, education level, social income and number of falls were evaluated.

		Grupos		
		FEG (n= 28)	FCG (n= 29)	%
Year	65 a 70	07	08	25.00 - 27.50
	71 a 75	09	09	32.10 - 31.22
	76 >	12	12	42.88 - 42.88
Marital Status	Married	23	22	82.14 - 75.86
	Widowed	03	02	10.72 - 06.90
	Single and others	02	05	07.14 - 17.24
Sex	Women	14	14	50.00 - 48.27
	Men	14	15	50.00 - 51.73
Schooling	Complete Middle	17	19	60.71 - 65.51
	Higher	11	10	39.29 - 13.80
		01	01	
Social income	Up to 1 salary	10	11	3.58 - 3.45
	From 1 to 2 salaries	12	11	35.72 - 37.93
	From 2 to 4 salaries	05	06	42.85 - 37.93
	+ 4 wages	26	25	17.85 - 20.69
Nº of falls	1 a 2	02	04	92.86 - 86.20
	3 ou >			07.14 - 13.80

Procedures and Instruments

Data collection was performed in a 9x8m, well-ventilated room that was illuminated and prepared in order to avoid noise that could disturb the attention of the volunteers, thus providing conditions adequate to maintain focus and attention on tasks. All tests, as well as electroencephalographic recordings, were applied in an individualized manner, except for the non-invasive brain stimulation procedure (NIBS), since the instrument used for this allows for application of the stimulation to ten subjects simultaneously. The tests, MEEM and EFS, were used in the diagnostic phase in order to define the experimental and control groups and, therefore, were not used as data for comparison between pre and post-intervention, unlike the other tests and the EEG data.

Demographic profile and the used tests

The demographic profile of the volunteers was recorded at the time of groups composition, including the following factors: sex, age, marital status, drug use, social

income, education level, physical activity level in the 12 months prior to admission to the study, frailty level and mental functional competence. After defining the groups, they were then tested in terms of falls propensity by the Tinetti Test (Tinetti) and the Motor Reaction Time Test under dual- choice task conditions (MRT). EEGs were also recorded in order to verify the functionality of Alpha and SMR bands in phases pre and post-intervention and the relationship of those waves with the other variables under investigation.

Edmonton Frail Scale (EFS)

This scale evaluates 9 domains, including two performance-based assessments: The Clock Drawing Test for cognition and the "Timed Up and Go" test for balance and mobility. The others are mood, functional independence, drug use, social support, nutrition, attitudes towards health, continence, medical illnesses, and quality of life. The maximum possible score is 17 points, which points to a high level of frailty. A score of 0-4 indicates

lack of frailty, 5-6 apparent vulnerability, 7-8 slight frailty, 9-10 moderate frailty and 11 severe frailty [15].

Mini Mental State Examination (MMSE)

The MMSE was used to determine the mental health of the volunteers. Its application is based on specific questions grouped into seven categories, each with the purpose of evaluating the operational cognitive functions of the mind. Scores range from 0 to 30 points, with higher scores considered as better. The cut-off point was a minimum of 20 points, representing a medium/high educational level. This test was validated in Brazil by Bertolucci, Brucki, Campacci, & Juliano [16].

Tinetti Test

This test consists of 16 items: 9 for balance and 7 for gait. The test ranks characteristics such as gait speed, stride, symmetry and balance while the individual in test is standing in place and while spinning with one's eyes closed. The score for each exercise ranges from 0 to 1 or 0 to 2, with a lower score indicating poorer physical capacity. The overall score is the sum of the body balance score and the gait score. The maximum score is 12 for gait, 16 for body balance and 28 for the overall score. A score <19 points refers to a high risk of falling, between 19 and 24 points, a moderate risk of falling and above 24 points, a low risk of falling.

Acquisition of electroencephalographic signals

In order to verify the amplitude of the Alpha and SMR bands, EEG-Neurofeedback Procomp+ (Touch technology-Canada) was used. This equipment has its own grounding, condition that minimizes the interference of electrical signals or electromagnetic noise os quais if not controlled would impair the reliability of signal capture. For the present study, the distribution occurred at scalp point CZ and at auricular points A1 and A2, as recommended in the international 10-20 system [17] when the objective is the verification of the standard modulator of cortical areas associated with motor functions management and the mental executive functions [12].

Non-invasive Brain Stimulation

This procedure was performed using an Orion (Mind Place Technology-Canada) a photic and auditee synthesizer with binaural emission frequency pulses from which was selected the frequency of 8-12 hertz (Hz). This emission promotes a cerebral inter-hemispheric equalization causing an inter-hemispheric equalization that possibly establishes a neural field more conducive to learning and capable to facilitate any type of mental analyses due to the neural modulation this type of emission frequency causes[11,18]. This procedure was applied prior to physical/mental activities for a period of

20 minutes applied at all sections during the intervention period.

Training Program Procedures

All volunteers followed the physical and mental activity program at the Elderly Cohabitation Center (ECC) in which they were enrolled. The physical exercises that comprised part of the activities practiced at this Center were of light intensity, like low-intensity dance and stretches that avoided causing discomfort.

The intervention lasted 10 weeks including a total of 30 60-minute sessions, three times a week, with physical exercises of moderate or high intensity and mental exercises with a maximum number of 15 repetitions and 60-second intervals. Mental exercises were composed of logic games, information interpretation and decision making in which volunteers would need to think through and choose a response based on a proposed question. Twenty minutes of non-invasive brain stimulation were added prior to the exercise session only for the FEG.

The general intervention program was composed of NIBS combined or not with moderate or high intensity physical exercises, static and dynamic balance exercises and mental exercises. The NIBS when in conjugation with the PMED was only applied to the FEG in addition to the exercises the both groups already practiced on different days, format and time period in the ECC.

The series of physical exercises was composed of a warm-up, main session and relaxation. The 5-minute heating included conjugated moderately intense stretching exercises that were always performed on chairs; the subjects should be stretched until they feel a moderate discomfort in their joints and they are asked, in this type of exercise, to maintain the position for ten seconds.

The main part of the physical program was composed of squatting exercises, push-ups against the wall, unilateral squats with the aid of a walking stick, standing bent-over rows with walking stick, standing plantar flexion, shoulder elevation with walking stick, sitting plantar flexion, trunk flexion and extension, always in the same sequence.

Static balance exercises were practiced, such as walking in a line on one (alternating feet) or two feet. Dynamic balance exercises were the controlled gait which consisted of heel-to-toe walking and alternatively raising the knee to a 90º angle of knee in relation to the hip flexion.

During the practice of the mental exercises the examiner produced an auditory and/or visual stimulus demanding a rapid change from standing to squatting, from feet planted and changing to tiptoe, and in combination to changes of direction that varied from 60 to 180 degrees. The practices were organized so that the

mental practices associated to the exercises had 20 minutes of the 40 defined for this phase of the training.

The cool-down portion was practiced sitting in chairs in the form of breathing and by exercises similar to those proposed by oriental techniques such as Tai Chi Tchuen and Yoga.

Exercise intensity during each session was the greatest possible, though determined by the self-capacity and self-perception of effort of each of the elderly adults in the research, giving them the condition to stop the circuit and rest as much as they felt it necessary.

Statistical Procedures

Normality in the distribution of group scores was examined using the Shapiro-Wilks test. The results related to the Tinetti Test and Motor Reaction Time were analysed by means of the ANOVA ONE WAY test with Tukey's posterior test. The Alpha and SMR band results of the EEG were analysed by the Kruskal-Wallis test with a Dunn's posterior test. In order to verify the possible correlation between the MRT and FPI variables, Spearman's Correlation was used. All statistical analyses were performed using the program Prism Stat 5.0 with a significance level of 95%.

III. RESULTS

The NIBS conjugated to PMET decreased the propensity for falls and enhance motor reaction time

In relation to the effect of the proposed training on the propensity for falls, the FCG obtained an average score of 17.79 ± 1.134 before the intervention period and 18.32 ± 0.98 after the intervention period with no statistical difference between pre and post-intervention being $p > 0.05$ (Fig. 2A). However, the FEG obtained a mean score of 17.82 ± 1.18 before the intervention period and 23.18 ± 1.74 afterwards, showing a significative difference from post- to pre-intervention with $p < 0.0001$ (Fig. 2A). There was an evident difference shown by $p < 0.0001$ (Fig. 2A) between the post-intervention periods for both the intragroup and the intergroup comparisons favoring the FEG one.

Regarding the reaction time variable, FCG obtained a mean of 0.65 ± 0.07ms before the intervention period and 0.642 ± 0.09ms after the intervention period, with no difference between the post-test and the pre-test with $p > 0.05$ (Fig. 2B). However, the FEG obtained 0.644 ± 0.07ms before the intervention period and 0.543 ± 0.043ms afterwards revealing a high difference between the post-test and the pre intervention MRT test being $p < 0.0001$ (Fig. 2B). Also, to this MRT variable there was a clear difference as shown by $p < 0.0001$ (Fig. 2B) between the pre and post-intervention periods for both the intragroup and the intergroup comparisons.

*Fig.2: A-B: Results of the Tinetti and the Motor Reaction Time tests. Elderly individuals separated into a Frail Control Group (FCG, n=29) and Frail Experimental Group (FEG, n=28) were submitted to 10 weeks of a combined physical and mental training program (CIP) and, before and after the intervention the propensity for falls and the motor reaction time was quantified and compared. ANOVA ONE WAY with Tukey's posterior test with a significance of 5% was used for intra and intergroup comparison. (ns = p> 0.05; ****=p<0.0001) respectively.*

The NIBS conjugated to PMET modulate the Alpha and SMR cortical wave pattern

In regards to the Alpha Band registered by the EEGs the FCG obtained an average of 8.64+7.72mV in the pre-intervention period and 7.41+5.71mV in the post-

intervention moment with no difference between the post-test and the pre-test being $p > 0.05$ (Fig. 3A). On the other side, the FEG, before the intervention period, obtained 8.24+6.01mV and afterwards, 18.32+6.52, showing a difference between the post- and the pre-test as indicated

by p<0.001 (Fig. 3A). In the intergroup comparison, the difference between the pre- to post-intervention periods was significative with p<0.0001 (Fig. 3A).

    Looking at the performance of the groups for the SMR band the EEG registered for the FCG shown a mean of 8.13+4.75mV in the pre-intervention and 8.04+5.15mV in the post-intervention period with no difference between the post- and pre-EEG registration. The obtained value for the FCG intragroup comparison was of p> 0.05 (Fig. 3B).

On the contrary, the registered score prior to the intervention period for the FEG was of 8.61+418mV and afterwards, 19.47+5.25mV, showing a difference between the post- and the pre-EEG registration of high significance with p<0.0001 (Fig. 3B). In the between groups comparison, also a high difference between the pre and the post-intervention periods was found with p<0.0001 (Fig. 3B) favoring the older adults who composed the FEG.
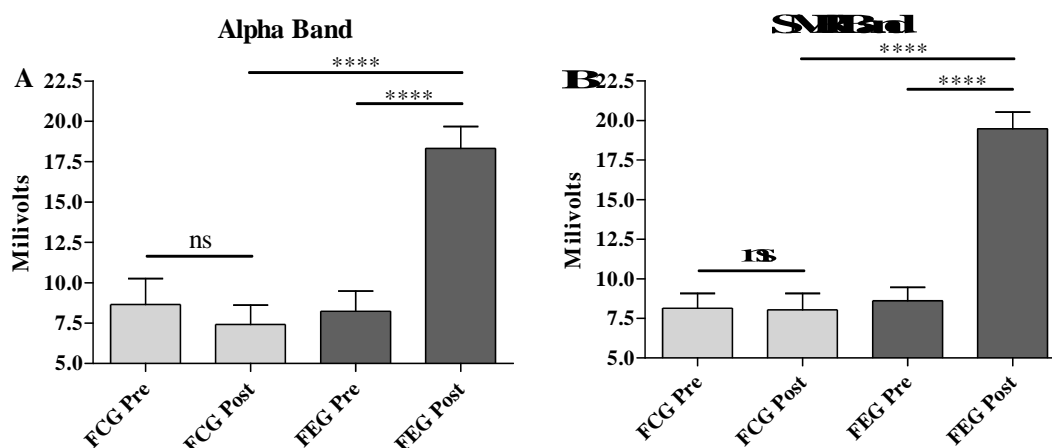
*Fig.3: A-B: Alpha and SMR band results from EEG. Elderly individuals separated into a Frail Control Group (FCG, n = 29) and Frail Experimental Group (FEG, n = 28) were submitted to 10 weeks of a combined physical and mental training program (CIP) and, before and after the intervention the amplitude of the Alpha and SMR band s were quantified by means of an EEG. The Kruskal-Wallis test with DUNN's posterior test with significance of 5% were used for intra and intergroup comparisons. (ns=p>0.05; ****=p<0.0001).*

Correlation between the modulation of Alpha and SMR cortical bands and Tinetti Test

    There was a correlation between the amplitude patterns of Alpha as shown by $p = 0.03$ (Table 3) and the SMR Band indicated by $p=0.006$ (Table 3). No correlation was observed considering the same factors for the FCG, nor to any others of the factors here studied for both groups.

    Table 3 describe the findings of the correlation run comparing all the factors to the Fall test (Tinetti Test)

*Table.3: Correlation Test. Elderly individuals separated into a Frail Control Group (FCG, n=29) and Frail Experimental Group (FEG, n=28) were submitted to 10 weeks of a combined physical and mental training program (PMED) and, after the intervention, the propensity for falls and motor reaction time along with electroencephalographic Alpha and SMR band amplitudes were quantified and correlations were determined by means of the Spearman Correlation test with a significance of 5%. ($^¢$=Moderate Correlation; *=Statistical Significance).*

		Test TRM	Banda Alpha	Banda SMR
Tinetti Test	FCG	0.02	0.1	0.2
	FEG	0.09	0.34$^¢$	0.45$^¢$
P Value	FCG	0.43	0.26	0.1
	FEG	0.31	0.03*	0.006*

IV.   DISCUSSION

In the present study we investigated if non-invasive brain stimulation (NIBS) by binaural pulse emission coupled with physical and mental exercises (PMET) and/or the PMED without the use of the NIBS procedure could minimize the propensity of falls in elderly frail adults and how those possible effects would relate to the Motor Reaction Time (MRT) and with the Alpha and SMR cortical waves.

As shown in the Figure 1-A in which is plotted the scores medium of the group's performance in the test evaluating their indexes for falls tendency, we may verify that the conjugated NIBS and PMET procedure significantly decreased the predicted rate of falls for the elderly adults in the FEG and that the PMED applied alone was not capable for significantly diminish the same investigated index for the elderly adults in the FCG.

In a more detailed explanation, the comparative analysis of the fall-related scores indicated that only the frail elderly subjects in the FEG changed from a high risk of falling to a moderate risk of underwent this type of accident, fact that indicates a good level of effectiveness of the conjugated program applied.

As we can understand from the results before presented, the conjunct application of NIBS and the PMED in addition to significantly reduce the propensity to falls for the elderly adults of the FEG may have, in consequence, reduced the likelihood of severe injuries that old individuals normally are committed in events of falls. In addition, due to the fact the test used for evaluating falls propensity includes the verification of most of the biophysical factors trained by the association of the NIBS to the PMED, we can affirm with some confidence here that the minimization in falls propensity the FEG demonstrated was due to gains promoted by the application of the conjugated training upon those referred factors.

In contrary to the conjugated training the PMET applied alone was not efficient enough to increase the performance of the FCG in the test that examined the levels of propensity to falls of this group. As we will see afterwards the same happened in relation to the MRT test in which this same group did not improve their performance in this variable after the PMED was applied in the intervention phase. As we can see in Figure 1-B, the gain of this group in terms of diminution of the probability of falls was very small and not statistically significant. The FEG, on the contrary did show a high and significant improvement in performance at the post intervention verification with his total members significantly minimizing their anteriorly verified levels of propensity to falls.

To explain the low effect of the PMED application for minimizing the probability of falls to the elderly adults in the FCG it can be post that this result is not in consonance with the literature in this line. Several studies have evidenced that exercises of higher or medium intensities increase the possibility of gains in physical and mental performance for all types of practitioners with important effects upon their executive and cognitive functions of them [19–22]and particularly may decrease the probability of falls, even among elderlies who are the most fragile, with poor health, irregular body composition, impaired balance and/or fear of falling [23].

That is, although, the studies above mentioned provide enormous support to the findings related to the FEG that evidenced a high diminution of risk to falling by effects of the practice of the conjugated training program, the same results when related to the FCG do not applies in a same way. In fact, the PMED applied alone was not capable of effectively ameliorate the level of falls risk for this group in specific.

In face of the impressive differential effect of the PMED applied alone compared to its partial effects when applied with the NIBS procedure, we may advance an hypothesis here that 10 weeks of it application was not sufficient to cause more effective biophysical changes on the FCG, but when applied adjunctly with the NIBS procedure the ten weeks was enough to promote significant biophysical gains which the FEG may have used to perform so well in the test measuring probability of falls that the two groups performed.

Attending to the Figure 1-B now, we can verify that even in relation to the Motor Reaction Time (MRT) variable, the PMED when applied alone did not improve the performance of the FCG. However, its conjunction to the NIBS procedure may have, in some way, contributed to the significant post intervention performance of the FEG on this same variable. Comparing the pre and post intervention scores of the FCG we can see that this group

diminished in about 0.08ms their mean response as the effect of the PMED application. Considering here the similarities of the two groups, we can reasonably consider that this particular effect of the PMED for the FCG may have been proportionally added to the NIBS particular effect upon the results of the FEG when submitted to the MRT test in the post intervention procedure.

In fact, it is evident that the FEG performance in the MRT test reduced in approximately 70 milliseconds from pre to post intervention measurements (Fig. 2B) demonstrating the positive partial effect of brain stimulation on this biophysical valence since the FCG reduction was of only 0,08 mseg by effect of the PMED. Considering the similarities of the groups, the question of why this happened can be answered as being in function of the conjugation of the NIBS to the PMED, and applied only to the FEG.

The results of the effects of the PMED intervention upon the FCG performance was not an expected one. There are a vast number of research that correlates physical exercises with good MRT capabilities [20–22].

Many are the authors who advocate the advantage of practicing physical exercises in order to effectively diminishes the probabilities for acquiring certain diseases as well for improving health, predisposition for work and life in an ample context [24]. In addition a great part, physical exercises are perhaps the most important instrument to permit ageing people to maintain an adequate life style and capacity to execute the tasks inherent to the common life of any person [8,21].

Along with the same line of reasoning we have had until now, the observed decrease in the probability of falls experienced by the FEG may have had primarily implications with the NIBS application to this group, a procedure which have been commonly mentioned as capable of promoting direct improvement on the mental operational systems, being the Alpha and the SMR cortical waves centers of resulting common modulations.

According to the neurophysiologic notion which associates the human brain waves to their biophysical behavior we may reasonably admit that the modulations which occurred by effect of the conjugated intervention on the Alpha and SMR bands, shown in Figure 2-A, probably more than the exercises implicit in the program PMED, were the main causes for the

results the FEG obtained in the test that examined the risk of falls of the elderly adults in each group. This supposition can gain support if we compare the results of the FCG whose components showed only a small and not significant diminution in falls risk after being submitted to the PMED.

Interestingly, if one recurs to the description of the correlation of the variables studied in this present research (Table3) will easily detect that the modulations of the Alpha and SMR cortical waves are derived of the increase of power emission of the both waves, even that in regard to the FCG the power emission increases were very small, with moderated correlations with falls propensity but to the FEG the correlations was high and significant. It also became clear that those increases were associated to a significant decrease in probability of falls to the FEG being that to the FCG the decrease in such probability was little.

The modulations in the amplitude of Alpha and SMR Bands as seen for the FEG in intra and intergroup comparisons (Figure 2 Ae B) were previously reported by Calomeni et al., (2017) who also evidenced, after the application of the NIBS program, significative increases in Alpha and SMR activity in the elderly adults with and without neurological disorders. In this regard, most of the increases in neural activity related with the bands Alpha and SMR seen in studies done with individuals in advanced age range are normally associated with improvements in the mental functions, conditions that usually interacts with better physical performance of them in many aspects of the human daily life [25].

We sawn in the in Figure 2 A-B, however, that a real improvement in power emission occurred only to the FEG in both waves and it was somehow a surprise since that at least to the SMR wave, we were expecting a different result. The SMR signals are recorded closer to the sensorimotor area and their amplitude is known to be reduced in relation to unsynchronized neural activities related to motor events, suggesting a possible electrophysiological signal of sensorimotor excitability [26]. In fact, they are located on the pericentral gyri and associated with the excitability of the cortico-spinal tract, as well as

intracortical disinhibition of the primary motor cortex [27].

Such a neural organic organization compound to the SMR wave function expressed its interrelationship with movement and thought in an ample version. Many authors have provided evidence that the rhythms of the SMR wave are associated with activity in the somatosensory area and accessory to neuronal chains related to effectiveness and control of movement [28–30]. Thus, we hypothesized that a higher emission power of Alpha and, specially, of the SMR wave at expense of equalized inter-hemispheric fluctuations would positively influence the biophysical functions necessary to improve gait control and consequently the frailty of the elderly adults submitted to our experimentation.

It seems to be adequate to emphasize here that although we have not researched frailty in specific, the decrease in the probability of falls observed by the effects of the application of the NIBS and the PMED to the FEG may be an extension of these same effects upon frailty itself. There are an ample and consolidated notion that regular practice of physical exercise can promote a reduction of frailty in people in advanced age and that this reduction may also benefit the quality of life of them [11,31–33]. Even that the period of training was short, we creed that an intensive and well-planned program of exercise would be enough to shown us some interactive results. It was so in regard to the conjugated program but not to the one composed only by physical and mental exercises.

V. CONCLUSIONS

The conjugation of the NIBS to the PMED promoted a significant reduction in the probability of falls in the frail elderly, improved motor reaction time and modulated the Alpha and SMR cortical waves. Furthermore, it became evident the existence of correlation between the increase in the absolute power emission of these cortical bands and the decrease of the probability of falls for the investigated elderlies. These data together suggest a clear existence of a relationship between cortical waves modulation and the probability of falls in the frail elderly adults' individuals. Therefore, it is reasonable to say here that the such observed reduction in probability of falls is to be thought as being associated with a reduction in the frailty

condition of the elderlies, thus establishing a clear relationship of cause and effect between those two factors. Thus, considering this relationship we can considerate that the gains obtained by the FEG go beyond those related to the decrease in rate of falls and that also indicate that the cortical Alpha and MSR modulations also interact with the frailty factor. That is, a good mental functioning may provide a good biophysical basis against the possibility of becoming a frail individual.

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Development of a Web Free Software for the Absolute Efficiency Calibration for HPGe Type Detectors

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Abstract— *The IEA-R1, swimming pool research reactor, from the Institute of Energy and Nuclear Research (IPEN), among other uses, the instrumental neutron activation analysis technique is widely used, and successfully, by the Neutron Activation Laboratory (LAN), using the comparative method. In this method a sample is irradiated simultaneously with a standard. In order to overcome the difficulty of a multi-elementary analysis, because it was necessary to prepare several standards, the k0 method of neutron activation was developed. In method k, the concentration of sample elements is calculated in relation to a comparator element, generally gold. However, for the use of the k0 method, it is necessary to accurately determine the detection efficiency in the energy range of interest and the geometry of the experimental arrangement. In order to circumvent the manual processing of the data in spreadsheets, which could be affected by errors, a free code web software was developed for calibration in absolute efficiency of an HPGe type detector for neutron activation analysis based on the k0. We used the free, low learning curve standardized Python programming language in the eScience project, which is part of the software, and the Django web framework with a simple and intuitive interface. In the system it is possible to register the detectors, radioactive sources and their manufacturers, projects and spectra, attributes necessary to calculate the absolute efficiency of an HPGe type detector. In addition to calculating efficiency, the system plots the graph with the efficiency points, trend curve, with possibility of adjustments, and error bar representing the uncertainties. The system issues reports on spectra and efficiency data for each project. The reports make it possible to check the data as well as its use in other applications. Because it is a web software, its access is allowed from any device with an internet connection. Another result obtained with the system is the reduction of the possibility of errors with the manual treatment of the data in spreadsheets.*

Keywords— *django, free software, k_0, neutron activation, python.*

I. INTRODUCTION

The IEA-R1 is a pool type, moderate and water-cooled research reactor utilizing beryllium and graphite elements as reflectors. The core of the reactor is located 6.9 m from the pool surface, has the shape of a parallelepiped, and consists of 20 standard fuel elements, 4 fuel control elements, about 25 reflectors and 7 irradiation positions. Designed to operate at a maximum power of 5 MW, this reactor, in the first decades, operated the power of 2 MW. Its first criticality occurred on September 16, 1957 and, after the initial testing and commissioning phase, started to operate at 2 MW, in an 8-hour cycle, 5 days a week. From 1993, it began operating in cycles of 64 continuous hours per week at 3.5 MW of power. As of August 2011, it started to operate at 4.5 MW of power. The increase in power to 4.5 MW allows the irradiation of materials with thermal neutron fluxes of the order of $9.7.10^{13}$ n/cm².s and epithermal and fast neutrons of the order of 10^{13} n/cm².s. Currently, the IEA-R1 reactor is used for the following purposes: a) Production of radionuclides for use in nuclear medicine; b) Production of radionuclides used in industrial applications; c) Research in Nuclear Physics and Solid State; d) Neutronography services; e) Training of licensed personnel to operate reactors; f) Irradiation of samples for multielement analyzes using the Neutron Activation Analysis technique in geological materials, industrial products such as plastics and resins, catalysts, petroleum, metals and metal alloys, archaeological samples, animal and human tissues, plants, food and environmental samples.

Among the reactor uses described above, the instrumental neutron activation (INAA) technique, an

important and powerful technique that allows the knowledge of the concentration of chemical elements in samples, has been successfully used in numerous experiments carried out by the Laboratory of Neutron Activation (LAN) of IPEN (Institute of Energy and Nuclear Research). For more than 40 years the LAN has been analyzing different matrices such as geological, biological, archaeological and environmental, among others, using the comparative method (FUGA *et al*., 2008, SAIKI, SOARES and ADACHI, 2008). In this comparative method, sample and standard (material with known concentration and mass of the element to be determined) are irradiated simultaneously with neutrons, under the same conditions, and both are measured under the same experimental conditions. In this way, all parameters associated with irradiation and detection are the same for both the sample and the standard, making it possible to determine the concentration of a given element in the sample through a simple comparison between the activities induced in the sample and in the standard. However, for multi-element analysis this procedure requires the preparation or acquisition of standards for each of the elements to be analyzed, which makes the method very laborious, expensive and time consuming, and requires high purity reagents, which are usually expensive. The time spent in the analysis also increases due to the measurement time of the patterns. In addition, some elements present in the sample cannot be analyzed due to the absence of a corresponding standard or because of their nuclear characteristics.

To overcome these difficulties, the k_0 method of neutron activation was developed by the Institute for Nuclear Sciences, Gent, Belgium (DE CORTE, 1986). This is a "quasi-absolute" neutron activation analysis technique which, because of its excellent accuracy, has emerged as an alternative to the comparative method, eliminating some of its disadvantages. The factors k0 are independent of the reactor spectrum and detector characteristics and have been experimentally determined for several target nuclei (DE CORTE and SIMONITS, 2003). The concentration of the elements is calculated relative to a comparator element, generally gold, eliminating the need for standards. The method k_0, because it allows the determination of the elemental concentration with great accuracy, has been widely accepted by users in several laboratories of the world, including Brazil (BACCHI, FERNANDES, DE OLIVEIRA, 2000).

A new pneumatic transfer system for irradiation of samples in the core of the IEA-R1 reactor was implemented to carry out multielement analyzes using the Neutron Activation Analysis technique (FERNANDO, 2011). This pneumatic station has a transfer time of approximately 12 s and is suitable for short-term irradiation (up to 30 minutes) Long-term irradiation is performed on the Water-cooled Irradiation Element (EIRA). For the use of the neutron activation method k_0, a precise characterization of the irradiation position is required as well as a characterization of the detection system. The precise characterization of the irradiation facility requires the determination of the ratio between the thermal and epithermal neutron fluxes (f) and the parameter (α) related to the epithermal neutron flux distribution, approximately given by $1/E^{1+\alpha}$ (it is a measure of how far the epithermal neutron flux from ideal behavior 1/E) (DE CORTE, 1986). These parameters are characteristic of the irradiation position in the nuclear reactor. In the characterization of the detection system, a parameter of great importance to be determined is the detection efficiency in the energy range of interest and in the geometry of the experimental arrangement.

There are some softwares available that allow the determination of the efficiency curve, such as the k_0-IAEA program, KayWin, Gespecor, Hyperlab, Hypermet. The k_0-IAEA program is provided free of charge by the International Atomic Energy Agency (IAEA) to neutron activation laboratories. However, its structure of operation, insertion of data in the permanent database and the analysis of the spectra are not friendly to be realized. The software KayWin, Gespecor, Hyperlab has a high cost for acquisition, over three thousand euros, and the latest version of Hypermet is 2008, which makes it incompatible with current computer systems.

The objective of this work was the development and implementation of a free code web software for the calibration of the absolute efficiency of an HPGe type detector for neutron activation analysis. In a complementary way, the aim was to integrate the software to the e-Science project to obtain gamma ray data from the cataloged projects, with a view to performing the absolute efficiency calibration efficiency curve determination.

It should be noted that the development was aimed at meeting the specific needs of CERPq (Center of the Research Reactor of IPEN), applying the concepts of software usability, at an extremely low cost when compared to the acquisition of proprietary software. It is also worth mentioning that it is a web-based software, access to information is available regardless of geographical location, and only Internet access is required.

II. MATERIALS AND METHODS

The present work was developed within the scope of the Cooperation Agreement signed between the Institute of Energy and Nuclear Research - IPEN and the Federal

Institute of Education, Science and Technology of Rondônia - IFRO and, therefore, the activities related to the development of the project happened in the dependencies of IFRO with esporadics visits to IPEN.

2.1 Software Engineering

Software Engineering emerged in the mid-1970s in an attempt to circumvent the software crisis and provide an engineering (more systematic and controlled) treatment to the development of complex software systems. A complex software system is characterized by a set of abstract software components (data structures and algorithms) encapsulated in the form of procedures, functions, modules, objects or agents interconnected with each other, composing the software architecture, which must be executed in computational systems. A formal definition of Software Engineering is the creation and use of sound engineering principles in order to obtain economical software that is reliable and that works efficiently on real machines (PRESSMAN, 2006).

2.1.1 Determination of requirements

Through the Engineering of Requirements one can define what really must be built in a software. The initial set of requirements must be to represent what the user wants and needs, given that software full of options and functionalities, since the customer needs a "lean" and simple system, is unnecessary. According to GUEDES (2011, p. 22), "the requirements survey and analysis steps work with the problem domain and try to determine 'what' the software should do and if it is actually possible to develop the requested software." In this sense, in order to actually understand the problem to be solved, it is necessary to understand the user's wishes regarding the system now being projected. In this paper, Guies (2011, p. 22) states that "in the stage of requirements gathering, the engineer seeks to understand the needs of the user and what he wants the system to be developed." It is then verified the real need to raise the requirements of a software in the initial stage of its development.

2.2 Database

A database is understood to mean any system of data storage on the subject (KORTH; SILBERSCHATZ; SUDARSHAN, 2006). A phone book, a book record, a collection of stamps in an album, each of the data series is a database.

Among the advantages of using a database can be found security, data storage in an orderly manner and data independence in relation to applications.

2.2.1 SQL

Structured Query Language, SQL, was originally developed in the early 1970s at IBM's San Jose labs, within the w: System R project, which aimed to demonstrate the feasibility of implementing the relational model proposed by E. F. Codd. The SQL language is the most used and is a standard in databases, and this stems from its simplicity and ease of use. It differs from other database query languages in the sense that a SQL query specifies the form of the result and not the path to get there. ROB and CORONEL (2011) state that: "Its basic set of commands has a vocabulary of less than 100 words. And, what is better, SQL is a non-procedural language: just enter the command on what should be done. There is no need to worry about how it should be done." (ROB and CORONEL, 2011, p.224). SQL presents a series of commands that allow the definition of data, called DDL (Data Definition Language), composed among others by the Create commands, which is intended to create the Database, the tables that compose it, in addition to the relationships between the tables. As an example of the DDL class we have the Create, Alter, Drop and Rename commands (DATE, 2004). Data Manipulation Language (DML) commands, intended for queries, insertions, deletions, and changes to one or more records of one or more tables simultaneously. As an example of DML class commands we have the Select, Insert, Update, Delete, Commit and Rollback commands.

2.3 Absolute efficiency calibration

In gamma spectroscopy, in the characterization of a detection system, the parameters of great importance to be determined are: calibration in energy, calibration of the resolution in energy and calibration of the detection efficiency in function of the energy, in the interval of energy of interest and in the geometry of the experimental arrangement. Gamma spectrum analysis involves, firstly, the assignment of the energy values to the spectrum peaks and, subsequently, the determination of the number of counts of each peak. The determination of the energy of the spectral peaks is performed by calibrating the detector with standard radioactive sources that emit gamma rays with known energies and intensities. In this way the relation between the gamma radiation energy and the channel number must be established. The performance quality of a detection system employed in the use of measurements of energy values is characterized by the pulse width of the distribution obtained with particles of the same energy. Even in the case where each particle deposits exactly the same energy in the detector, the pulse height distribution will not be a single line. Instead, there will always be a finite width which will be due to statistical fluctuation in the number of charge carriers

produced in the detector; due to the electronic noise produced in the detector itself, the preamplifier and the amplifier; and the incomplete collection of loads produced in the detector. The detector (Canberra 8) semiconductor of the hyperpure germanium type (HPGe), Canberra brand model GX3018, with cylindrical geometry and relative efficiency of 30% for the energy of 1332.5 keV of ^{60}Co was used. For this energy, the resolution is 1.8 kV. The associated electronics is the conventional one for simple spectroscopy. The detector is connected to a Canberra DSA-LX multichannel analyzer on a microcomputer available from IPEN's neutron activation laboratory. Gamma ray spectra were collected and processed using the Genie 2000 v.3.3 software. The efficiency curve for the HPGe spectrometer was determined using the standard sources of 241Am, 243Am, 133Ba, 166mHo, 60Co, 57Co, 54Mn, 137Cs, 152Eu and 22Na, with energies ranging from 43 keV to 1500 keV. The efficiency was adjusted according to the energy by means of appropriate parameterization. The parameterization used in this work is the Least Squares Method using the covariance matrix methodology that provides information about the existence of the level of correlation between the uncertainties in the parameters of the adjusted function and calculated efficiencies for different energy values (DE CORTE et al, 1993). All the described experimental analysis was applied to experimental data obtained at the IPEN Research Reactor Center (CERPq).

III. SOFTWARE MODELING
3.1 Unified Modeling Language

The Unified Modeling Language (UML) is the most widely used language for the specification and design of software in the object-oriented approach. The UML is the instrument that allows the modeling of the software "visually", making it easy to start from the requirements of the system to the implementation in a friendly way (BRAHA and RUMBAUGH, 2006). GUEDES (2011) states that: "The UML - Unified Modeling Language - is a visual language used to model software based on the object orientation paradigm. It is a general-purpose modeling language that can be applied to all the fields of application. " (GUEDES, 2011, p.19). The UML covers all stages of software production but is mainly used to translate system requirements (at a high level and closer to the user) into coded components (closer to the application). Even among these two layers, the UML aims to be easy to understand for all involved (BRAHA and RUMBAUGH, 2006). In this sense, GUEDES (2011) states that: "It should be made clear, however, that UML is not a programming language, but a modeling language, a notation, whose purpose is to help software engineers define the characteristics of the system (...). Such characteristics can be defined through UML before the software actually begins to be developed. " (GUEDES, 2011, p.19). UML is a language, and as such, it is a means of communication. PENDER (2004) states that through graphic diagrams it is easier to discuss and visualize the ideas and solutions between the team, or the user. Much simpler than with code programs.
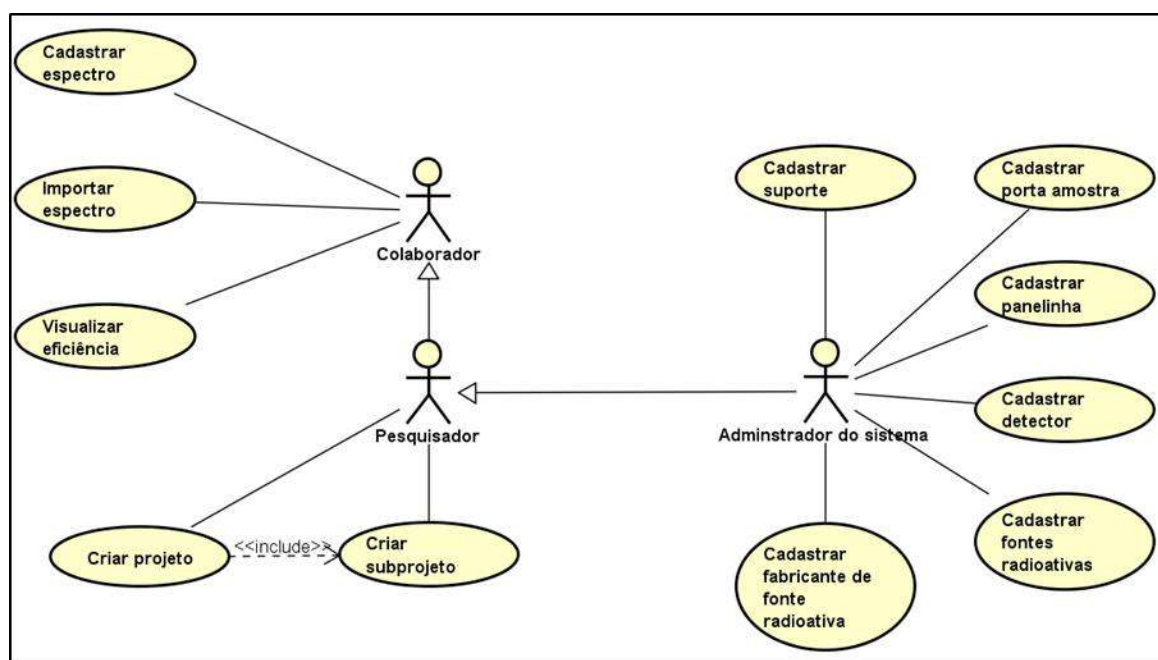
Fig. 1: Use-case diagram

Source: Elaborated by the authors

3.2 Use-case diagram

In order to provide the user with a simple presentation on the functionalities of the system, the use case diagram is presented as a viable alternative, since, according to GUEDES (2011, page 52), "the case diagram of use seeks, through a simple language, to enable the understanding of the external behavior of the system (...) by any person (...) ". It can be said that the use case diagram provides an external view of the system, delimiting its scope and indicating the services it has and the services it provides (PENDER, 2004). The use-case diagram is also used to demonstrate user interaction, through actors, with the system. Figure 1 shows the use cases of the developed system.

3.3 Class diagram

The class diagram provides a view of all the "structures" that are manipulated and/or managed by the system. The fundamental element of this type of diagram is the classes. GUEDES, 2018 states that: "Its main focus is on allowing the visualization of the classes that will compose the system with their respective attributes and methods, as well as on how the diagram classes relate, complement and transmit information among themselves. This diagram presents a static view of how classes are organized, worrying about how to define their logical structure. " (Guedes, 2018, p 112). Figure 2 presents the classes, and how they relate, of the developed system.
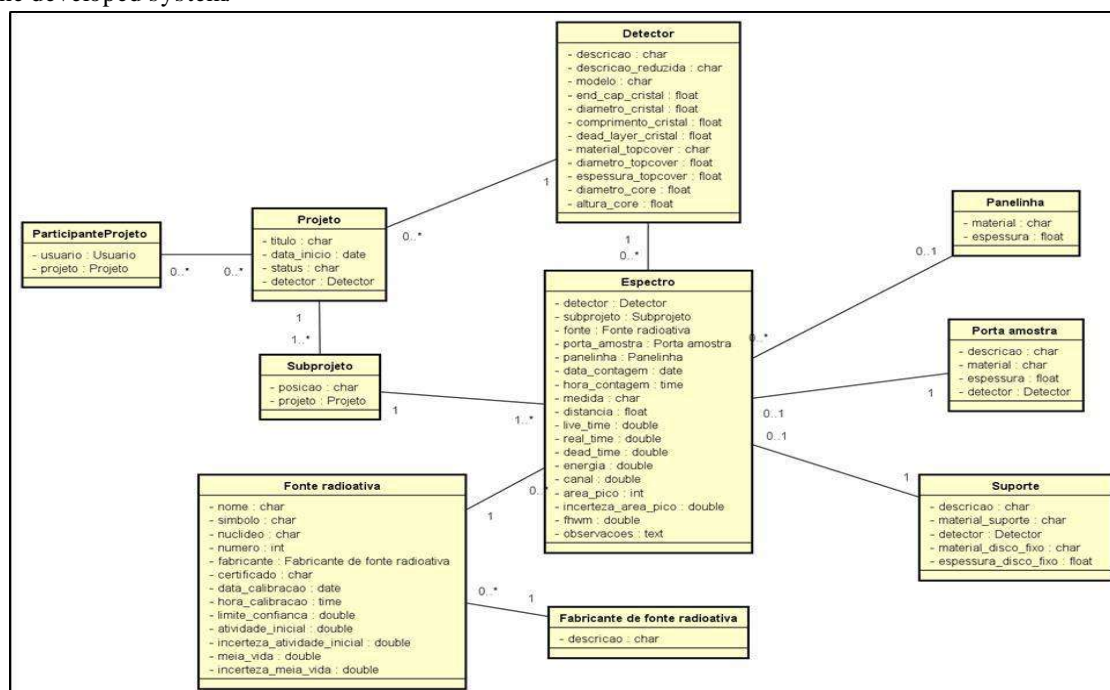
Fig. 2: Class diagram

Source: Elaborated by the authors

IV. SOFTWARE IMPLEMENTATION

4.1 Python

Language created in the 1990s by Guido van Rossum focusing on users as physicists and engineers. Because it is a language of the highest level, it has an easy understanding "and that supports multiple programming paradigms: imperative, object oriented and functional" (CRUZ, 2015, p.3).

With a clear and somewhat summarized language, the readability of the written code is favored, making it a more productive language. (BORGES, 2010). Among the main features of the Python language are: a) Low learning curve; b) Simplicity of the code; c) Library of functions; d) Multiplatform; e) Free software.

4.2 PyCharm

PyCharm is an integrated development environment, that is, a programming environment that is able to provide the developer with a single, comprehensive and tool-based environment that speeds up the process of building software used specifically for the Python programming language. Owned by the JetBrains company, it has paid version (Professional) and free (Community). In this work, due to the condition of Professor of the Federal Institute of Rondônia, had been used the professional version, since teachers are contemplated with a JetBrains program of unrestricted use of its tool for free.

V. RESULTS AND DISCUSSION

5.1 Comparison between spreadsheets and developed software

The current method of calculating absolute efficiency is done using spreadsheets, with manual data entry. This type of control presents a greater possibility of human errors being committed, which can compromise the result and all the processes that are associated with it. Figure 3 shows how the data is manipulated in the spreadsheet that is currently used.
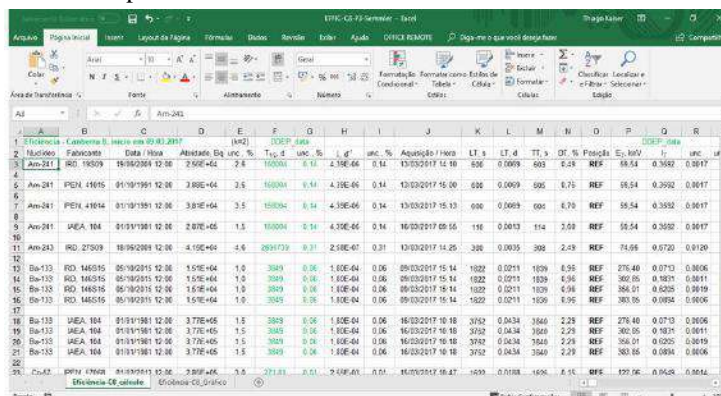
Fig. 3: Spreadsheet with data

Source: Elaborated by the authors

In addition to calculating the efficiency values for each energy, the efficiency curve and its adjustment are also obtained using the spreadsheet, as shown in figure 4.
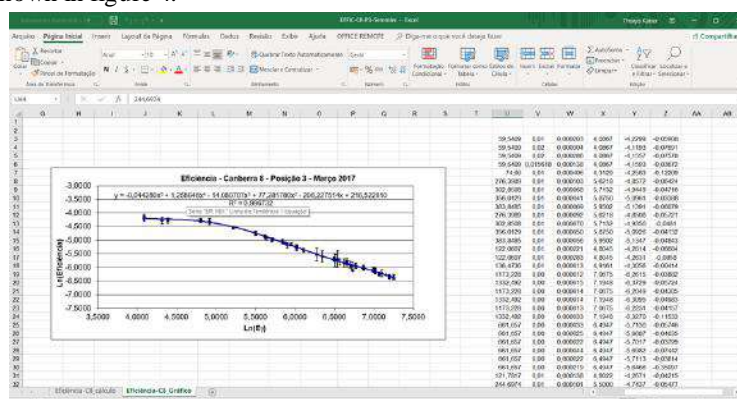
Fig. 4: Spreadsheet with efficiency chart

Source: Elaborated by the authors

The use of an information system, developed specifically for this purpose, provides the reduction in the incidence of errors during the handling of the data. It also provides the structuring and organization of all data artifacts that make up the scope of the activation analysis.

The system, developed in the Python language using the Django web framework, makes it possible to register the detectors, radioactive sources, projects and subprojects. All these registrations follow simple and intuitive interface in the system, based on the user experience.

The efficiency calibration curve is obtained for each subproject, that is, for each counting position of a given detector in a specific project, therefore, it is necessary to create the projects in the system. The interface for project registration can be seen in figure 5 and the subproject visualization interface in figure 6.

Fig. 5: Project registration

Source: Elaborated by the authors
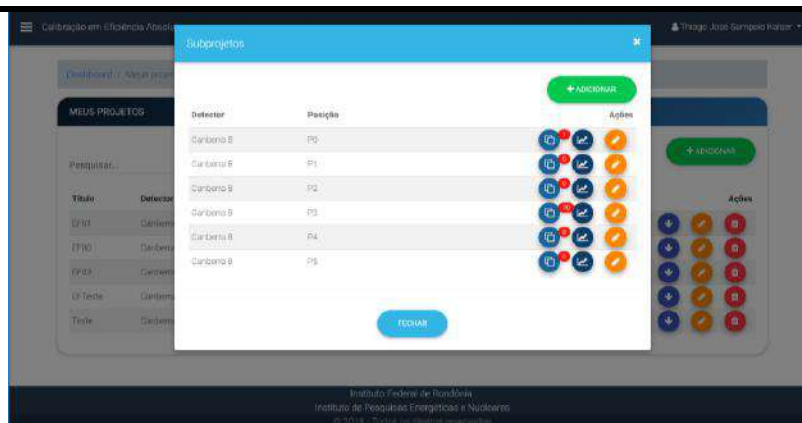
Fig. 6: List of subprojects

Source: Elaborated by the authors

Figure 7 shows the list of gamma spectra associated with a given subproject of absolute efficiency calibration. It is the systematized representation of the spreadsheet data presented previously in figure 3.

Fig. 7: List of spectra

Source: Elaborated by the authors

In addition to the evident improvement in the organization of data, a clear and intuitive interface for insertion of new data into the project is observed. In the spreadsheet, you need to navigate between cells, using the keyboard or mouse, until you find the desired cell and enter the values manually. That's when mistakes can happen. When you enter the value in an incorrect cell, the entire calculation will be based on incorrect data, causing an error in the efficiency calculation.

It should be noted that, even with the manual insertion of the data, the system, when saving, performs the validation of this data. This way you can minimize the possibility of entering incorrect data.

5.2 Efficiency calculation results

With the data of the spectra duly inserted in the software, the efficiency was calculated for each energy of interest and, for purposes of validation of the software, the values of the obtained efficiencies were compared with those obtained by the use of the spreadsheet. Table 1 shows the results of the efficiency calculations for position 03 (three) of the Canberra 8 detector. Column A has the calculation made by the use of the spreadsheet and in column B that obtained by the system for a standard radioactive source of ^{133}Ba, (IRD, 146S15 certificate). The uncertainties for the values of the efficiencies were obtained by simple propagation of the uncertainties of the quantities involved in the calculation: number of counts in the photopic, probability of gamma emission by decay of the line considered, initial activity of the standard source and half-life of radionuclide.

Table.1 - Comparison of efficiency: ^{133}Ba / IRD 146S15

Energy (keV)	Efficiency A	Uncertainty A (%)	Efficiency B	Uncertainty B (%)	Difference (%)
276,40	7,6632E-03	1,40	7,6842E-03	1,37	0,27
302,85	7,0227E-03	0,88	7,0184E-03	0,96	-0,06
356,01	6,0427E-03	0,66	6,0452E-03	0,67	-0,04
383,85	5,7906E-03	1,30	5,8011E-03	1,21	0,18

Source: Elaborated by the authors

The difference obtained by comparing the values of the efficiencies is due to the way of obtaining the area of the peak. In the case of the spreadsheet the software used in the deconvolution of the spectra was the Hypermet, in the 2008 version, and for the use of the developed system, the software was Genie 2000 v.3.3. Area differences are shown in Table 2 and may be considered negligible.

Table.2 - Area comparison and uncertainty: ^{133}Ba / IRD 146S15

Energy (keV)	Area A	Area B	Uncertainty area A (%)	Uncertainty area B (%)	Difference area (%)
276,40	13702	13741	1,00	0,96	0,28
302,85	32246	32230	0,40	0,56	-0,05
356,01	94028	94078	0,30	0,33	-0,05
383,85	12982	13007	1,00	0,88	0,19

Source: Elaborated by the authors

5.3 Efficiency chart

Figure 8 shows the logarithmic efficiency graph generated from the developed system. A grade 5 polynomial fit was obtained.

Eficiência: $- 0,04750x^5 + 1,36896x^4 - 15,52965x^3 + 86,49699x^2 - 236,76939x^1 + 251,06350$

R^2: 0,966
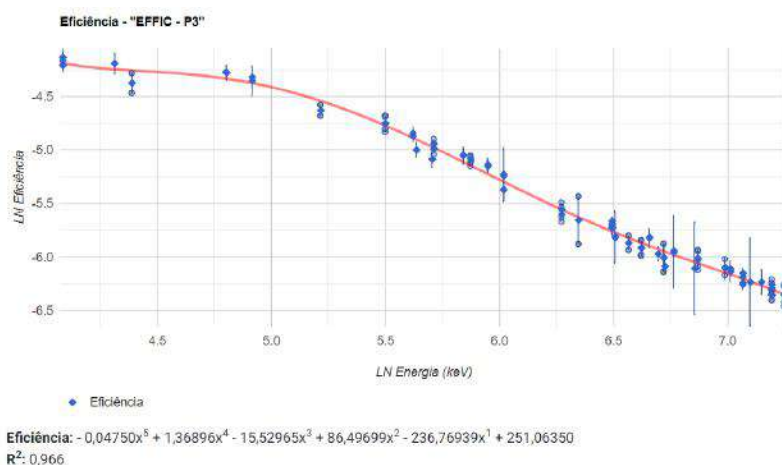
Fig. 8 Graph obtained in the developed system Source: Elaborated by the authors

For comparison purposes, the efficiency graph, calculated with the same data using the Excel worksheet is shown in Figure 9.
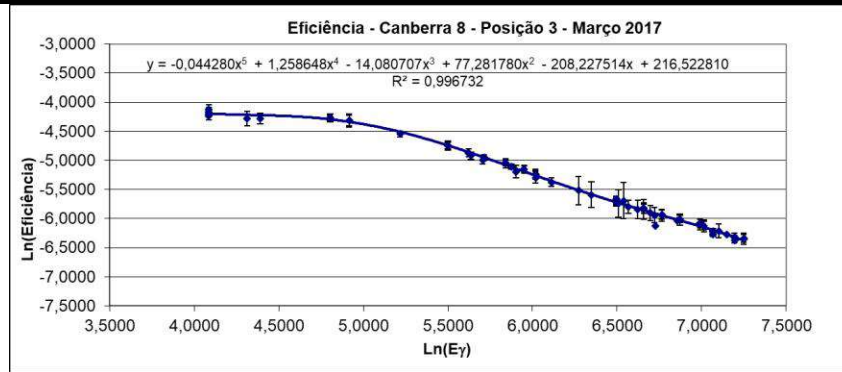
Fig. 9: Chart obtained in spreadsheet

Source: Elaborated by the authors

5.4 Issuance of reports

In addition to performing calculations and managing stored data, the system is able to issue several reports, in Portable Document Format (PDF) and Comma-separated values (CSV) formats, so that they can be used in other platforms, at the discretion of the researcher. Figure 10 shows the spectra report, its efficiencies and uncertainties, in PDF format, for a given subproject. Figure 11 shows the report, with the same data, in the CSV format.

Fig. 10: Reporting efficiency data in PDF

Source: Elaborated by the authors

Fig. 11: Reporting efficiency data in CSV

Source: Elaborated by the authors

VI. CONCLUSION

The purpose of this work was to develop a free code web software to calculate the efficiency of HPGe type detectors from the Neutron Activation Analysis Laboratory (LAN) of the Energy and Nuclear Research Institute (IPEN).

The use of the software aims to avoid errors in efficiency calculations, as well as agility in performing these calculations and chart plotting. It is also mentioned the standardization of information in an intuitive and friendly environment. The use of the activation k_0 method requires an accurate characterization of the detection

system and thus the detection efficiency in the energy range of interest and the geometry of the experimental arrangement must be known with precision.

The validation of the results was obtained by obtaining several spectra in the LAN, which had the efficiency calculated in the system and the results compared with the procedures currently used in IPEN, thus proving the efficiency of the developed system, reaching the initially proposed objective.

As future work we have developed a specific software for the k0 method: analysis of gamma spectra, calibration of efficiency, determination of the parameters related to the characterization of the irradiation position (alpha ef) and correction factors (self-shielding, sum cascade) and efficiency calculation for thick fountains.

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Impact of Economic Vulnerability on Sustainable Development

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Abstract—The purpose of this article is to address economic vulnerability in sustainable development. The population of poor countries has a state that does not guarantee them minimum conditions of survival and sustenance, and in the pursuit of personal and social growth there is no concern with sustainable development. Countries that are in increasing poverty show a population that exploits the environment to its last resources. Therefore, the main objective is to address how countries with low economic and social development tend to exhaust natural resources in order to guarantee their livelihoods, while neglecting the need for sustainable development. Thus, the article was divided into three topics: the first dealing with sustainable development, the second on the financial and economic crisis and its social and environmental impacts, and finally the third dealing with how the crisis and the economic vulnerability of a country may result in the extraction of the available natural sources for their sustenance.The present research closes with the final considerations, in which are highlighted aspects about the environmental depletion in countries of low development. In the various phases of the research, the techniques of referent, category, operational concept and bibliographic research

Keywords— Environmental impact. Crisis. Economic vulnerability.

I. INTRODUCTION

The present article aims to address how countries with low economic and social development tend to exhaust natural resources in order to guarantee their livelihood, without concern for the environment and sustainable development. That is, to go deeper into the reasons why there is this unbridled degradation of nature, without concern for the environment, with other species or with future generations.

For that, the article is divided into three parts. In the first one, it will be approached about the Sustainable Development, being drawn a general line on its meaning and its importance for the planet.

The second part will address the financial and economic crisis of the economically vulnerable countries as a justification for the lack of social structure for its inhabitants, implying the constant need for sustenance and the search for its own maintenance.

In the third item, it will demonstrate how the crisis and the economic vulnerability of a country can result from the extraction to exhaustion of available natural sources.

As for the Methodology used, it is recorded that in the Investigation Phase the Inductive Method was used, in the Data Treatment Phase the Cartesian Method, and the Results Report expressed in the present research is composed on the inductive logic basis (PASOLD, 2018).

II. SUSTAINABLE DEVELOPMENT

Sustainable development occurs when there is an economic and social growth of a society and is marked with corresponding attention also to environmental preservation(CORREIA & DIAS, 2017).

Consciousness about the degradation of the environment is a recognized theme all over the world, for society is at a critical moment in the history of planet Earth (MARQUES, 2016), since much has been extracted from nature to advance growth, while our ecosystem has not regenerated at the same speed (PAMPLONA & CACCIAMALI, 2017; DE FREITAS, 2018).

Thus, having already reached levels of urbanization and development, all countries are more attentive to the fragility of nature, seeking to reconcile development with preservation (DE SOUZA, 2016).

Although greed motivates the enterprise at all costs, the edition of legislation pertinent to the use of the natural resources is growing, being societies, institutions, government, scholars and sympathizers in constant vigilance so that the Law pertaining to the environment is fulfilled, and the cases the necessary punishment and reprimand.

In this way, sustainable development is a way of maintaining a balanced relationship between the progress of man and the maintenance of nature, carefully regulating all activities that may adversely affect the environment.

As for this, Bosselman says:

> The key element of sustainable development is recognition that economic and environmental objectives are inseparable. This prohibits any self-insulation of the economic development of the environment. Obviously, "needs" must be seen with respect to economic and environmental conditions (BOSSELMANN, 2015).

The right to the environment is considered as a fundamental right (both individual and collective), protected by the Federal Constitution, which stresses that it is the right of everyone to health and to the ecologically balanced environment, being the duty of the State and of all to protect and to materialize one of the objectives of sustainable development, which is the communication between fundamental social rights and the fundamental right to the environment, as Fensterseifer points out:

> Communication between fundamental social rights and the fundamental right to the environment is also one of the central objectives of the concept of sustainable development on the horizon constituted by the socio-environmental state of law, since, together with the idea of environmental protection, it is present in its central objective the service to the basic needs of the parts of the world and the equitable distribution of the natural resources (FENSTERSEIFER, 2008).

In relation to the need for the law to qualify human action from a responsible and communitarian perspective, Cruz emphasizes:

> In this way, it is the duty of the law to axiologically qualify human action, not only in the perspective of responsible intersubjective and community behavior, but also as an extended ethical commitment and exercised in the long term, both for the benefit and attention of future generations as well as for all the community of life (CRUZ, 2008, page 68).

The concern is constant, as with the advancement of technology and access to information, consumption increases every day, and we are all in constant movement, and consequently, this state of alert is perennial.

III. THE STATE OF CRISIS IN ECONOMICALLY VULNERABLE COUNTRIES

A country in economic crisis experiences differences between the possibilities of financial capital accumulation.

The lack of structure, knowledge, social development, implies the unregulated advance of life with community, not paying attention to environmental issues, since in a poor people, the quest for survival is already difficult, so that one can still think of preservation of the environment, becomes almost impossible (BARBOSA *et al.*, 2016; FINCO & WAQUIL, 2016; MELLO & FREIRE, 2016; RODRIGUES *et al.*, 2016).

In relation to the crisis as a phase of recession and lack of investment, Bauman describes that "The economic crisis is, according to the dictionaries, a recession characterized by lack of investment, reduced production, increased unemployment" (BAUMAN & BORDONI, 2016).

Commenting on the impact of the crisis on the citizen of countries affected by the crisis, Bauman points out:

> The countries affected by the crisis are too indebted and lack the strength, perhaps not even the tools to invest. All they can do is random cuts, which have the effect of exacerbating the recession rather than mitigate its impact on citizens (BAUMAN & BORDONI, 2016).

Countries with low economic power tend to grow in a disorderly way and the increase of the urban population without the figure of rule and of a public power accompanying this natural urbanization, has as unalterable consequences without adequate structure of security, unregulated use of sources of energy, in the end, a naturally disorganized growth (SCHONARDIE, 2017).

The lack of sanitation in the homes "is indicative of unsatisfactory socioeconomic conditions, besides insufficient coverage and quality of the use of basic health care procedures, especially of children" (CHIARINI, 2006).

If in these countries there are few investments in education, health, food, culture, even fewer investments in social and urban structure.

Environmental destruction has a strong link to poverty, Beck warned:

> (...) the ecological destruction conditioned by poverty and technical-industrial risks. The Brunatland commission was the first to point out that environmental destruction is not only the treacherous shadow of modern growth and that, contrary to popular belief, there is an intimate relationship between

environmental destruction and poverty (BECK, 1990, p.80).

Another relevant aspect is that we live in a society that tends to repeat the attitudes that it experiences and the mistakes of the past, reconstructing its experiences from the previous references it has, that is, the past of poverty, together with the lack of improvements, will bring a sequence of repetition.

As a result, environmental degradation and lack of concern for the environment become something common and normal (SÁNCHEZ, 2017).

> Poverty can be one of the main problems of environmental degradation, as well as the highest income in rich countries, causing a relationship between poverty and environmental degradation with the income levels of the population:

> In general, the relationship between poverty and environmental degradation is linked to the income levels of the population; a higher income suggests environmentally cleaner consumption patterns, higher levels of education and, consequently, an adequate destination for their waste is expected. This increase in income can lead to improved water quality, increased access to basic sanitation and reduced pollution. The improvement in environmental quality can lead to an improvement in the quality of life, such as a decrease in the incidence of infectious diseases, a drop in infant mortality, among others, problems in populations living in poverty and social vulnerability (MORETTO & SCHONS, 2007).

Claiming that history is ever more immediate, objective and ephemeral, Bauman asserts:

> The story began to appear on the front page, and so it is more and more immediate, objective and ephemeral. It is easy to forget and to be replaced by the next news, in a fast process, which loses the whole of sight, and consequently offers an always current, vivid, but fragmented, incoherent and contradictory image (BAUMANN, 2016, p. 11).

Bauman also says that:

> The society of the future is a society without memory, destined to repeat the mistakes of the past and to reconstruct its own experience exhaustively from the rubble, but so different from the modern society that we leave behind that even the mistakes of the past, thus repeated, will emerged in new light, as if they had never been evaluated. So profound is the change that has taken place with the end of modernity, and so rapid are the innovations that experience does little good. It is simple archeology and as such should be preserved in museums (BAUMANN, 2016, p. 132).

Bauman points out that "for this reason, the most recent event, the present and the new, represents the face of the truth and defeat of the previous event" (BAUMANN, 2016, 132), and complements:

> The past does not directly interfere with the present: all interference is mediated by a story. Which way this interference will take in the end, this is something decided on the battlefield of memory, in which stories are the troops and storytellers are the cunning or unfortunate commanders of the fighting forces. The lessons to be drawn from the past represent the main booty of the battle (BAUMANN, 2016, page 68).

About the growth of countries without structure and organization, the losses are taking on even greater proportions, since growth does not imply improvement, only increasing.

Commenting on this uncontrolled growth, Cruz (2012) claims to be a source of imbalance and injustice:

> The existence of an uncontrolled international economy, a source of disequilibrium and injustice, the growing distance between the developed world and those excluded from the earth, or the permanent threat of wars and ecological catastrophes, have put humanity in an undeniable civilization crisis, including its continuation as a species (CRUZ, 2012, page 56).

The countries of the European Union have seen their wealth grow between fifty and seventy percent in the last twenty years. The economy grew much faster than the population. The European Union has twenty million unemployed, five million people living in poverty and five million homeless people (BECK, 1990, p.20), and complements.

The customs that people of poor countries have is shaped as a mirror of the life with which local communities lead, without structure, without organization, in a simple way, and are more concerned with personal survival than with the organization of advancement.

In the report prepared at Founex, several warnings were included on the issues that could hinder the development of Third World nations, reaching four theses:

1) The degradation of the environment in rich countries derives mainly from the development model, while the environmental problems of the underdeveloped countries are a consequence of underdevelopment and poverty.

2) Threats may arise for exports from underdeveloped countries as a result of the environmental concerns of developed countries.

3) There is a need to monitor the creation of non-tariff barriers based on environmental concerns.

4) Additional funds are needed to support research on environmental problems in third world countries to offset major changes in export flows; to cover significant increases in the cost of many projects due to higher environmental standards; and to finance the restructuring of investment, production or export profile, which would be required by the developed countries' environmental concerns (DA VEIGA, 2013).

As for the human experience as a reference for the image that each creates of the world, Bauman ponders:

> People tend to weave their images of the world with the threads of their experiences. The present generation may find Logstrup's sunny and joyful image of a confident and trusting world to be forced, or even in sharp conflict with what one learns today and with what is hinted at by the common narratives of human experience heard all the days (BAUMANN, 2016, 43).

In a very elucidating way Bauman cites examples in which there is a conflict between personal values but the needs of the behavior pattern of a world of consumption:

The severe demands of professional survival often confront men and women with morally devastating choices between the demands of their careers and the likes of others. Bosses prefer to employ dishonest individuals, ready to break all ties in the face of a moment's demand, who never think twice about sacrificing "ethical demands" in the name of "job demands."

We live today in a global consumer society, and patterns of consumer behavior can only affect every other aspect of our lives, including working and family life. We are all pressured to consume more, and in this journey we ourselves become products in the consumer and labor markets (BAUMANN, 2016, pp. 44/45).

In a world of competitiveness, where we are constantly encouraged to consume, the vulnerability of a country leads its people to seek exclusively personal improvement, and there is no opportunity to reach levels of environmental concern.

IV. OF THE ENVIRONMENT OUTLINING POVERTY

In poor countries, with uneven development and lack of orderly growth, their citizens have become warriors in the pursuit of survival.

Citizens who do not have decent living conditions, health, education, culture, leisure, offered by the government, still have the capacity to condition their survival to care for the environment.

Seeking the improvement and guarantee of sustenance will be done at all costs, having no criterion of care with the environmental preservation. And this from the conditions for housing, food, sanitation, among others.

In order to assess socio-environmental quality, account should be taken of the seriousness of existing environmental problems, according to two criteria: (a) the impact that such a problem has on the health of the human being; (b) the degree of damage that the environmental problem can bring to aggravate the depletion of natural resources essential to a sustainable (HARDOY & SATTERTHWAITE, 1990).

"(...) the environmental conditions to which people are exposed are intimately related to quality of life, a concept whose fundamental reference is the individual person.Quality of life is conceived as resulting from the health of the person (evaluated objectively or intersubjectively) and the (subjective) feeling of satisfaction "(GALLOPÍN, 1982).

If in economically vulnerable countries there is talk of environmental degradation in the area of deforestation for urbanization, excessive use of natural resources, inadequate disposal of solid waste, the structure and necessity of these places is very different from the growing countries where it is worth pondering , the degradation reaches even higher levels. In these countries the population seeks to guarantee their housing, food, growth, causing environmental degradation with excessive use of chemical fertilizers and polluting fuels, contamination of groundwater, rivers and soil impoverishment, among others, we have that in the great world powers the natural injury reaches much larger proportions, such as the use of nuclear energy.

Degradation does not only affect industry, agriculture and livestock, but also in individual and family social issues, since, since they do not have the economic capacity to structure themselves in the housing market, the poor settle informally in any marginalized areas and live there, without sanitation, without security, without organization (PIMENTA & PIMENTA, 2016; SOUZA, 2016; SANTOS, 2017).

Developed countries seek to use technological innovations to create ecologically viable production

processes, but they have an urban and industrial structure that.

Thus, in the pursuit of social growth and the development of daily life, it is not uncommon to practice depletion of natural resources in poor communities, justifying the damage of environmental degradation by the need to live, to sustain oneself, to maintain oneself with dignity. In this sense, Beck highlights the focus theme that inspires the production of this scientific article, stating:

> It is not hard to imagine that a country living in increasing poverty will exploit the environment to its ultimate resources. In despair (or in the political cover-up of despair) he can use the armed force to take possession of foreign sources of survival (BECK & CARONE, 1999).

And often the depletion of the environment of a country is not only to meet the needs of its people, but also because of the greed of better developed countries that take advantage of this vulnerability to benefit from natural matter with low cost and abundance.

It is noted that great world powers were born and stood out because of this exploitation of the poorest countries, exhausting their natural resources at low cost.

Fortunately, there have been disruptions and productive restructuring around the world, as more conscious countries are engaged in the discovery of new energy sources, technological innovations and workforce management adjustments, always aiming at a sustainable development that can be applied around the world.

Unsustainable exploitation of natural resources in poor countries can be bypassed as long as they invest in decent living conditions, education and income opportunities. Cruz, defends the possibility of economic justice for distribution of wealth, adding that "it becomes indispensable to configure a new concept of democracy that helps to safeguard legality in the transnational scope" (CRUZ & BODNAR, 2012).

It should be borne in mind that economically developed countries should assist economically vulnerable countries. In this regard, "[...] the question is not whether the rich world can afford to help the poor but can afford not to help them."(SACHS, 2005). It is important to emphasize that "this aid" would consist of administering the "consequences" left by poverty and environmental depredation, based on technological outputs, far from the economic, political and social determinants that produce them (SCHONS, 2012).

The idea that any damage done on planet Earth directly affects all its inhabitants has intensified the discussion of the growth model more suited to the goal of sustainable development, and it is also up to the developing countries to collaborate for improvements in all continents.

Thus, the poverty-environment relationship must understand the themes of equity, justice and ecological health, not allowing the belief that the poor are the cause of all urban evils to crystallize (COMIN, 2002).

Finally, the duty to the environment is the duty of all, not only of the states and the private sector, but must be guaranteed for future generations, beyond the current one.

V. CONCLUSIONS

At the end of this article, we notice the degradation of the environment is present in economically vulnerable countries, in the sense that no economic conditions for the sustainable use of the environment, and often not even a study on this.

The constant search for economic development causes these countries to degrade the environment in order to reach their goal of industrializing and developing economically before the rest of the world.

The advance of civilization and urbanization of cities has led to environmental disasters so severe that it has become essential to create regulations to minimize environmental degradation.

Sustainable development should not be a goal to be followed, but it is a fundamental condition for guiding the advancement of civilizations with the guarantee of environmental conditions already so damaged.

Most developed countries have already severely degraded the environment to reach the levels of urbanity and social structure they experience today, which is why laws and regulations have emerged that set limits to the advance of modernity.

This is because it is not enough to think about advancement and growth without the concern that there is a healthy and adequate environment for future generations.

In countries with low economic and social development, we have the difficulties of their populations, even in the challenge of their own survival, in search of housing, food, study, culture, leisure, among others.

This vulnerability implies practically no concern and possibility of care with environmental and social degradation.

The poorer the population, without a state fulfilling its role as provider of social welfare, people will have less education, financial conditions and will have less awareness and opportunities to pay attention to environmental issues and to effectively difference.

Therefore, a poverty-stricken country will result in inhabitants exploiting the environment to their last resources, depleting natural resources, without any concern for sustainable development.

The existence and creation of means of production, distribution and consumption of existing resources, in a

more ecologically viable way, is essential, to be initiated by countries already in development, in collaboration with the poorest countries, that is, state intervention is necessary.

There is no way to forget the existential minimum ecological, which is a constitutional guarantee of a dignified existence, which operates in a way linked to fundamental social rights and fundamental environmental law.

The socio-environmental state is also concerned with guaranteeing people's quality of life and the protection of the environment, and not only with the unbridled economy, and it is in this sense that the developed countries must operate in favor of the less favored.

Finally, one realizes that the individual is the protagonist of his own history, and plays a fundamental role, together with the State, in the construction of fundamental rights, as well as in the rescue, protection and growth of sustainability and the environment ecologically correct and dreamed by all.

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Public Policy and Public Management: an Emphasis on the Evaluation Phase

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Abstract—This article aims to describe the evaluation phase in public policy and how a greater emphasis in this phase can contribute positively to the public management, for this the technical procedures were outlined by the bibliographical research, from a review of the main concepts on the subject matter.As a result, the importance of the evaluation phase in the public policy process can be perceived as a way of guaranteeing greater effectiveness in the results obtained by Public Management. Finally, the paper points out the indispensability of a theoretical deepening that allows future discussions on the theme.
Keywords—Public Policy, Public Administration, Evaluation.

I. INTRODUCTION

The current context of changes, in the economic, political and social segments, added to the technological transformations and speed in the communications, began to demand a better performance on the part of the public administration. Public policies, government programs, actions, or any activity by the State need to be well formulated, monitored, and evaluated for the achievement of the expected objectives.

Public Policy is a sub-area of Political Science and has in its DNA multidisciplinary aspects, which are contributions of the different areas to the theme involved, that is, a field permeated by various disciplinary collaborations [2].

The objective of this paper is to describe the evaluation phase in public policies and how a greater emphasis in this phase can contribute positively to public management.The relevance of the study is due to the fact

that the State is required to provide better services, greater effectiveness in its policies [7].

The present investigation is justified by the lack of work on the evaluation phase of government policies and programs.The phases and implementation phases have always received more attention from the specialized literature.According to Costa and Castanhar [8] for many years the development of technical knowledge in the area of public policies, focused on improving the standards for the formulation processes.

Taking into account that this subject is very wide and dynamic, this paper intends to contribute with the detailing of the evaluation phase for an improvement of public management.Some important concepts related to the theme are highlighted here.

To account for the purpose of the work, in addition to this first introductory section, the chapter is composed of four more sections. In the second section we present a brief review of the literature on public policies, in the third section a brief public management review.In the fourth section of this paper the methodology used is presented, followed by the final considerations and future work proposals.

II. REVIEW OF LITERATURE

Public Policy

There is no consensus regarding the conceptualization of Public Policy. This section of the paper tried to structure a theoretical reference as a way of support and foundation on the researched topic.

Public Policy is abstract and materializes through public programs, projects, laws, publicity campaigns, organizational innovations, judicial decisions, direct public expenditures, government subsidies, among others.

It takes shape through interventions in the areas of health, education, security, housing, among others. Examples of these interventions include a drug distribution program for hypertensive patients, a school lunch program for elementary school students, the installation of police stations, a federal government housing lease program [21].

A public manager needs to propose alternatives and changes to the reality that presents itself. For Souza [25]Public Policy is "the field of knowledge that seeks, at the same time, to put 'government into action' [...], and when necessary, propose changes in the course or course of these actions [...]".

The increasingly complex society, with more conscious citizens and, on the other hand, cities with problems in the areas of mobility, safety, health and education, generate problems of various orders and it is in this field that public policy strikes. As Secchi [21] explains, Public Policy "is an elaborate guideline to address a public problem".

And what would be a public problem? Problem is the discrepancy between the status quo and an ideal situation possible. A public problem is the difference between what is and what one would like to be the public reality [24].

A public manager by failing to address a problem or doing nothing about it is also a political choice and can be defined as Public Policy.According to Dye [10]Public Policy is "everything that governments choose to do or not."
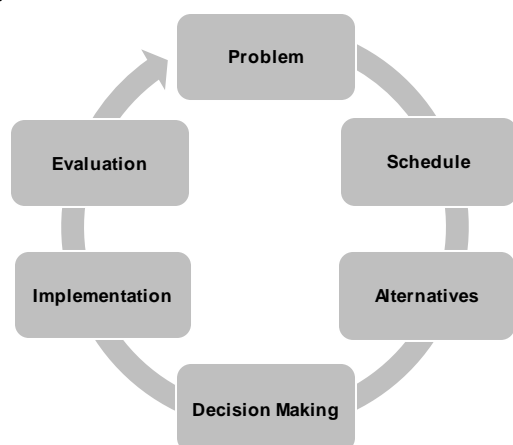
Fig.1: Public Policy Cycle, 2015 [2].

Secchi [21] further deepens the discussion and determines a longer sequence of the Public Policy cycle: identification of the problem; formation of the schedule; formulation of alternatives; decision making; implementation; evaluation and extinction.

The public policy cycle is a graphic representation of the phases from formulation to implementation to evaluation. This is not to say that all Public Policy necessarily goes by through this logical sequence, the function of this cycle is merely illustrative and didactic. For Secchi [21]the cycle "[...] rarely reflects the real dynamics or life of a Public Policy. The phases are usually mixed, the sequences alternate".

The cycle "is a way of visualizing and interpreting public policy in phases and sequences organized in an interdependent way" [2]. For the MPOG (Ministry of Planning, Development and Management)[17]the cycle consists of measures and these "measures must be meaningful, they should not be operationalized by legal obligation or imposition, but because they are useful tools throughout the cycle of Public Policy management."

This paper aims to analyze a final phase of this process, an evaluation phase, as a determinant of good management of public resources applied in policies. For this purpose, we sought to deepen the subject.

Evaluation is an analysis that begins as a good planning process and goes through a good definition of indicators, hence the concept of systemic analysis. In this sense Weiss [27]assessment is a "systematic analysis process and/or the results of a program or policy [...] with the objective of contributing to the improvement of this program or of this policy ".

When governments are accountable to society and evaluate their performance, they are seeking to qualify public management [18]. The evaluation phase of the results is also relevant in the organizational learning process, since the accountability for goals and objectives not implemented helps to review the performance [6].

Effective management is one that can be more efficient, that is, make the best use of its resources. Cohen and Franco [7] define evaluation as an "activity that aims to maximize the effectiveness of programs in achieving their goals and the efficiency in allocating resources to achieve them". When evaluating a Public Policy, the manager can decide to continue, or even limit, the continuity of a Public Policy. Without the evaluation process, it is difficult for the state to control the results of its government policies and programs. "The purpose of evaluation is to guide decision-makers, guiding them as to the continuity, need for corrections or even suspension of a particular policy or program" [8].

For Gelinski and Seibel [13], "[...] there is no unambiguous way of analyzing Public Policies. From design and formulation to monitoring and evaluation ".

The Public Policy field can produce a varied range of responses, including how the current policy is behaving, through indicators based on valuation measures, for which are created evaluation parameters and ways of measuring performance based on criteria and previously defined patterns [2].

Garcia [12] defines evaluation highlighting the importance of a previously defined comparative standard

to arrive at a desired value in the obtained results: "Evaluation is an operation in which the value of an organizational initiative is judged from a reference framework or a previously defined comparative standard. It can also be considered as the operation of finding the presence or quantity of a desired value in the results of an action undertaken to obtain it, based on a frame of reference or criteria of acceptability intended" [12].

Perhaps the evaluation has been overlooked, in this public policy process, by the manager's or formulator's difficulty in accepting their results being exposed.Often this aspect of self-criticism coupled with the discontinuation of policies scarcely diminishes the importance of evaluation. Agum, Riscado e Menezes [2]say that "one of the most critical moments in a policy may be its evaluation".

Quality in actions and activities goes through a process of continuous improvement and adaptability. "The evaluation phase is essential for the development and continuous adaptation of forms and instruments of public action" [11].

Public Administration

The literature review presented in this section sought to base the public management construct as a way of contextualizing the discussion here.

The State increasingly charged for satisfactory performance and results needs to better monitor and evaluate its policies and government programs. "The evaluation of results is therefore a cornerstone in sustaining the State" [8].

People are increasingly demanding and participative, seeking a more effective public management that can optimize public resources.A change aimed at "a more effective State and willing to discuss and respond to the aspirations of society certainly runs through the existence of a more active citizenship and engaged in the search for solutions" [26].

The government's coercive and regulatory capacity makes it the largest public policy proposer / implementer. How do you defend Silva and Bassi[23], with regard to Public Policies "[...] only the government can implement them because it has the capacity for universalization, coercion and regulation and can adopt measures of a universal character[...]".

The establishment of the agenda and the decision of which problem to face, given the scarcity of resources, obliges the public manager to choose an alternative to solve the problem. Management needs to choose available alternatives, thus, policy formulation "[...] involves identifying and determining possible solutions to political problems, exploring the various options or alternative courses of action available to address them"[14].

Nowadays, public management is expected to be more focused on managerial aspects, management in search of

excellence and better performance. For Costa [9]the new public management – NGP – presented with a set of ideas such as management quality, performance evaluation and a style of management that emphasized goals, periodic contracts and managerial autonomy.

In public management, efficiency is the rational and economic use of inputs in the production of goods and services; is a relation between: inputs, products, quality and cost. Efficiency refers to the degree of achievement of the goals (or short-term goals), it is a measurement of results used to evaluate the performance of the administration.Effectiveness, in turn, is the final impact of actions, the degree of satisfaction of the needs and desires of society for the services provided by the institution, goes beyond immediate deliveries (goals/objectives) and analyzes the transformation caused by the execution of actions [19].

Table. 1: Effciency, Effectiveness andEffectiveness, 2013[20].

EFFCIENCY	EFFECTIVENESS	EFFECTIVENESS
COST	RESULT	IMPACT
Do properly	*Do what must be done*	*Do correctly what should be done*
Use productive resources	*Ability to achieve objectives*	*Transform the existing situation*
Cost benefit	*Meets goals*	*Change and development*
Minimum of losses and/or waste	*Do what was proposed*	*Relationship between production and capacity to produce*

Within a scenario where the public manager is charged more efficiently, because resources are scarce. Caiden [4]states that a government cannot become a company, but in turn, it can become more entrepreneurial. This view is consistent with Manning et al. [16]: "The notion of performance is seen as fundamental to the modern state: governments need to increasingly gain legitimacy from the provision of promised services."

The movement to seek more quality in the public sector with a focus on citizens was one of the main revolutions of the managerial model [1]. For Cabral Neto [28], the management reform presents in its set of objectives "the de-bureaucratization, the decentralization, the transparency, the ethics, the professionalism, the competitiveness and the citizen focus".

To encourage innovation and entrepreneurship of public officials, management contracts would be the most efficient way to manage the State and the performance of managers. The public administration must modernize and combine orientation to the citizen/client and thus obtain results [3]. For a management to improve its results, it is more useful to think of performance management than to measure performance as an end in itself[15].

III. METHODOLOGY

The research adopted a qualitative approach and the data were obtained through bibliographic research in books, articles, dissertations and theses.Data collection was performed between March 20 and June 25, 2018.

As for qualitative research, the bibliographic review is not limited to the initial stage, but plays an extremely important role throughout the research.

The bibliographical research is a survey of some works that call attention to this theme, of an exploratory nature due to the fact of gathering data with the specialized literature to elaborate the theoretical framework of the work. In this way, it allowed to update knowledge in order to appreciate the diverse positions that the scholars have on the subject.

Bibliographical research is reaffirmed as an important methodology in the production of science capable of generating in subjects still little explored, the postulation of hypotheses or interpretations that will serve as starting point for other researches.It is important to confirm that the bibliographic research is carried out to theoretically base the study object, contributing with elements that support the future analysis of the data obtained.

According to Severino [22], the bibliographic research are studies carried out through available and properly published records of previous researches, which approach the proposed theme.In addition, it provides a better understanding of the phenomena and contributes to new readings, being possible through the theoretical basis chosen.

From the methodological point of view, we sought to study and understand the main parameters and form of application employed in the studies found.Thus, the present work is part of the perspective of contributing to the development of the thematic under analysis.

IV. CONCLUSION

In view of the above, considering the specific issues of this, it is observed that through an emphasis in the evaluation phase, public management can be more effective in attacking the problems and dilemmas faced by the public administration.

It also appears as relevant to understand that within the cut of this research the due importance of the public policy cycle, in an increasingly complex society with more latent problems. Public Policies that are not evaluated are still detected and from this the public management loses control of the degree of effectiveness of each policy.

Although of the limitations that this work faced, this review concluded that the evaluation phase, within the Public Policy cycle, has become of fundamental importance and that it still needs to be improved and intensified due to its complexity.

Throughout the article a series of definitions and conceptualizations was presented,showing the concern of the work with theoretical support.

The present study proposes as future investigations, the later study that emphasizes the influence of the PDCA cycle, a tool widely used in the field of administration, on the public policy cycle.

It is worth emphasizing that the debate raised here still requires, of course, an accumulation of knowledge about other studies that may, in turn, enhance the analysis.

Therefore, the present work is presented as a simple collaboration for a reflection and discussion about aspects considered essential for a sensible understanding of the evaluation phase within the Public Policy cycle.

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Wind Analysis over Multistorey Building Having Flat Slab-Shear Wall Interaction: A Review

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Abstract— *In high rise multistorey building there is a big problem to resist the lateral forces which are acting over it such as wind forces so it is important to make the structure more stiff. To counteract various lateral forces on a structure in which beam is not used, it is very difficult to make it stable. Furthermore, when the flat slab used in the structure, lateral effects are very high and the result parameters are very worst. In this paper, the approaches for finding the objectives which the researchers have already defined in their research, but no one have first designed the structure manually and then analyze the worst wind effects by software approach. Equivalent frame method is selected for the further analysis and data collection for software approach.*
Keywords— Building cases, Equivalent Frame Method, Flat slab, Shear wall, Wind load.

I. INTRODUCTION

In present time during the construction, the researchers faces many problems related to stability of building, height of building, load bearing and also aesthetic purposes so that to fulfil these type of criteria, the flat slab is important components in the multistorey buildings in present time because it has many advantages over the R.C. framed structures. Beamless structure which is directly supported to vertical columns to transfer its load is called Flat slab. It is used for appealing point of view in the structure. The headroom in the flat slab which is more as compare to Reinforced Concrete slab which may be one way or two ways or grid slab. Flat slab are more flexible as compare to other type of slabs but weak in lateral loading such as wind load and earth quake load so that it is important to find the behaviour of flat slab in lateral loading. The flat slab is good as compared to R.C. frame buildings but in flat slab buildings has low base shear capacity and large deflection.

In architectural point of view, flat slabs are good. Flat slab permits flexibility in building construction. It takes clear space, low height, easy framework and taken less time. Therefore flat slab buildings are used now-a-days in India. Flat slabs are used now-a-days but there is no any best design procedures of flat slab. In Indian standard

code of practice, there is not any provisions of irregular geometry and design of it.
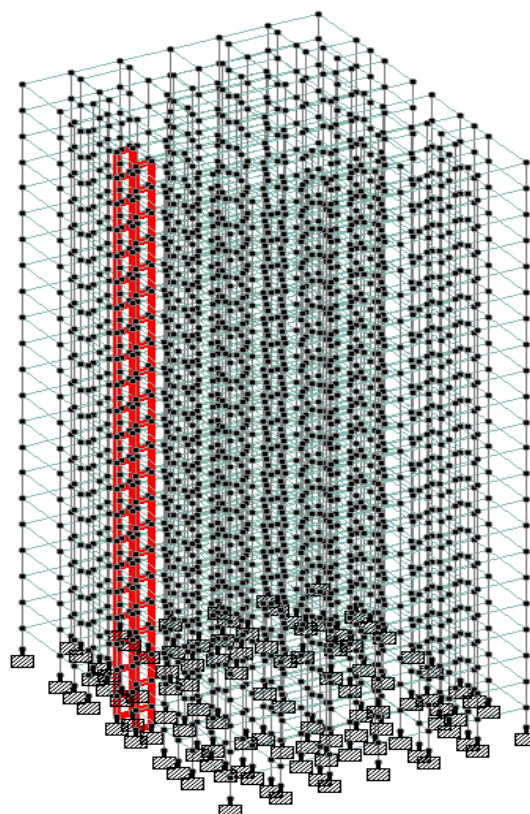
Fig. 1: Model building plan case 1 provided shear around the lift area.

Table 1: Wind forces as per IS code. (Zone wise table)

Wind Speed (m/s)	Wind type
55	Type 1
50	Type 2
47	Type 3
44	Type 4
39	Type 5
33	Type 6
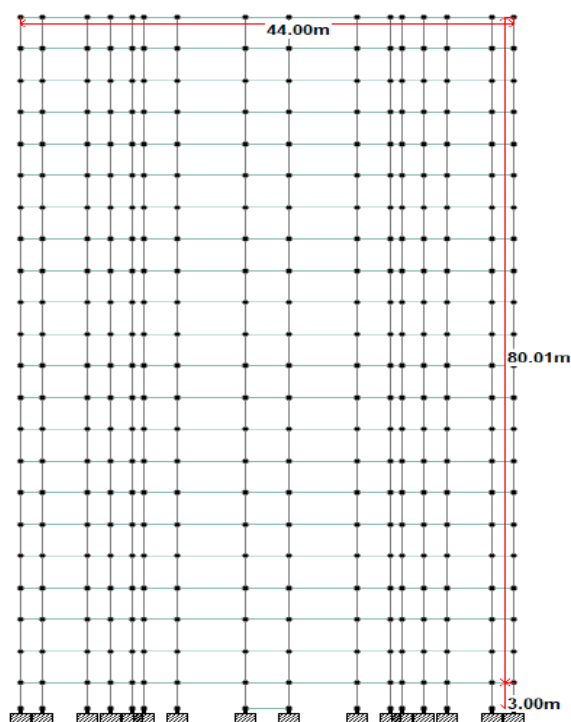
Fig.2: Model building case front view

II.   REVIEW OF LITERATURE

The four types of flat slab i.e. simple flat slab nor drop nor head, flat slab added drop, flat slab added column capital and flat slab added drop and column capital are described by them. They compare only simple flat slab, flat slab added drop and grid slab to find most economical slab among them. As per this work, the description of flat slab is economical i.e. simple flat slab or added drop with flat slab and grid slab have shown. Therefore to come up this research work it has been found that the added drop flat slab is more economical as compare to without drop and grid slab. They compare simple flat slab, flat slab added drop and grid slab on the basis of concrete used, steel and total rate of each slab component. They also found that grid slab is not economical as compared to flat slab because in grid slab concrete is more required. Therefore the result obtained is, the flat slab with drop is the most economical among them [1].

The analytic definitions of 15 storey model building with and without shear walls under seismic loading are used by them. To find the different locations of shear wall with the help of R. S. A. using software ETAB was one of their objectives. Cases of shear wall are used in building with different locations of shear wall, building without shear wall, building with L type shear wall, building with shear wall along periphery and building with non-parallel shear wall along periphery. Since the results have been observed that the building with shear wall is better due to difference in storey displacement, time period, base shear and storey drift. Shear wall along periphery is also better for the effect of seismic load and earthquake load. Base shear in X and Y directions for building with shear wall are 3.08% for former and less for latter one, without shear wall values along EQX=48.52% and EQY=53.36% are detected. So the results are the building with shear wall is better because of difference in storey displacement, time period, base shear and storey drift. Shear wall along periphery is good for the effect of wind load and earth quake load [2].

The behaviour of buildings having flat slabs added drops with shear wall and flat slab added drop without shear wall are presented by them. So for this, comparison of the actual behaviour of multistorey buildings having flat slabs added drop provided shear wall and without shear wall to check these two types of buildings under seismic forces. The zones 3rd, 4th, 5th are taken by them. To analyze this using Staad pro software, for this they take six model cases on the basis of different storey.

Table.2: Different model cases

Model case 1 (16x24) G+7   provided Shear wall at plinth
Model case 2 (16x24) G+9 provided Shear wall at plinth
Model case 3 (20x30) G+7   provided Shear wall at plinth
Model case 4 (20x30) G+9   provided Shear wall at plinth
Model case 5 (20x30) G+11 provided Shear wall at plinth and 1st floor
Model case 6 (20x30) G+13 provided Shear wall at plinth

The result is that the flat slab added drop has more drift as compare to simple flat slab so that for shorter span of flat slab building can be used as master slave and for longer span using realistic approach [3].

The expression about G+8 storey building model and the method to design the flat slab is the direct design methods are described by them. To increase the performance of seismic behavior of a building is analyzed with the help of E-Tab software. In this paper the comparison of basically two shapes of flat slab have been evaluated. They are:-

 a)   Rectangular Flat slab (6.8*6.4) added drop , without drop
 b)   Square flat slab (6.4*6.4) added drop , without drop

Manual design and software analysis results are equal for Punching shear. Base shear is greater in flat slab without drop as compared to flat slab with drop. Storey drift is nearly same in Rectangular slab as well as square slab.

Storey displacement has observed maximum in rectangular slab and minimum in square slab [4].

Using SAP 2000 software, on the basis of seismic loading, the comparison of flat slab building and regular frame building have discovered by them. For this, they took G+ 3 model with plan area of $(24*24)$ m^2, plinth height of 1.8m and took floor height of 3.6m. After comparing the result the regular frame building performance found to be better than flat slab. To increase the performance of flat slab building using shear wall has suggested by them [5].

The consequences after punching failure of flat slab are considered by them. The flat slab structures are fail due to punching so it would become danger for humans and other damages. So those in this work, to find the post-punching shear strength of slab-column joints with the help of an experimental and theoretical research. So after punching, the residual shear strength could be increased due to the activation of the flexural reinforcement. To enhance the punching shear strength they suggested providing bent-up bars [6].

Comparative studies of flat slab with post tensioned flat slab are publicized by them. In this paper, they take two types of flat slabs i.e. simple Flat slab and Post tensioned slab. These two types of slabs are compared with each other. For this purpose, they used code IS-1893 and considering Zone 2 and 3. There are various types of model building considered which was G+9,G+11,G+14,G+19,and G+24 storey which have different in their geometrical properties and material properties. Linear time history analysis method is used by software ETAB 2015. The results observed that the flat slab is more flexible as compared to post tensioned slab and also the post tensioned flat slab is uneconomical and the former one fails earlier to lateral loading. In post tensioned slab roof displacement is minimum as compared to R.C. Flat slab buildings having drops [7].

The presentations of enhancement of punching shear strength of flat slabs using shear-bond reinforcement are shown by them. The main problem of flat slab is the punching failure which is known as sudden brittle failure, so that there are many ways to reduce the punching shear failure as increasing slab thickness, also increasing column thickness was found out. Since these provisions are not seems to be better for architectural purposes. So that the work suggests providing shear reinforcement and to find which shear reinforcement is reducing maximum punching failure. The results found that, without shear reinforcement, in concrete slab, there was a sudden failure in brittle manner. To increase the punching shear capacity of the slab, shear bands are provided. It is provided over the critical punching shear zone. Shear bands with

vertical legs are easier in detailing placement and fail in more ductile mode. So using shear band parallel to the potential shear crack is less useful. Orthogonal distribution shear bands are slightly enhancement in failure load capacity ranges is 6% has found better. The arrangement of shear bands around the column circumference provides enhancement [8].

Flexibility in building construction permitted in flat slab is defined by them. But flat slab is weak against earthquake loading. The main purpose of this paper is to find the load carrying capacity of different proportioning of flat slab which resist the punching shear failure. The different flat slabs are the simple flat slab neither of drop, head, flat slab added drop, flat slab added column capital and flat slab added drop and column capital.

The seismic analysis of multi storey building with flat slab resting on plain and sloping ground are defined by them. In this work, the associations between plain and sloping ground against seismic loading and its effect have suggested. With the help of analysis it has been known that the construction of building is more danger in sloping ground as compare to plain ground. 3D analytical model of 10 storied building has considered by them. In plan which includes 4 bays in y-direction and 6 bays in x-direction was analyzed with the help of Response Spectrum Analysis using software ETAB. The result found with the help of dynamic linear analysis and it includes the effect of base shear, displacement, storey drift, time period, frequency and force. Hence the result observed that the performance of the building on sloping ground is more danger as compared to plain ground [9].

The investigation is based on storey displacement, frequency base shear, storey level, accelerations and punching shear failure. In above four cases we found out which type of combinations generate less punching shear at slab column joint. The structure is analyzed with the help of ETAB software [10].

The information about major issue associated with flat slab and different method for analysis of flat slab used to confirm the behaviour of flat slab. This paper gives the guidelines for designing the flat slab. Flat slab is only design for gravity loading (according to IS-code 456-2000).They define the three methodology to analyze the flat slab.

a) Direct design method- Used for gravity load (regular shapes)

b) Equivalent frame method- Used for gravity load (regular shapes)

c) Finite Element method (also known as descretisation method) - Used for gravity load (irregular shapes).

In this work they stretches the information about the data related to flat slab and different method for analysis of

flat slab to support the behaviour of flat slab with including all information related to flat slab [11].

The Flat slab construction in India is designed by two methods which is conventional RCC and post tensioning and their relation between them have been described. Many advantages of Post tensioned flat slab over R.C.C. slab such as minimum reinforcement is provided, crack free load at full service load, smaller deflection etc., but in practical in post tensioned member the thickness is not reduce and also the cost is high. Because Post tensioned flat slab cost is very high so that conventional R.C.C. flat slab are constructed in India but it has some deficiencies so that to minimize it which is used Indian codes in combination with other code ACI, BS, EURO [12].

III.   CASES TO BE SOLVED

To design the components of the flat slab multistorey building, after the literature survey, to make the building more economical, the different parameters should be checked as per the selection of different model cases-

Model case M1 = Simple Flat slab model building with shear wall around the lift area.

Model case M2 = Simple Flat slab model building with shear wall around the lift area and around the major stress plate parts.

Model case M3 = Flat slab added drop model building with shear wall around the lift area.

Model case M4 = Flat slab added drop model building with shear wall around the lift area and around the major stress plate parts.

IV.   CONCLUSIONS AND OUTLINE OF THE PROPOSED WORK

After studying various research papers having different themes and reviewing the papers related to flat slab that it is designed for multistorey buildings for eliminating the projection of beams, providing the shear wall to offer the stiffness to the building. So in this work, to propose the technical work for worst wind effects, the flat slab shear wall interaction under wind loading has been detected with the help of various papers reviewed and the conclusive results are written below:

1. There are two methods for finding out the design of flat slab manually.
2. The panels are selected and divided as per different loading conditions.
3. The analysis can be done on simple flat slab, flat slab with added drop to it.
4. Worst wind condition should be defined as per wind zone selection or by city as per Indian Standards.
5. The study should conduct by both manual approaches as well as by software approach.
6. A model plan should be defined first and then various models have taken for analysis.
7. The main aim of this study is to design the simple flat slab and added drop flat slab with equivalent frame method and analyze the model building plan to resist the wind load with providing shear walls and find the most economical model plan among the all cases.

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Application of the Internet of Things in the Development of a "Smart" Door

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Abstract—In this article we propose the development of a prototype that consists of two systems that make a door "intelligent". These door-coupled systems allow a person through an application to have control and access to the door, gaining information about who the door is by unlocking and locking it without having to move to the door. For the development of these systems was used the microcontrollers of the esp8266 family, as these allow connection to wi-fi network, making other devices with access to this network can connect, such as a smartphone with application. During the development of the prototype one can observe the complexity for the production of the application and the communication between the systems by wi-fi. However, the low cost of systems and the availability of peripherals that allow the integration of these systems with the most varied applications, make electronic security accessible to all those who wish to enjoy, further enabling technological inclusion in society.

Keywords— IoT, Smart Door, Microcontroller.

I. INTRODUCTION

The definition of the "internet of things" is to say that all "things" can be monitored or given data and can be used for various purposes. More technically, through sensors and embedded electronics providing access to data over the internet. (STEVAN JR., 2018)

Internet devices and equipment are usually marketed with high prices, as they offer comfort, practicality and a differential for the user of the technology, making it difficult and limiting access to a certain public. How then is it possible to enjoy such benefits at low cost?

The development of a prototype, using low cost electronic components and knowledge of electronics, automation and basic programming can show how it is possible to have access to such resources, solving problems, bringing practicality to our everyday life and giving us the possibility to follow the technological evolution in real time.

II. THEORETICAL REFERENCE

When we think of an autonomous microcontroled system, we think of a system that does the task alone, without the need for human interference. For this, our system must be endowed with some intelligence, such as a computer or artificial system. In systems the ESP8266 will be used as the brain of our system.

The smart door will be built into systems installed at strategic points in the door. On the outside we will have system 1, which will be composed by presence sensor, NodeMCU (ESP8266), LCD Display and IP camera.

The presence sensor is an electronic module that functions as an input peripheral within a system, ie, it sends information to the brain of the system (NodeMCU) and it decides which function to perform. Here, the sensor will have the function of identifying the presence of an individual at the door.

The NodeMCU is a microcontroller that has the feature of being able to connect to Wi-Fi networks. It will perform two functions in this system from the moment you receive information from the presence sensor, the first being to send a notification to the smartphone of the owner of the system that there is a person at the door and trigger a message on the LCD to inform the person that their presence has been identified, so the person does not have to worry about using any means to inform the owner of their presence.

The IP camera is a separate device, ie without interaction with the system, only with the owner's smartphone containing the application that will give access to the camera, so when the owner receives the notification it will open the application to know who the door is, if you recognize the person, this through the application can unlock the door.

System 2 is inside the door. And it will be responsible for the control of the door, consisting of the Wemos D1 Mini (ESP8266), relay module and solenoid lock. Basically, this system has the function of receiving the command of the application to unlock or lock the door. However, for this command to be sent from the Wemos D1 mini to the latch, it is necessary that there is a

relay module interlocking them, as they both operate at different levels of electrical current.

Programming and Applications

The systems composed of the ESP8266 microcontrollers have been programmed in the C language through the Arduino IDE, software that allows programming through the creation of sketches. These sketches would be what we could define as instructions.

Working in conjunction with the Arduino IDE, we have the Blynk App. This application allows the development of applications that require connectivity, ie, internet interaction for sending data and remote control devices. In the proposed system, BlynkAppterá an application that will notify the owner whenever there is a person at the door.

Finally, we have App Inventor, a software developed for anyone who has never programmed, but wants to start creating applications. With this tool it was possible to develop the application responsible for accessing the IP camera and controlling the port.

Communication

The default mode of Wi-Fi communication used in most applications is called "fixed infrastructure" due to the presence of an access point (AP) that is intended to connect to Wi-Fi network communication. In this mode, all communication must go through the AP, which identifies its recipient and passes the communication.

In the prototype developed, the two systems together with the smartphone that owns the application are connected to a router. This functioning as access point, will have the function of mediating the communication between these devices, thus allowing them to form a Wi-Fi network.

III. MATERIAL AND METHOD

The development of each system occurs in such a way that all the components that have pins, these pins will be responsible both for the connection of the components to each other, and for performing certain functions. Therefore, the pins that would be responsible for establishing electrical connections between the components are defined. So programming is developed through the Arduino IDE. With the pinout having been defined, they must be declared in programming.

With the development of the programming finished, the program is transferred to the microcontroller of each system through USB connection. Then, it is observed whether the components of each system were performing the functions that had been defined during programming.

Starting the most important stage of the project, we established communication between the systems through the implementation of each program and the use of Wi-Fi network, along with the development of the application to be used by the user. The same was installed on a smartphone to test communication with the systems.

Sistema 1

In system 1, we have the presence sensor that for its operation, needs a power of 5 to 20 volts. The LCD display needs 5V. Note that both operate at 5 volts, so an external 5-volt power supply has been added to the design, as the NodeMCU is not able to supply such voltage as it works with the 3.3 V voltage on its pins. Thus, VCC and GND will be the respective pins fed by the source as shown in figure 1.

The NodeMCU will work with the D1 pin running on a GPIO and pins D3 and D4 have functioned as SDA and SCL respectively. D1 will be connected to the OUT pin of the presence sensor that works with an output voltage of 3.3V, meaning that a detected movement remains at 0V if there is no movement. However, pin D1 running as GPIO interprets these values as 1 or 0 respectively.

The OUT pin remains energized for a certain time, this is due to the presence of a trimpot that is responsible for the time the output remains at high level. With this, the trimpot was adjusted according to the time in which it was desired that the display would be shown the message to the client. This will be better explained in the programming logic part.

Regarding the LCD display, the SDA pin will be connected to the D3 for serial data transmission and the SCL pin connected to the D4 for sync, also serial.
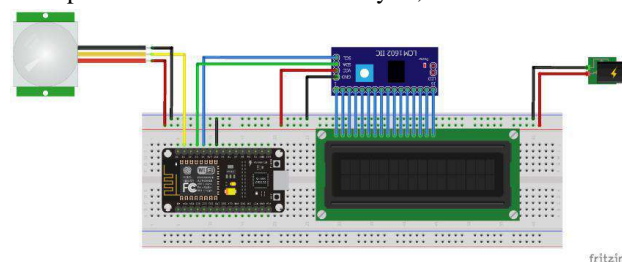
Fig.1: Connection scheme of system 1

Source: Author

System Progamming Logic 1

In order to read the presence sensor, it is necessary to state in the sketch in which pin the sensor communicates with the NodeMCU, how it is operating, in this case, as input, ie, sending data to the NodeMCU, and add the function that will be responsible for reading the digital pin, reading is with two values, 1 or 0.

A decision making is done according to the value read by the NodeMCU, actions will be defined through a

conditional structure. In this case, the value that interests us is 1, since it indicates that a presence has been identified. And it is based on this value, that the conditional structure will perform two actions.

In order for the welcome message to be displayed, it is necessary to establish a communication between the NodeMCU and the LCD Display, and this is done through the I2C protocol and also the definition of the pins that will be the communication channels. The display will show the message only for the time that the OUTPUT pin of the presence sensor is set to 1. As the sensor trimpot has been set.

Sending notification to your smartphone through Blynk takes place in two steps. The first step is to install Blynk App on your smartphone, in this application we will develop a secondary application that will send a notification if someone is detected. Each application that is developed in the Blynk App, receives an access key. This access key will be responsible for establishing communication between the NodeMCU and the Blynk App. In step 2, we configure the NodeMCU to communicate with the Internet, to access the Blynk Server. Thus, the NodeMCU is identified by the server through the access key and the server sends the notification to the smartphone.

System 2

To connect the magnetic sensor to the Wemos D1 mini, we need to add a resistor so as not to short-circuit the microcontroller. Insertion of the resistor is necessary to reverse the input. Without the drive, the 0 volt signal arrives at the GPIO input by the resistor. When it is activated, the 3.3 volt signal arrives directly at the GPIO pin, which can understand the change of the input signal. With this we use pin D3 for the magnetic sensor according to Figure 2.
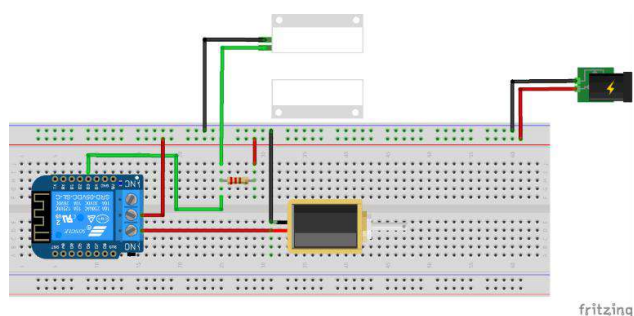
Fig.2 - Connection scheme of System 2

Source: Author

The relay module used in this project is nothing more than a shield to be attached to the mini D1, this shield has a circuit in its bottom that allows interaction as the D1 mini without complications.

Like the NodeMCU, the Wemos D1 mini runs 3.3 V on its pinout. Therefore, the addition of a transistor circuit allows the activation of relay of 5 volts. The transistor acts as a switch powered by 5V, voltage that can be obtained through the board itself through the pin VIN or VCC.

The relay is driven by pin D1. When the signal sent by the board is high, ie 3.3 V, the transistor is polarized and creates a channel between the 5 V VCC and the relay activation pin. The resistors are calculated precisely to make possible the polarization of the transistor.

The electric lock requires a power supply of 12 V and 2 A. The Wemoscan not supply the lock and therefore an external source is used. The interaction between the lock and the Wemos is done through the relay module. The contacts used in the NO (normally open) relay module, which is open until the coil is powered (when it is closed). In this is the positive part of the power supply that connects the lock. And the COM (common) contact that receives the positive from the source.

Finally, Wemos shares as the NodeMCU the two I2C communication pins of the LCD, all Wemos pins have support for I2C communication accepted to D0, in case the selected ports were D2 and D4.

System Programming Logic 2

To establish communication between the Wemos and the Application will require the creation of WebServer through the Arduino IDE. The WebServer will have to send Wemos data to the application by Wemos, the latter will act as server receiving, processing and responding to requests made by the client, in this case, the Application.

The port sensor will function as a digital input sending signals, depending on the state of the port, this sensor works as an NF (normally closed) switch, ie if the sensor contacts are close the signal sent to the Wemos will be 3.3 V, at this time, the Wemos running as a server will send the client a message that corresponds to the status of the port, in case the port is closed, in addition to sending the status, will also perform the door lock. If the sensor contacts are distant the signal sent will be 0 indicating only that the status of the sensor is sent.

Responsible for triggering the lock through the application, wemos functions as a server waiting for the requested requests from the client, these requests will be made by creating a URL, in the case of the project, two web pages will be created for the URL, one page will be created responsible for triggering the other relay of the

lock by disengaging the relay of the lock by unlocking the door.

In the application, the web pages will be represented by a button represented by an icon of an open lock if the relay is not activated, and a closed lock icon if relay is activated according to Figure 3.

Fig.3 - Lock icons

Source: Author

Smartphone

The smartphone will interact with both the NodeMCU and the Wemos D1 mini. For this to be possible, all devices in the system must be accessing the same network. In the project in question, a router will be functioning as access point, to have access to the router is necessary to know the name and password of the same. Thus, with all the devices connecting to the same access point, it is possible to establish a communication between all of them.

NodeMCU will communicate with the smartphone through the Blynk App only if a presence has been detected, in this case the Blynk App will trigger a notification on the smartphone home screen notifying the user of the presence.

Next, the user will open the Smart Port 1.0 application as shown in Figure 4. On your main screen we will find two buttons, one for port control and the other for viewing the IP camera application. The idea is that when receiving the notification the user opens the application and press the button to view the IP camera, in order to know who the door is.

In the application, we will also find the status display area, which will help the user know when the door is open or closed when it is unlocked, so that we can activate the same unlock button to lock.

Fig.4: Smart Port Application Main Screen 1.0

Source: Author

Analysis and discussion of results

During the development of the project, there were difficulties that were already foreseen, among them, we had the first one that was with regard to the notification, which would aim to warn the user of the presence of someone. Initially, it had been planned that the notification was from the door application itself. For this, during the development of the application would be added an extension called TaifuNotification, which would be responsible for the notification. However, it was found that the extension only executed the notification if the application was running or sending some command to notify.

With this, we looked for other alternatives, like using Telegram message application. In this, a bot was used called BotFather, this bot allows to use commands of residential automation, through sending and receiving messages, the results were positive, but the idea of having to run two applications with basically the same functions is not interesting. Finally, Blynk App was used, an exclusive application for the development of project and of easy understanding, that met the needs.

Another difficulty found in the project was in relation to wi-fi communication between the systems. Due to the lack of knowledge in programming, and delimitation of processing systems, another alternative was to establish I2C communication to share the LCD Display.

During project development, other ways were known to simplify, reduce project components, and use only the door application as interaction. One of them, would be to use the esp32, development board that has wi-fi and bluetooth communication, plus two processing

cores, which allows to perform various tasks, reduce the number of boards. The esp32-cam model, besides having all these functions, also comes with a camera attached to the board, here we would reduce space, components and above all cost. For both boards do not reach more than 10 dollars in international shopping sites.

IV. CONCLUSION

The development of the prototype allows us to understand that the Internet of Things has become a reality due to the low cost of electronic components and microcontrollers, allowing the development of microcontroller systems that are used for certain applications that do not require much energy or many tasks. Alongside this, we have the development of portable devices that complete the scenario bringing mobility and easy access to information from these systems. Finally, the control of digital access to a port increases the level of security of an environment, in addition to bringing comfort to the user.

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Control Management System for Air Conditioner via Power Line Communication Modem - PLC

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Abstract—*With several technological initiatives developed with the PLC modem (Power Line Communication), among the most varied themes developed regarding the relationship from the characteristics of the electric distribution networks, the study in transmitting data through the electric network is to show that it is possible to transmit the data in a fast, reliable and safe way through the electric circuit well structured, thus adjusting the connections between the profit, the reduction of costs and the conservation of preventive maintenance, mainly in what concerns the reuse of electric network in already structured places. However, in addition to implementing control management, we have identified some reasons that have not made it possible on a large scale as an alternative for transmission with regard to interference and noise and how we pointed out solutions to this problem. Thus, we addressed technical characteristics between equipment, circuit structure, multiplexing, frequency, technical comparisons with other data transmission technologies and an overview of the market, evaluating and showing that this technology has the potential to enable the communication of data in low-voltage electricity networks to serve the specific school, meeting the requirements for protocol transfer, especially for monitoring applications, and rapid response. The explanations about definitions, advantages, disadvantages, requirements, the interfaces of the electrical system and other arguments, are portrayed in a didactic and simple way, in order to facilitate the understanding of this technology.*
Keywords: PLC, data transmission, cost, monitoring.

I. INTRODUCTION

The idealization of transmitting data via the power grid is exceptional and very promising. In a country like Brazil, where it is very expensive to pay for internet broadband, taking advantage of the electric network that reaches practically all the companies in the country as a means of transmitting information would be a huge advance at a very low cost when compared to other means of transmission. This research has as improvement of the digital technology for benefits and comfort to a school of education.

According to RUIZ (2017,) PLC consists of data communication by power transmission lines, which have unique and expressive attributes that can be applied in telecommunications projects. We will delve deeper into this technology by presenting a method of data transmission in a management system for an air conditioner in a school located in the southern central zone of Manaus, as well as its future use scenario perspective.

Thus we will implement a device of optimum performance, using the Power Line Communication - PLC modem, for the management of the operation of the air conditioners in the school CEMETRO, having control and efficiency also in maintenance.

II. THEORETICAL FRAMEWORK

Today in all networks, whether residential or industrial, they need a means of data transmission, the most handled is the cable, and some operate in wireless transmission. The use of the same usually offers high cost, long period of installation, and need of maintenance, making the transmission medium subject to several types of weather and electromagnetic interferences.

According to Ruiz (2017, p.22), the study and improvement of technologies to reverse this unfavorable scenario is fundamental. Among the various means of access, the Power Line Communication - PLC appears as one of the viable alternatives for solving such a problem.

The PLC technology can be used as an alternative in an environment such as the school without the utility of installing its own physical means for data transmission,

considering a financially viable hypothesis. However, in addition to the financial aspect, other requirements such as reliability, signal quality, safety, transmission distance, signal delay, among other parameters, are required before the school.

The main advantage of this technology is the use of an existing electrical network structure in the school for data transmission, to reach the distributions of the electrical network where, alternatives for quick access, are not yet available or connected to a specific network. And the disadvantage is the noise, in which according to Jardim (2016, p.03) noise is strange and unwanted signals in a means of communication distorting the signals of information. Noise overflow can make it difficult for a network to operate or drastically reduce its transmission.

According to Mendes (2006, p.06) the electrical structuring in a certain place already in activity, does not require any new electrical installation, and the network does not add any cost to your electric bill, PLC is the cheapest method of connecting diverse devices in different sectors.

The PLC to be used in this control system is suitable for any application and has a maximum capacity of 5120 digital I/O distributed by power between circuit connections by the school. According to Santos (2016, pg.34), PLC modems can be connected up to 7 expansion servers to a single CPU server, with a maximum number of 80 I/O air conditioners. The PLC modems will automatically monitor the transmission quality through the data transmission error control system, which helps when needed. The purpose of this system is to develop, through the basic principles, an air conditioner management control system of a teaching school, improving the practical knowledge in control, climatization and automation systems.

III. METHODOLOGY

Research of an applied scientific nature in which it is dedicated to the generation of knowledge for the solution of specific problems, directed to the search for the truth for a given practical application in a particular situation. It can also be called plan proposition, because it seeks to present solutions to certain organizational issues according to Lakatos (2012, pg.261). In this research, will be presented a management system for air conditioner in the school of Metropolitan Teaching Center of Manaus - Cemetro.

3.1 FIED OF STUDY

Centro Metropolitano de Ensino LTDA - CEMETRO, was founded on May 10, 2000, and its school year began on February 12, 2001. Aware that it is through education that all barriers and obstacles that slow down the

development of a community and a country are overcome, it was created with the Metropolitan Institute of Teaching LTDA - IME as its maintaining entity. It is a civil society of educational and cultural character, whose purpose is the human promotion in all its aspects. The main characteristics of the study area are presented in Table 1.

Table 1 - Built area, number of classrooms in the school and number of air conditioners

Placeofstudy - CEMETRO		
Builtarea 2099,23 m²	QtyRoom	Qty Air Conditioner
Administrative	13	17
Class	23	28
Auditorium	1	1
Computer Laboratory	1	2
Dance	1	1
Teachers	1	1
Total	40	50

Source: Owner, 2018

3.2 STUDY PROJECT

The project was developed from the characteristics of low-voltage energy networks, a prototype that offers a sufficient rate in the physical layer and thus demonstrate that this technology has the potential to transmit a data communication in the low-voltage electrical distribution to the air conditioning devices in the school sectors.

The system consists of a PLC modem in addition to a configuration software that will manage the entire electrical network connected to each air conditioner. It was designed in two stages, first with the study of the location, placing technical data and second with the construction of the PLC modem, being done in two phases, first by creating the PLC modem in an Automation 5.0 simulator program, second by executing the PLC modem in the electric circuit in the Proteus 8 simulator program. We made a catalog of the air conditioners by sector and BTU.

Performing a comparison of the installation of the devices at school, provided for in the standard NBR 16401-1, shown below in Table 2, in which it was verified the compatibility if it is correct with the physical characteristics of the environment. In this table are the specifications of how many BTUs are needed to install by area.

Table 2 - Standard NBR 16401-1 installation of air conditioner by area

Área	BTUs	Área	BTUs
9 m²	7500	30 m²	24000
12 m²	9000	40 m²	30000
15 m²	12000	50 m²	36000
20 m²	18000	60 m²	48000
25 m²	22000	70 m²	58000

Source: ABNT NBR 16401-1,2008

The manager has as one of the objectives the thermal comfort, in the words of Schipitoski (2016, p.02) we call by "condition of spirit in which the individual expresses satisfaction in relation to the thermal environment". This state is obtained when an individual is in a condition of balance with the environment in which he works, which means that the system will manage the temperature of the device according to the physical characteristics of the environment, in a domain of strict variation, without there being a sensitive effort of the devices.

We paid attention to the exposure of the sectors to the sun and also remember that even the number of people and electronic devices present in large numbers or with inadequate power in the environment can interfere with the capacity of the air conditioner. We specify in Table 3 the quantities of air conditioners for each sector, and which BTUs installed in relation to the area.

Table 3 - Number of air conditioners per BTU in each area per sector

Sector	Área	Qtyofairconditioner	BTUs
Reception/Conviviality	161,15	3	22000
Secretariat	32,94	2	18000
			9000
Financial	25,38	2	18000
			9000
Collection / Financial Pres.	15,75	2	9000
			7500
Teachers' lounge	63,63	1	22000
PedagogicalCoordination	11,3	2	7500
Direction	30,55	1	12000
Computer Laboratory	46,69	2	12000
Library	41,92	1	18000
humanresources	19,78	1	12000
TechnicalCoordination/EJA	19,78	2	7500
			9000
Warehouse/Proofs	28,3	1	18000
Dance Room	29	1	18000
Auditorium	64,8	1	22000

Classroom	31	5	18000
Classroom	40	15	18000
Classroom	20,4	8	12000

Source: Owner, 2018

IV. ANALYSIS AND DISCUSSION OF RESULTS

The construction of the simulator was made up of two parts: the first by automation a control circuit implementation using the logic of electronic distribution; the second by proteus in the construction of the program that will provide the input variables for the modem and also receive the output variables of the devices. For Ruiz (2017, p.21) there is a regulation for the conditions of use of radio frequency in broadband systems through the electric network. It was defined that we will use the 1.705 kHz to 50 MHz band to use the project.

As well as the automation program as the proteus, procedures have been carried out to make the power line modem useful for sending and receiving serial data via supply lines. According to Costa (2016, p.05) will demonstrate a high immunity to persistence of electrical noise in the power line, verifying errors to not give corrupted data.

4.1 PLC MODEM CONTROL AND DATA TRANSMISSION MONITORING

The modem provides bi-directional communication over the network of any voltage up to 250V AC and for frequency 50hz or 60hz. According to Pereira (2010, p.06) half duplex communication means you can transmit or receive data at a time, but not both at the same time. After the program provides serial data to transmit on its RX-IN pin, it switches to transmit and transmit the data through the power line.

When the transmission process is complete, it returns to reception mode. Data transfer is indicated by the red LED. Modem data reception is indicated by a green LED that is on the Txout pin itself. According to Farias (2017, p.34) the modem data communication is transparent to the user data terminals and independent of the protocol. There is no adversity in the structuring of interface circuits. The PLC modem card is shown in Fig. 1.
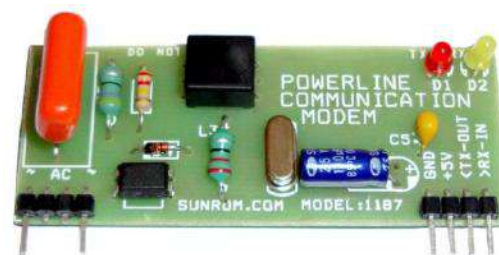
Source: Owner, 2018
Fig.1 - Power Line Communication Modem (PLC)

The equipment of the PLC modem was installed in the input of the power outlet, where the power outlet of the air conditioner device is connected, throughout the development of this project showed that the manager acted considerably the signal of the PLC system. For Ruiz (2017, p.41) the PLC modem has the function of performing data communication with the other modems, so that the demands for consumer data services are met. The PLC modems communicate with other networks or with each other only through the PLC manager system.

Transmission is being based on byte per base byte. After giving the modem a byte for transmission, it was necessary to wait at least 500 ms (milliseconds) before a new byte is given to the modem again since the modem waits for the AC network to cross zero to transfer a bit. For Farias (2017, p.63) the AC system 50Hz, the zero crossing of AC signals happens every 10 ms and the modem needs 50 zero crossings to transmit a byte with error checking data. This is why it takes 500 ms for one byte. This can be quite a lot in relation to slow speed for large data transfer, but the purpose of this modem is to transfer small data bytes so that it recognizes the sensor readings so that this speed will work when implemented.

4.2 APPLICATION DIAGRAM

The diagram shown in Fig. 2 shows the application of the PLC modem in blocks.
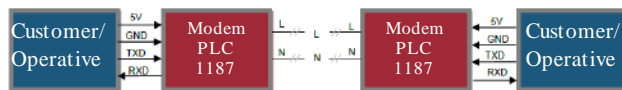
Fig.2 - AC Power Line

Details of the diagram interface shown in Fig. 2 refer to the PIN: RX-IN receives the 5V logic level input serial data input, in which it is connected to the TXD pin of the microcontroller. TX-OUT transmitted the 5V logic level serial data output, in which it is connected to the RXD pin of the microcontroller. +5V is the regulated 5V power input power source. GND is the power supply level that must be a common ground part of the microcontroller.

4.3 INTERFACES USED IN THE PLC MODEM

In the interface below shown in Fig. 3, it shows the interaction with the module directly with the pins of the microcontroller, since the module level is at 5V level. For Ruiz (2017, p.38) they can be used on any microcontroller, AVR, PIC or something similar. We just had to configure the microcontroller to communicate at 9600 baud rate. The TXD pin of the MCU will go to the RX-IN pin of the PLC modem, the RXD pin of the MCU will go to the TX-OUT pin of the PLC modem, ground power supply and + 5V between the PLC modem and the MCU must be connected. This document below has

remote control application notes and little below the source code shown in Fig.4.
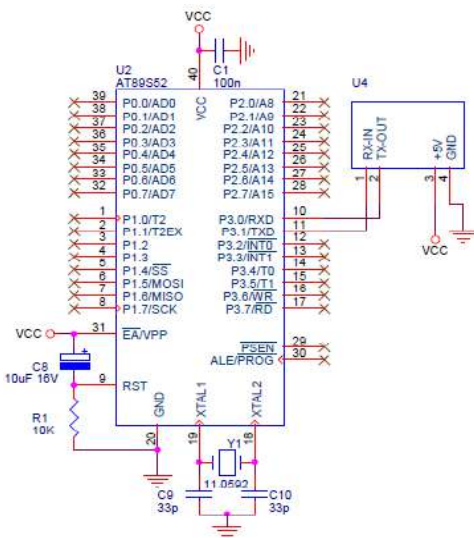
Source: Owner, 2018

Fig.3 - Simulation of the PLC interface in the automation program

O show how we will turn on/off the air conditioners through the PLC modem, we use an application that will be the control panel with ON and OFF switch. When activated the switch is pressed, the "A" character is transmitted, when the OFF switch is pressed, the "B" character is transmitted through the PLC modem. As shown in Fig. 4 a part of the source code to transmit the data and we have a basis for viewing the operation.

Fig.4 - Source code control panel with ON and OFF.

Na interfacecom ON e OFF com relay na Fig.5 estamos mostrando a simulação para os condicionadores de ar no painel de controle através de um relay para desligamento e ligamento através de agendamento de horário.
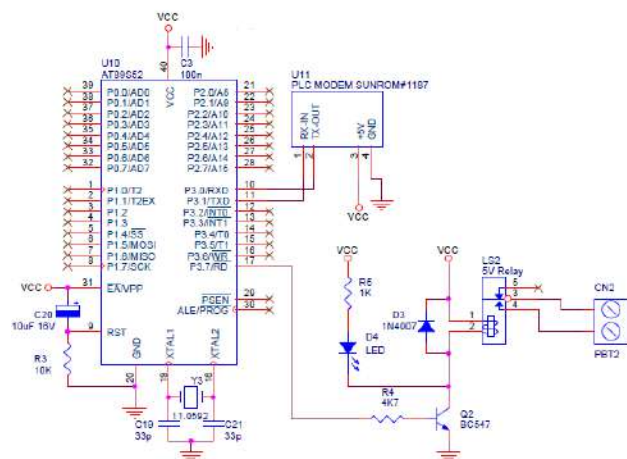
Source: Owner, 2019.

Fig.5 - Control panel simulation with ON and OF with relay.

V. CONCLUSION

This project, based on the data collected and the help of scientific research, was observed that it is possible to transmit data through the electricity grid, reliably, and can reuse the structure of the electricity grid, if it is in good condition of use and with the electrical circuits properly connected, thus the use can solve problems related to infrastructure and maintenance cost. Although there are problems with noise and weakness, with new technological developments in modeling and digital processing, we began to unveil practical applications in frequency and amplitude through the PLC, analyzing each channel present, thus providing the constant evolution of signal modulation techniques used.

The PLC modem can become a realizable alternative to the communication networks, not only reducing the cost, but also the installation time and the data communication time, for this, simulations were made closer to the real, isolating environment through controlled source, placing different number of inverters connected in the network, distance between transmitter/receiver modem, thus despite that the use of the frequency inverters affect the performance of PLC communication, causing losses of data packets. However, it showed that its modem is able to send and receive data in critical environments, at a low effective reference rate of 5 kbps, which allows concluding the feasibility of collecting information, which need to act in real time.

Therefore, the school has a new means for data transmission, called PLC modem, as a low-cost alternative, easy to install and that promises to meet the expectations of the school regarding the performance of air conditioners. The next steps to be followed for better monitoring of this project are the inclusion of monitoring functionality by the Zabbix program, monitor the power load and specify if any part of the air conditioner was affected.

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Yield and Chemical Composition of Essential oil of Piperaceae in one Segment of the Semi deciduous Forest of Paraná State, Brazil, in Seasonal Samplings

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Abstract— Essential oils are composed of a complex mixture of various classes of substances; among them are phenylpropanoid, monoterpenes, and sesquiterpenes, belonging to the secondary metabolism of plants. However, these compounds can be influenced by seasonal factors, among others. The objective of this study is to realize the prospect of obtaining Piperaceae with aromatic potential from a segment of the semideciduous forest of the Atlantic Forest Biome in the northwester region of Paraná State. The aim is to assess the qualitative and quantitative characteristics of its essential oil in the collection during the winter and summer seasons of year 2016. The statistical design was internally randomized in a factorial of 4 (species) x 3 (replicates). The species studied were Piper mosenii C. DC., Piper xylopioides Kunth, Piper diospyrifolium (Kunth) Kunth ex C. DC., and Piper gaudichaudianum Kunth. A total of 78 compounds were identified, 68 in winter and 71 in summer. The species presented a variation in the yield and composition of essential oils, both in winter and summer. The predominant chemical composition was sesquiterpenes followed by monoterpenes, with prominence of (E)-caryophyllene, germacrene D, bicyclogermacrene, α-pinene and β-pinene.

Keywords— Bioprospecting, genus Piper, protected areas, secondary metabolism, species aromatics.

I. INTRODUCTION

Brazil has a wide territorial area with a rich biodiversity, which provides a valuable source of plant species. Many of these are little studied and constitute a large biological collection for scientific research. The prospect of finding aromatic species in the forests of the Atlantic Forest biome, with its significant biodiversity, may represent the discovery of new essential oils with a potential for beneficial use, increasing the viability of sustainable management of this ecosystem, which is highly damaged, with a gerat need for conservation.

The plants are inexhaustible sources of natural products, many of them essential oils and secondary metabolites, mainly used in perfumery and cleaning products. They are also a source of active ingredients for the pharmaceutical industry (5; 33; 11). They can also be used in crop protection against pests and diseases, with the advantage of not accumulating in the environment and have a wide spectrum of action, which reduces the risk of developing resistant strains pathogenically (10).

More than 2000 plant species produce essential oils, among them are several representatives of the Piperaceae family, which possess high agronomic and commercial significance, as they are used as condiments, adornments, food, and in popular medicine. Some species of the genus *Piper* are also used in folk medicines, especially in Brazil, and many have proven to be of great significance due to the pharmacological activity and/or production of essential oils in their structure (13).

Piperaceae encompasses approximately 2,000 species allocated in approximately five genera. Just over 500 species are recorded in Brazil, distributed in four genera (30). The *Piper* genus is represented by 290 species and the Atlantic Forest is one of the centers of diversification and endemism of the genus, with about 150 species (14).

The production of essential oils in Brazil is still incipient to meet the demand. However, the national and international market has demonstrated a great interest in new essences; something that this biodiversity has a great potential to meet. In this context, the conservation units are an excellent laboratory for research and prospecting of essential oils. Various floristic studies were carried out at

the Caiuá Ecological Station, North Diamond, Paraná State, however, phytochemical and biological studies with the aromatic native species in this forest formation are scarce, which makes this research highly relevant.

The objective of this study is to evaluate, quantitatively and qualitatively, the essential oil in the seasonal samplings of Piperaceae, which is commonly found in a segment of the semideciduous forest of the Atlantic Forest Biome located in the Northwest of Paraná State.

II. MATERIAL AND METHODS

The study was conducted in the Caiuá Ecological Station, a Conservation Unit in the state, with an area of 1,427.30 ha, located in the northwestern region of Paraná State, Municipality of North Diamond, with approximate coordinates between 52º49' to 52° 53' W and 22º 34' to 22º 37' S and an altitude that varies from 240 m to 380 m. It belongs to the hydrographic basin of the Lower Paranapanema River, with part of the area occupying the banks of the reservoir of the Rosana Hydroelectric Power Station (UHE Rosana), remnant of the Paranapanema River.

According to the Koeppen climate classification, the northwestern region of Paraná State presents the Cfa type climate - mesothermal, humid, without a dry season, and with hot summers. The average temperature of the coldest month is below 18ºC and the average temperature of the hottest month is above 22ºC. The average annual rainfall is 1,200 to 1,400 mm, being the quarter (December, January, and February) when it rains. The average annual

temperature is between 21ºC and 22ºC, being the average of the hottest month (February) 24 to 25ºC and the coldest month (July) 17ºC to 18ºC. The relative humidity of the air average is 75%, (4).

The formation of the majority of the soil in the Caiuá Ecological Station, is represented by soils derived from river sediments in portions adjacent to the Paranapanema River, with a predominance of Red Latosols, Red Argisols, Red-Yellow Argisols, and Quartzarenic Neosols, respectively (7). Its vegetation cover is inserted in the Atlantic Forest biome in the region of the Semideciduous Forest vegetation type, whose ecological concept is conditioned to the dual climate seasonality (15).

The studied species were *Piper mosenii* C. DC., *Piper xylopioides* Kunth, *Piper diospyrifolium* (Kunth) Kunth ex C. DC., and *Piper gaudichaudianum* Kunth species. These occurred commonly in the conservation unit.

The field work consisted of the collection of approximately 1 kg of plant material of each species (leaves and branch terminals) for extraction and quantification, and for determining the moisture content of the samples. The collection and transport of the plant material was prompted by the Environmental Institute of Paraná, under proper environmental authorization, with number 03/2016. The herbarium specimens were transported to the Botanical Museum Hall of Curitiba city where they were herborized and classified (Table 1).

Table 1- Description of species collected during the winter and summer of 2016 in the Caiuá Ecological Station, North Diamond /PR.

Species	Herbarium number	Latitude	Longitude	Altitude
Piper mosenii C. DC	MBM 396409	22º36'8.5"S	52º53 4.7W	288m
Piper gaudichaudianum Kunth.	MBM 396403	22°36'29.3"S	52°51'58.4"W	277m
Piper xylopioides Kunth	MBM 396405	22°36'34.4"S	52°51'48.7"W	273m
Piper diospyrifolium (Kunth) Kunth ex C. DC.	MBM 396413	22º36'21.7S	52º52'4.8W	268m

The identification of species was performed with the aid of specialized bibliographies, comparison of herbarium specimens declared at the herbarium, and consultation with experts on the respective groups of plants of these species.

The oil extraction was done by means of hydrodistillation during four-and-a-half hours in a graduated Clevenger apparatus using 100 g of fresh leaves and one liter of distilled water, with three repetitions.

The essential oils were diluted in hexane at a ratio of 1% and 1.0 µL of the solution where it was injected, with a split flow of 1:20, in an Agilent 6890 gas chromatograph coupled with a mass selective detector Agilent 5973N. The injector was maintained at 250°C. The separation of the constituents was obtained in a capillary column HP-5MS (5%-phenyl-95%-dimethyl polysiloxane, 30 m x 0.25 mm x 0.25 µm), using helium as a carrier gas (1.0 ml min^{-1}). The temperature of the oven was scheduled to be 60°C to 240°C at a rate of 3°C

min^{-1}. The detector of mass was operated on electronic ionization mode (70 eV), at a rate of 3.15 s^{-1} sweeps and mass range of 40 μ to 450 μ. The transfer line was maintained at 260°C, the source of ions at 230°C, and the analyser at 150°C.

For the quantification, the diluted samples were injected into the chromatograph Agilent 7890A equipped with flame ionization detector (FID), operated at 280°C. The same column and analytical conditions described above were employed, except for the carrier gas used, which was hydrogen, at a flow rate of 1.5 mL min^{-1}. The percentage composition was obtained by electronic integration of the signal of the FID by dividing the area of each component by the total area (area %).

The identification of the constituents was obtained by comparison of their mass spectra with those of (32) and (18) and also by their linear retention indices calculated from the injection of a homologous series of hydrocarbons (C7-C26) and compared with data from the literature (1).

The results were submitted to analysis of variance and the means of treatments were compared by the Tukey test at 5% probability, using the software SISVAR (9) and the principal component analysis (PCA) using the program BioEstat v.5.

III. RESULTS AND DISCUSSION

There was a significant difference in the essential oil content among species and at different seasons of collection (Table 2). The species *P. xylopioides* presented an average yield of oil statistically superior to others, and in the summer this content was higher. *P. mosenii*, *P. gaudichaudianum,* and *P. diospyrifolium* showed similar levels of oil in winter, however, in the summer these species differed in the levels among them, whereas, *P. xylopioides* presented the highest content followed by *P. diospyrifolium* and *P. gaudichaudianum*. *P. mosenii* did not produce oil in the summer contrary to the study of (24) conducted on the coast of Paraná State, where the species showed a low variation in the essential oil content in the winter, spring, and summer seasons.

Table 2 – Averages of the content of essential oils of fresh samples of species collected during the winter and summer of 2016, in the Caiuá Ecological Station, North Diamond, Paraná State, Brazil

Species	Oil content (%)*	
	Winter	Summer
Piper mosenii C. DC	0.28 b A	--
Piper gaudichaudianum Kunth.	0.13 b A	0.05 c B
Piper xylopioides Kunth	0.94 a B	1.37 a A
Piper diospyrifolium (Kunth) Kunth ex C. DC.	0.13 b B	0.38 b A
CV (%)	23.54	

* Medium followed by the same letter in column and capitalized on the line did not differ statistically among themselves by Tukey test at 5% probability.

The species *P. mosenii* and *P. gaudichaudianum* presented an essential oil yield that was higher in winter. As stated, *P. xylopioides* and *P. diospyrifolium* presented higher yield in summer.

The study on *P. gaudichaudianum* performed by (23) in a population in Santa Maria, Rio Grande do Sul State, found an average content of oil from fresh leaves of 0.38%, superior to that found in the present study, but without the effect of seasonality.

The chemical composition of essential oils is generally a characteristic of a given species and from the point of view of the chemical composition it is genetically and epigenetically controlled. The quantity, quality, and concentration of these species are influenced by the environmental components. Among the environmental factors that can be highlighted are, light intensity and photoperiod, the latitude, temperature (minimum and maximum average), soil (chemical and physical properties), wind, and the availability of water, or even a combination of some of these subfactors and seasonality (26).

Studies conducted by (24) on the *Piper* genus in the Atlantic Forest, on the coast of Paraná, showed the influence of seasonality on the yield and the constituents of essential oils. (16), (27), (29), (17), (21), (20), and (19), also identified the influence of seasonality on the chemical profile of the oils analyzed.

The chemical composition of the essential oil of the studied species identified 78 constituents, corresponding to an average of 90% of chemical compounds of the essential oil, in the identified samples (Table 3). The species *P. diospyrifolium* was the one that presented the highest number of compounds identified, with 55, followed by *P. gaudichaudianum* with 50, *P. xylopioides* with 35, and *P. mosenii* with 33 compounds.

Table 3 - Phytochemical analysis of essential oils of fresh samples of species collected during the winter and summer of 2016 in the Caiuá Ecological Station, North Diamond, Paraná State, Brazil.

Compounds	IR^c	IR^t	P. mos	P. gau	P. xyl	P. dio
3Z-hexenol	849	850	---	0.31	---	---
α-pinene	931	932	---	5.09 (2.86)	4.14 (2.40)	1.01 (1.97)
β-pinene	974	974	---	6.62 (3.88)	0.25	2.14 (1.46)
6-methyl-5-hepten-2-one	984	981	---	0.77	---	---
myrcene	989	988	---	0.26	1.22 (0.82)	0.23 (0.28)
α-phellandrene	1004	1002	---	---	1.56 (1.16)	---
o-cymene	1022	1022	---	---	0.13	---
limonene	1026	1024	0.10	0.72	---	7.77 (5.22)
β-phellandrene	1027	1025	---	---	12.50 (8.97)	
(Z)-β-ocimene	1028	1032	---	0.18	0.89 (0.37)	0.24 (0.18)
(E)-β-ocimene	1045	1044	---	---	0.33 (0.32)	2.64 (1.96)
γ-terpinene	1055	1054	---	---		0.16 (0.16)
linalool	1100	1095	---	---	(0.25)	
δ-elemene	1333	1335	1.27	---	7.52 (7.38)	0.39 (0.28)
α-cubebene	1345	1345	0.16	0.57 (0.54)	---	0.20 (0.21)
cyclosativene	1366	1369	---	(0.55)	---	(0.40)
α-ylangene	1366	1373	---	---	---	(0.27)
α-copaene	1370	1374	0.80	3.15 (4.33)	---	1.95 (1.88)
β-elemene	1387	1389	2.15	(0.10)	1.91 (1.91)	0.77 (0.57)
Z-caryophyllene	1399	1408	---	---	---	(0.54)
α-gurjunene	1403	1409	---	0.54 (0.44)	---	0.11 (0.14)
(E)-cariophyllene	1413	1417	16.39	7.40 (7.25)	2.59 (2.34)	20.56 (20.65)
β-copaene	1422	1430	0.69	---	---	(0.41)
β-curjunene	1422	1431	---	4.94 (5.13)	---	0.44
γ-clemene	1429	1434	0.78	---	---	0.27 (0.24)
α-guaiene	1433	1437	0.83	---	---	---
aromadendrene	1431	1439	---	1.44 (0.37)	0.30 (0.35)	0.70 (1.10)
6.9-guaiadiene	1437	1442	---	0.18	---	(0.14)

					(0.18)	
trans-muurola-3.5-dieno	1441	1451	---	---	0.40 (0.35)	---
α-humulene	1446	1452	3.21	2.32 (1.36)	0.50 (0.50)	1.66 (1.70)
geranyl acetate	1451	1453	---	5.33 (5.66)	---	---
allo-aromadendrene	1453	1458	0.13	---	5.49 (4.52)	0.35
cis-cadina-1(6).4-diene	1456	1461	0.23	0.28 (0.31)	---	0.21 (0.27)
dauca-5.8-diene	1471	1471	---	5.24 (6.26)	0.12 (0.14)	(0.18)
Trans-cadina-1(6).4-diene	1471	1475	---			(1.68)
γ-muurolene	1474	1478	---	0.61 (0.56)	0.35 (0.39)	1.55
germacrene D	1476	1484	30.36	1.41 (1.73)	3.09 (1.75)	10.06 (6.84)
aristolechene	1477	1487	---	---	0.13	---
β-selinene	1479	1489	0.69	0.13 (0.36)	---	0.37 (0.42)
δ-selinene	1484	1492	0.19	0.29 (0.36)	---	---
Trans-muurola-4(14).5-dieno	1484	1493	---	---	---	0.14
Epi-cubebol	1484	1493	---	---	---	(0.15)
valencene	1486	1496	---	---	0.58 (0.56)	
biciclogermacrene	1490	1500	13.46	4.15 (4.81)	29.83 (33.45)	8.42 (8.51)
α-muurolene	1495	1500	---	4.00 (4.98)	0.77 (0.83)	0.55 (0.60)
(E.E)-α-farnesene	1499	1505	0.94	0.34 (0.48)	---	---
germacrene A	1497	1508	---	---	(0.56)	---
δ-amorphene	1501	1511	---	---	---	0.76 (0.43)
γ-cadinene	1508	1513	1.56	3.77 (4.05)	1.27 (1.93)	1.57 (1.92)
δ-cadinene	1518	1522	2.74	5.59 (7.12)	3.69 (3.87)	2.72 (3.22)
trans-cadina-1.4-diene	1526	1533	---	0.57 (0.83)	---	0.49
α-cadinene	1532	1537	---	0.31 (0.37)	0.20 (0.26)	0.53 (0.34)
α-copaen-11-ol	1543	1539	---	0.19 (0.14)	---	---
α-calacorene	1535	1544	---	0.25 (0.58)	---	---
selina-3.7(11)-Diene	1536	1545	---	---	---	(0.40)
germacrene B	1548	1559	4.53	0.43	---	1.31

				(0.21)		(1.27)
(E)-nerolidol	1561	1561	1.42	6.13 (7.11)	1.83 (1.78)	1.72 (0.23)
germacrene D-4-ol	1568	1574	---	---	4.52 (8.57)	---
espatulenol	1569	1577	1.86	3.20 (0.82)	---	0.77 (0.78)
caryophyllate oxide	1574	1582	1.60	3.14 (3.69)	(0.90)	2.30 (3.22)
diethyl Phthate	1585	1590	0.15	---	---	0.13
globulol	1582	1590	---	0.10	0.26 (0.22)	(0.25)
viridiflorol	1582	1592	0.45	0.21 (0.20)	---	---
rosifoliol	1594	1600	---	0.50 (0.51)	---	---
ledol	1593	1602	0.45	---	---	(0.40)
humulene epoxi II	1600	1608	0.16	0.86 (0.51)	---	(0.14)
1-10-di-Epi-cubenol	1607	1618	0.17	0.67 (0.77)	---	0.16 (0.29)
10-Epi-γ-eudesmol	1612	1622	---	---	---	(0.13)
1-Epi-cubenol	1621	1627	0.93	1.22 (1.59)	---	0.38 (1.91)
γ-eudesmol	1623	1630	---	0.57 (0.61)	---	---
muurola-4.10(14)-dien-1-β-ol	1621	1630	---	---	1.13 (0.92)	---
Epi-α-cadinol	1634	1638	---	---	---	1.55 (1.91)
caryophile-4(12). 8(13)-dien-5β-ol	1630	1639	0.24	0.18 (1.20)	---	---
Epi-α-muurolol	1634	1640	1.88	1.94 (2.21)	2.67 (3.40)	1.55
α-muurolol	1639	1644	1.03	1.89 (2.17)	0.50 (0.68)	(0.34)
β-eudesmol	1644	1649	---	0.66 (0.76)	---	0.39
α-cadinol	1647	1652	3.27	1.26 (1.31)	4.51 (4.86)	1.38 (1.46)
Epi-α-bisabolol	1680	1683	---	1.88 (1.38)	---	---
Monotherpenes (%)			3.03 (---)	12.50 (4.44)	21.87 (18.75)	17.50 (15.22)
Oxygenated monotherpenes (%)			--- (---)	--- (---)	--- (3.13)	--- (---)
Sesquiterpenes (%)			57.58 (---)	45.83 (55.56)	53.12 (53.12)	57.50 (58.70)
Oxygenated sesquiterpenes (%)			36.36 (---)	35.42 (35.56)	21.88 (25.00)	22.50 (26.08)

Phenylpropanoids (%)	3.03 (---)	2.08 (2.22)	3.13 (---)	2.50 (---)
Others (%)	--- (---)	4.17 (2.22)	--- (---)	---
Total compounds identified (%)	94.89 (---)	91.66 (89.21)	96.07 (96.73)	80.21 (81,23)

IRc= retention index calculated; IRt= retention index of literature; P. mos= *Piper mosenii*; P. gau= *Piper gaudichaudianum*; P. xyl= *Piper xylopioides*; P. dio= *Piper diospyrifolium*. Values between brackets correspond to the composition of the essential oil samples collected in the summer.

The chemical composition of the species *P. mosenii* identified during the winter had an average of 57.58% of sesquiterpenes hydrocarbon, 36.36% of oxygenated sesquiterpenes, and 3.03% of monoterpenes and phenylpropanoids. A majority of the constituents of samples performed was identified as germacrene D (30.36%), (E)-caryophyllene (16.39%), and biciclogermancrene (13.46%), with the total compounds identified as 94.89%. During the summer an yield of oil was not observed for that species.

The chemical composition of essential oils is determined by genetic factors, however, according to (17), other factors may cause significant changes in the production of secondary metabolites. In fact, the secondary metabolites represent a chemical interface between plants and the environment. The stimuli arising from the environment in which the plant is located can redirect the metabolic pathway, causing a biosynthesis of different compounds. Among these factors, we can highlight the interactions between plant/microbial, plant/insect, and plant/plant; age and stage of development, abiotic factors such as brightness, temperature, rainfall, nutrition, time, and time of collection, as well as techniques during harvest and post-harvest. It is valid to note that these factors can present correlations between themselves and not act in isolation. They can exercise joint influence on secondary metabolism, which causes a variation in the income and composition of the essential oil analyzed.

The yield of essential oil of the species *P. gaudichaudianum* collected during the winter season showed a proportion of 45.83% of sesquiterpenes hydrocarbon, 35.42% of oxygenated sesquiterpenes, 12.50% of monoterpenes, 2.08% phenilpropanoids, and 4.14% of other components (chain of 8 and 12 carbons), with the total of compounds identified of 91.66%. Samples collected in the summer showed a proportion of 55.56% of sesquiterpenes hydrocarbon, 35.56% of oxygenated sesquiterpenes, 4.44% of monoterpenes, 2.22% phenilpropanoids and for other components (chain of 8 and 12 carbons). The majority of constituents were (E)-caryophyllene (7.40%), β-pinene (6.62%), (E)-

nerolidol (6.13%), δ-cadinene (5.59%), geranyl acetate (5.33%), Dauca-5,8-diene (5.24%), α-pinene (5.09%), β-gurjunene (4.94%), and bicyclogermacrene with 4.15%.

Yet for *P. gaudichaudianum,* it was observed that in the summer there was a reduction in the proportion of monoterpenes (12.50% to 4.44%) and increase of hydrocarbons of sesquiterpenes (45.83% to 55.56%) and the total compounds identified was 89.21%. The main constituents identified were (E)-caryophyllene (7.25%), β-pinene (6.62%), δ-cadinene (7.12%), (E)-nerolidol (7.11%), dauca-5,8-diene (6.26%), geranyl acetate (5.66%), β-gurjunene (5.13%), and α-muurolene with 4.98%.

Among the principal constituents, a majoritarian checked in some municipalities of the state of Rio Grande do Sul/Brazil for essential oils from leaves and inflorescences of *P. gaudichaudianum,* stand out α-humulene (13.3–37.5%), ß-caryophyllene (10.4–19.3%), ß-pinene (5.6–7%), E-nerolidol (5.32–22.4%), E-caryophyllene(8.9%), bicyclogermacrene (7.4%), β-selinene (3.7–15.7%), α-selinene (8.9–16.6%), alloaromadendrene (7.7%), linalool (4.8%) (3; 25). Already in a seasonal study in the municipality of Atalanta (Santa Catarina State) the constituents were observed to be β-caryophyllene (10.4–12.5%), α-caryophyllene (8.2–10.4%), δ-selinene (5.4–6.9%), δ-cadinene (6.0–7.3%); E-nerolidol (3.0–7.2%), Z-β-guaiene (5.5–5.6%), δ-cadinene (6.4–7.3%) and Valencene (4.0–5.6%) (22).

This difference in the chemical composition of the essential oil of the study population in comparison with the other studies carried out with the same *P. gaudichaudianum* extract could occur due to environmental, genetic, and biotic factors. Second, (31) stated, the chemical variability may be the result of the selection pressure of the environment and/or the ecology or characterizing a chemical adjustment to the environmental conditions prevalent.

The phytochemical composition of the essential oil from samples of *P. xylopioides* collected during the winter season showed a proportion of 53.12% of sesquiterpenes hydrocarbon, 21.88% of oxygenated

sesquiterpenes, 21.87% of monoterpenes, and 3.13% of phenylpropanoids, and a total of 96.07% of identified compounds. The majority of the constituents were bicyclogermacrene 29.83%, β-phellandrene 12.50%, δ-elemene 7.52%, and alloaromadendrene 5.49%. In the summer we found a proportion of 53.12% of sesquiterpenes hydrocarbon, 25% of oxygenated sesquiterpenes, 18.75% of monoterpenes, and 3.13% of oxygenated monoterpenes, with a total of 96.73% of compounds identified. The proportion of constituents found by the majoritarian was bicyclogermacrene 33.45%, β-phellandrene 8.97%, and germacrene D-4-ol 8.57%.

The samples of *P. diospyrifolium* collected during the winter season showed the proportion of oxygenated monoterpenes of 57.50%, oxygenated sesquiterpenes of 22.50%, monoterpenes of 17.50%, and 2.50% of phenylpropanoids, with a total of 80.21% compounds identified. The majority of the constituents were (E)-

caryophyllene of 20.56%, germacrene D of 10.06%, bicyclogermacrene of 8.42%, and limonene of 7.77%. Already, during the summer season we found a proportion of 58.70% of sesquiterpenes hydrocarbon, 26.08% of oxygenated sesquiterpenes, and 15.22% of monoterpenes hydrocarbons, with a total of 81.23% compounds identified, and the proportion of constituents the majoritarian found was (E)-caryophyllene of 20.65%, germacrene D 6 of 68%, bicyclogermacrene of 8.51%, and limonene of 5.22%.

The predominance of sesquiterpenes in the genus *Piper* was also observed by (8), (6), (28), and (12).

In the winter/2016 station, the dendrogram (Fig. 1) demonstrates the similarity of the chemistry among the *Piper* genus studied, where three distinct groups of Euclidean distances were observed. This can also be explained by the genetic variability among species and populations (2).
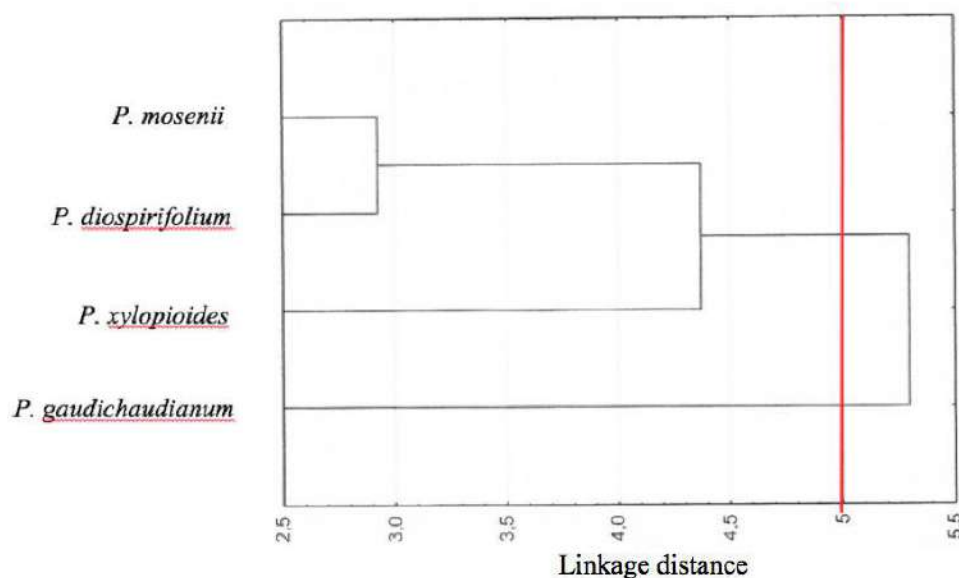
Fig.1: Dendogram of the Piper species showing functions of the chemical compounds in the essential oil of fresh samples collected in winter/2016, using the Euclidean distance.

The first grouping is formed by two Species: *P. mosenii* and *P. diospyrifolium*. This cluster is characterized by (E)-caryophyllene (16.39–20.56%), germacrene D, (10.06–30.36%) bicyclogermacrene (8.42–13.46%), γ-cadinene (1.56–1.57%), ß-elemene (0.77–2.15%), δ-cadinene (2.72–2.74%), (E)-nerolidol (1.42–1.72%), Óx. caryophyllene (1.60–2.30%), epi-α-muurolol (1.55–1.88%), and α-muurolol (0–1.03%). The cluster II includes the species *P. xylopioides*, which features (E)-caryophyllene (2.59%), germacrene D (3.09%) bicyclogermacrene (29.83%), γ-cadinene (1.27%), ß-elemene (1.91%), δ-cadinene (1.27%), (E)-nerolidol

(1.83%), epi-α-muurolol (2.67%), and α-muurolol (0.5%). The last group consists of (E)-caryophyllene (7.40%), germacrene D (1.41%) bicyclogermacrene (4.15%), γ-cadinene (3.77%), δ-cadinene (5.59%), (E)-nerolidol (6.13%), ox. caryophyllene (3.14%), epi-α-muurolol (1.94%), and α-muurolol (1.89%) in the species *P. gaudichaudianum*.

To determine the degree of variations in the phytochemical, a principal component analysis (PCA) was performed using a correlation matrix of all chemical compounds (Table 4 and Fig. 2).

Table 4 – Eigen values and accumulated variance for factors obtained from principal components analysis, based on the chemical composition of the species of Piper, studied on the basis of the composition of its essential oils during the winter season/2016.

Compounds	Factors[*]		
	1	2	3
(E)-cariofilene	0.015	-0.152	0.338
germacrene D	0.521	0.327	-0.274
biciclogermacrene	-0.019	0.653	-0.098
γ-cadinene	0.459	-0.135	0.433
ß-elenene	0.414	-0.137	-0.162
δ-cadinene	-0.152	0.067	-0.584
(E)-nerolidiol	-0.348	0.247	0.117
Óx. cariofileno	-0.124	-0.502	-0.317
Epi-α-muurolol	-0.223	0.105	0.325
α-muurolol	0.130	-0.238	0.150
α-cadinol	-0.347	-0.149	0.058
Eigenvalues	5.83	3.35	1.82
% of variance	56.64	33.44	16.55
Cumulative %	56.64	90.08	100,00

[*] significance ≥ 60%
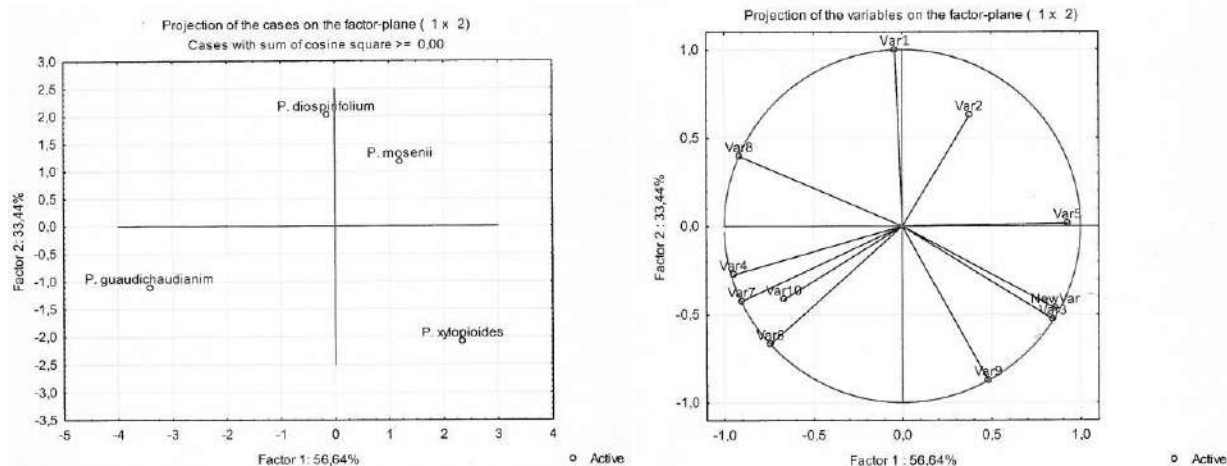
Fig.2 - Principal Component Analysis (PCAs) for the species of Piper based on chemical composition of essential oils of fresh samples collected in the winter season/2016. New Var: (E)-caryophyllene; Var1: germacrene D; Var2: bicyclogermacrene; Var3: γ-cadinene; Var4: ß-eleneno; Var5: δ-cadinene; Var6: (E)-nerolidol; Var7: Óx. caryophyllene; Var8: epi-α-muurolol; Var9: α-muurolol; Var10: α-cadinol.

Results obtained by PCA, based on 11 chemical compounds, are shown in Figure 2 and Table 4. The three factors explain 100% of the accumulated variation in the data; the first two factors being considered the most important, as they described 90.08% of the accumulated variance (Table 4). The compounds germacrene D, γ-cadinene, and ß-elemene, demonstrate the relevant contributions, with 56.64% of the variation in the principal components (PC 1). Bicyclogermacrene, germacrene D, and (E)-nerolidol are compounds that contributed, by explaining 33.44% of the variance of principal components (PC 2).

For summer 2016, the dendrogram (Fig. 3) is submitted to chemical similarity of the *Piper* genus where three distinct groups of Euclidean distances were observed. The first grouping is formed only by the species *P. mosenii,* which showed an absence of the production of oil from this station. The cluster II includes the species *P. gaudichaudianum* and *P. diospyrifolium*, which present as constituents (E)-caryophyllene (7.25–20.65%), germacrene D (1.73–6.84%) Bicyclogermacrene (4.81–8.51%), γ-cadinene (7.12–3.22%), ß-elemene (0.10–0.57%), δ-cadinene (0.37–0.34%), (E)-nerolidol (7.11–0.23%), caryophyllene oxide (3.39–3.22%), Epi-α-muurolol (2.21%) and α-muurolol (2.17–0.34%) and α-cadinol (1,31–1,46%).
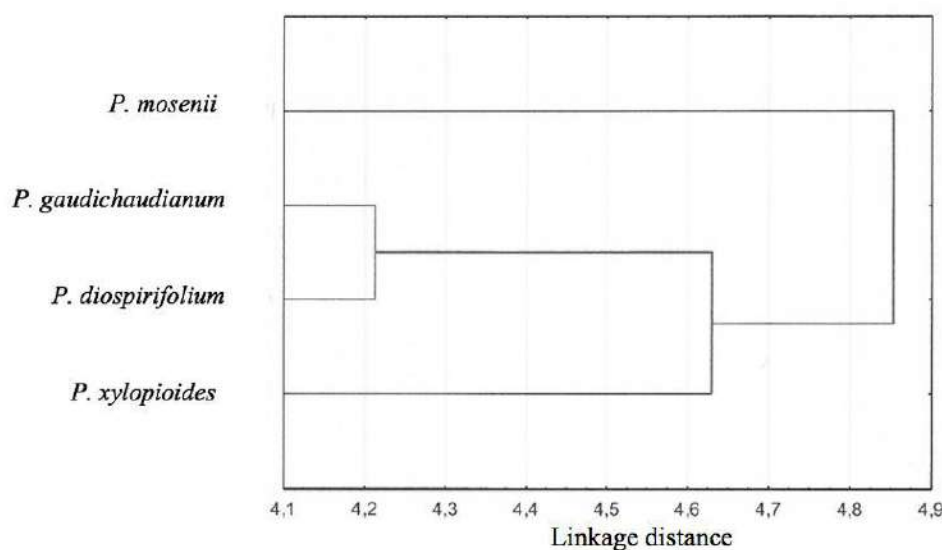
Fig.3 - Dendrogram for the Piper species and function of the chemical compounds of the essential oil of fresh samples collected in the summer/2016, using the Euclidean distance.

The last group consists of (E)-caryophyllene (2.34%), germacrene D (1.75%) bicyclogermacrene (33.45%), γ-cadinene (1.93%), ß-elemene (1.91%), δ-cadinene (3.87%), (E)-nerolidol (1.78%), caryophyllene oxide (0.90%), epi-α-muurolol (3.40%), α-muurolol (0.68%), and α-cadinol (4.84%) in the species *P. xylopioides*.
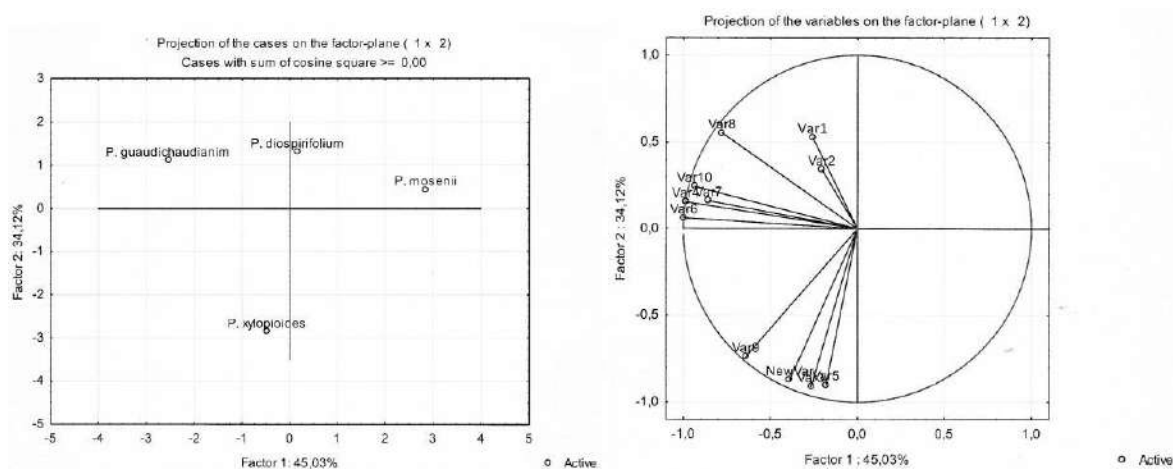
Fig.4 - Principal Component Analysis (PCAs) for the species of Piper based on chemical composition of essential oils of fresh samples collected in the summer season/2006. NewVar: (E)-caryophyllene; Var1: germacrene D; Var2: bicyclogermacrene; Var3: γ-cadinene; Var4: ß-elemene; VAR5: δ-cadinene; Var6: (E)-nerolidol; Var7: Óx. cCaryophyllene; Var8: Epi-α-muurolol; Var9: α-muurolol; Var10: α-cadinol.

Results obtained by PCA based on the analyzed species and 11 chemical compounds are presented in Fig. 4 and Table 5. The three factors explain 100% of the accumulated variation in the data; the first two factors being considered most important, because they described 79.15% of accumulated variance. The α-muurolol compounds, (E)-nerolidol, and germacrene D, demonstrate the relevant contributions, with 45.03% of the variation for the principal components (PC 1). Epi-α-muurolol and δ-cadinene are compounds that contributed by explaining 34.12% of the variance in the principal components (PC 2).

Table 5 – Eigen values and accumulated variance for factors obtained by principal components analysis (PCA) based on the chemical composition of the species of Piper studied, based on the composition of their essential oils during the summer season/2016.

Compounds	Factors[*]		
	1	2	3
(E)-cariophyllene	0.117	0.093	0.120
germacrene D	0.272	0.176	-0.470
biciclogermacrene	-0.534	-0.606	-0.208
γ -cadinene	0.010	0.071	-0.146
ß-elenene	0.041	-0.061	-0.392
δ-cadinene	-0.586	0.484	-0.281
(E)-nerolidiol	0.278	-0.110	-0.273
Óx. cariofilene	0.070	-0.154	-0.587
Epi-α-muurolol	-0.253	0.520	-0.068
α-muurolol	0.284	0.184	0.019
α-cadinol	-0.235	-0.101	0.209
Eigenvalues	4.953	3.753	2.293
% of variance	45.03	34.12	20.85
Cumulative %	45.03	79.15	100.00

[*] significance ≥ 60%

The different stations influenced both the quantity and the chemical compounds of the evaluated essential oils of the species of genus *Piper*. With the exception of *P. Mosenii,* compounds α-pinene, (E)-caryophyllene, aromadendrene, α-humulene, germacrene D, bicyclogermacrene, α-muurolene, γ-cadinene, δ-cadinene, α–cadinene, and (E)-nerolidol were found in other species in both stations of collection. The compounds of α-phellandrene, β-phellandrene, trans-muurola-3,5-diene, valencene, germacrene D-4-ol, and muurola-4,10(14)-dien-1-β-ol were found only in the species *P. xylopioides* in the collection of two seasons.

Differences in chemical constituents can be justified by the regulation of gene expression of the enzymes involved in the biosynthetic route of terpenes. In addition, climatic conditions (collections at different seasons) contributed to the chemical characterization of the essential oil of the species analyzed.

IV. CONCLUSION

The results presented here demonstrate that the environmental factor of seasonality interfered with the levels and the average percentage of the chemical constituents of essential oils.

The studied species of genus *Piper* can be distinguished into three groups per workstation, in accordance with the composition of the essential oil of fresh leaves.

The chemical composition of the predominant species evaluated consisted of sesquiterpenes followed by monoterpenes, with emphasis on (E)-caryophyllene, germacrene D, bicyclogermacrene, α-pinene and β-pinene, α-phellandrene, β-phellandrene, trans-muurola-3,5-diene, and Valencene; germacrene D-4-ol and muurola-4,10(14)-dien-1-β-ol were found only in the species *P. xylopioides* in the two seasons of collection.

With the exception of *P. mosenii* compounds, α-pinene, (E)-caryophyllene, aromadendrene, α-humulene, germacrene D, bicyclogermacrene, α-muurolene, γ-cadinene, δ-cadinene, α-cadinene, and (E)-nerolidol were found in the other species and in both workstation collections.

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Physical-Chemical Evaluation in Biodisponible Water Samples used for Consumption

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Abstract— Water is a vast biomolecule in the systems, it can come from surface water or from underground abstraction, in order to consider it pure, it is necessary to evaluate its physical, chemical and biological characteristics, since it is directly linked to the health of the population. The objective is to evaluate the main chemical and physical parameters in order to compare and verify the quality of the natural waters that are distributed to the population of the municipality of Boquira-Ba, making a comparison between the dry and rainy periods. The physical-chemical parameters analyzed were: hydrogen ionic potential (pH), electrical conductivity, turbidity, resistivity, total dissolved solids (STD), hardness and alkalinity. The data obtained were compared to the values established by the Resolution of the National Council for the Environment (Conama) 357/2005 and Ordinance of MS 2914/2011. The samples collected during the dry season when compared to the rainy season showed a variation in the results, but remained at the maximum allowed values, thus proving to be quality water for consumption. Only two periods in the dry season (P3 and P4) and (P9 and P10) rainfall presented a variation in conductivity, resistivity and hardness, thus compromising the quality of this water.
Keywords— groundwater, surface water, quality parameters.

I. INTRODUCTION

Fundamental to the life of living beings, water is a vast biomolecule in systems (Brito, 2017). With the increase of the economy and the indiscriminate use of water resources, it can be exhausted since most of this good is unfit for use, 95.1% of which is salt, 4.7% of glaciers and only 0.147% for consumption (Barreto & Bitar, 2011).

According to Coletti et. al. (2010), the concept of water quality does not mean that it is pure, the physical, chemical and biological characteristics can confirm its potability, and these are linked directly with the health of the population. The waters used for human consumption may come from surface water, groundwater abstraction and also rainwater, the surface and groundwater being the ones most used by the Brazilian population, since most of the time they present potability and thus be distributed for urban and rural populations (Pereira et al., 2018).

According to ordinance no 2914 of the Ministry of Health (2011), water must meet consumption standards, and regardless of their origin should not pose risks to human or animal health, and is suitable for producing and preparing food, drinking and personal hygiene (Portfolio No. 2,914, Of December , 2011).

The waters according to their environment of origin can present varied characteristics, from where they circulate to where they are stored. In this context it is necessary to differentiate them from the natural ones for those that have been contaminated by human action, since in some cases, taking into account availability and demand, contaminated water is offered, making it impossible to use and use it without prior treatment (Oliveira & Silva, 2013).

Several factors can influence the water quality of the springs, such as rainfall, vegetation cover, livestock activities in their surroundings, among others (Ako et al., 2012). Thus, it is necessary to monitor the quality of the water through the physical-chemical aspects, which will allow to perceive possible changes generated by natural or anthropic actions (Marmontel & Rodrigues, 2015).

The physical-chemical analysis allows to identify if the water is at optimal levels, not bringing risks to human health as well as other ecosystems (Braga, 2015). By means of the ordinances and resolutions it is possible

to verify if the water samples are within the quality standards determined (Parron et al. 2011).

Resolution 357/2005 provides for the classification of water bodies and environmental guidelines for their classification, as well as establishing the conditions and standards for the discharge of effluents, and other measures. The water quality standards established in the resolution establish individual limits for each parameter (Resolution No. 357, Of March 17, 2005).

Since water is a common good, essential for human survival and other ecosystems, it is necessary to control it, in order to guarantee the quality and safety to those who consume it. Therefore, the present study aimed to evaluate the main physico-chemical parameters in order to compare with the maximum values allowed by current legislation and verify the quality of the natural waters that are distributed to the population, making a parallel between periods of drought and rainy in the municipality of Boquira-Ba.

II. METHODOLOGY

Location of study area

The place of study is located in the municipality of Boquira-BA (name of indigenous origin that means 'D'Agua', because it has plenty of aquatic sources), is located in the Southwest of Bahia. Known for the extraction of zinc, lead, silver and gold, it has a total territorial unit area of 1,426,233 km² (IBGE, 2018).

According to the National Guide for Collection and Preservation of Samples (2011), water quality is given by its analysis, which allows identifying risk factors for those who consume and use it for various activities. In this way, the sampling sites should be more comprehensive, so 6 (six) points were chosen, which are distributed to the population, being 3 (three) points of springs and 3 (three) tubular wells (Brandão, 2011).

Data collections

The samples were collected in a drought period (October 2018) and in the rainy season (February 2019), in new 1.5 L polypropylene bottles, for collection at springs the bottle was washed with the water of collecting 3 (three) times, filling the bottle halfway and despising the liquid, after which it performed the collection procedure filling the bottle completely, in the direction of the stream with a depth of 15 - 30 cm. Collection in tubular wells, the water must be pumped until it is completely eliminated from the tubing, and it must be performed at a faucet closer to the site, following the hygienization of the bottle (Apha, 1998).

The collection was carried out between springs and tubular wells, respectively named as: Big Brush

Spring (P1, dry and rain); Caldeirão Well (P2 drought and rain); Well Chico iron (P3 drought and rain); Well Working village (P4 drought and rain); Spring of the Forest (P5 dryness and rainfall); Rising Shots (P6 drought and rain).

Study variables

The analyzes of the samples were carried out in the chemistry laboratory of the Faculdade Independente do Nordeste, using calibrated equipment such as: Quimis microprocessed conductivity meter, Model Q405M, serial number: 09112578. For Conductivity, Resistivity and Dissolved Total Solids analysis; HANNA Instruments Microprocessed Turbidimeter Model Q279P, Serial No.: 10014168. For the analysis of Turbidity; Quimis bench thermometer, model Q400AS, serial number: 08071347. For pH analysis; The titration method for Alkalinity and Hardness analysis was done in triplicates according to the practical manual of water analysis and in accordance with Standard Methods for Water and Wastewater (Funasa, 2013; Apha, 1998).

The data were processed using statistical methods, and the results obtained will be compared with the maximum values allowed (VMP) according to CONAMA resolution 357/2005 and Portaria MS n° 2914/2011.

III. RESULTS AND DISCUSSION

Six samples of water were collected for physico-chemical analysis to determine the parameters of water quality, being: pH, conductivity, turbidity, resistivity, total dissolved solids, alkalinity and hardness. The results of these analyzes served to evaluate the quality of each one of them.

Hydrogen ionic potential (pH)

Hydrogen ion potential (pH) is the concentration of H + ions in a solution and indicates whether the medium analyzed has basic, acidic or neutral characteristics. The natural waters usually have a basic character, they can also present acidic character which does not become undesirable for consumption, because, mineral waters have these characteristics. However, in the long term the acid becomes corrosive in pipes and the basic one can cause incrustations (Santos, 2016; Ueda, 2013).

According to ordinance No. 2914/2011 of the Ministry of Health, the water suitable for consumption must have pH between 6.0 and 9.5. PH levels outside the parameters can lead to various health disorders such as irritation of the eyes, skin and mucous membranes

(Pereira et al., 2018, Portfolio No. 2,914, December 2011).

Table.1: Demonstrating the variations of the parameter of Hydrogenion Potential..

SAMPLES	RAINY	STRETCHING
P1	5,37	5,82
P2	5,84	6,39
P3	6,93	7,39
P4	8,15	8,33
P5	7,24	7,14
P6	5,76	6,31
MEAN	6,55	6,90

Source: Own author.

We can observe in table 1 (drought period) that P1, P2 and P6 are below the values recommended by the ordinance, and points P3, P4 and P5 are in normality. We can already notice that the values of P2 and P6 that were below increase and only the P7 remained, could be due to the lack of ciliary forest in its return. The divergence between values from one period to the next may be due to drought and shortage of rainfall to previous periods.

Electrical Conductivity (C.E.)

The electrical conductivity in water occurs with the ability of the salts dissolved in it to become electrolytes capable of conducting electric current, indicating salts in the medium (Daltro, 2017).

It immediately does not cause harm to humans, in aquatic environments it can be a valuable indicator of contamination (Ferreira et al., 2015). When electrical conductivity is associated with the presence of ions in the water, farmers who own irrigated crops may have damage to their land. As is not shown in the VMP legislation for electrical conductivity, Kpdes (2010) and Logan (1965) say that the values range from 300 μS / cm to 750 μS / cm, this is the limit value for the analyzed water to be considered saline and improper for consumption (Kpdes, 2010; Logan, 1965).

Table.2: Demonstrating the variations of electrical conductivity.

SAMPLES	RAINY	STRETCHING
P1	5,20 us/cm	17,01 us/cm
P2	30,5 us/cm	32,2 us/cm
P3	1714 us/cm	1923 us/cm
P4	1511 us/cm	1675 us/cm
P5	16,45 us/cm	13,73 us/cm
P6	32,7 us/cm	34,5 us/cm
MEAN	551,6 us/cm	615,9 us/cm

Source: Own author..

Analyzing Table 2, we can see that only P3 and P4 are well above the literature, and points P1, P2, P5 and P6 are within normal limits. We noticed that the points P1, P2, P5 and P6 (rainy) increased their values, but nevertheless they remained in normality, being able that with the increase of the rains the quantity of salts are more easily dissolved in the middle, and in the P3 and P4 we had an increase in what was already considered a high value, which also justifies the issue of other points, in which case this water already becomes unfit for consumption.

Resistivity

A resistance omitted by a material to the flow of electric current when it is subjected to an external electric field, is classified as electrical resistivity. It is an inverse parameter to the electrical conductivity (Freitas, 2008). The average values allowed are not contained in the Resolution of the National Environmental Council (Conama) 357/2005.

Table.3: Demonstrating the variations of Resistivity.

SAMPLES	RAINY	STRETCHING
P1	69K Ω/cm	62K Ω/cm
P2	32,3K Ω/cm	31,2K Ω/cm
P3	520 Ω/cm	534 Ω/cm
P4	613 Ω/cm	606 Ω/cm
P5	69K Ω/cm	70K Ω/cm
P6	27,8K Ω/cm	29,3K Ω/cm
MEAN	33,3K Ω/cm	32,3K Ω/cm

Source: Own author.

As the parameter is inversely proportional to that of the conductivity, we can observe that when compared to the results, the parameter was confirmed, because when the conductivity value is high, that of the resistivity was shown to be low.

Turbidity

Turbidity is a parameter that characterizes the quality of the water by means of the measurement of the dispersed light, the recommended one is that the water does not have color or turbidity, because the appearance of color in the sample can lead to rejection being associated with waste water, usually due to suspended matter, organic and inorganic matter (Brito et al., 2017). Therefore, in the organoleptic parameter, the water must be colorless, insipid and odorless, and according to MS Ordinance No. 2914/2011 the maximum allowed value for turbidity is 5 NTU (Pereira et al., 2018; December 12, 2011, Daltro, 2017).

Table.4: Demonstrating Turbidity variations..

SAMPLES	RAINY	STRETCHING
P1	0,18 NTU	3,66 NTU
P2	0,70 NTU	1,01 NTU
P3	0,03 NTU	0,00 NTU
P4	0,39 NTU	0,00 NTU
P5	0,05 NTU	0,00 NTU
P6	0,00 NTU	0,00 NTU
MEAN	0,225NTU	0,778NTU

Source: Own author.

The values found during the dry season are in the range of 0.00 NTU and 0.39, all within the maximum allowed value (VMP). In the rainy season we can observe that the range is between 0.00 NTU to 3.66 NTU, the results remain within the VMP, but it is noted that in the rainy season the turbidity in some points increased, indicating that in that sample possibly there was an increase in suspended materials, but not enough to make it improper.

Total Dissolved Solids (STDs)

Total Dissolved Solids defines the volume of organic and inorganic substances in molecular or ionic forms, thus being a parameter of evaluation of water quality. The increase in STD is also associated with nitrate concentrations in the medium (Kent & Landon, 2013).

According to CONAMA Resolution 357/2005 and MS Ordinance No. 2914/2011, the maximum permitted value for STD is 1000 mg / L (CONAMA 357/2005 and MS Ordinance No. 2914/2011).

Table.5: Demonstrating as parameter variables total dissolved solids.

SAMPLES	RAINY	STRETCHING
P1	7,20 mg/L	8,03 mg/L
P2	15,6 mg/L	15,5 mg/L
P3	953 mg/L	914 mg/L
P4	801 mg/L	820 mg/L
P5	7,34 mg/L	7,30 mg/L
P6	17,8 mg/L	16,9 mg/L
MEAN	300,3mg/L	296,9mg/L

Source: Own author.

We can see in table 5 that the points P1, P2, P5 and P6 have much smaller values, and the points P3 and P4 the values increase significantly. It is seen that in P1 and P4 the values increased little, and points P2, P3, P5,

and P6 decreased when compared to the dry season. Probably what made the values increase was to rainwater, as they may have carried salts that increased STD concentrations. However, all samples had the maximum permitted value according to the legislation.

Dureza

One of the interferers of water quality, hardness is an association of calcium to bicarbonate being transformed into calcium carbonate by heating or increasing Ph (Piratoba, 2017). It is usually influenced by anthropogenic activities, and its main sources of hardness are calcium and magnesium (Nazir, 2015). Ordinance 2914/2011 Ministry of Health recommends that the maximum permitted hardness value for drinking water should be 500 mg/L (Portal N ° 2,914, December, 2011).

Table.6: Demonstrating the variations of the Hardness parameter.

SAMPLES	RAINY	STRETCHING
P1	0mg/L	0 mg/L
P2	0mg/L	0 mg/L
P3	537 mg/L	264 mg/L
P4	556 mg/L	336 mg/L
P5	0 mg/L	0 mg/L
P6	0 mg/L	0 mg/L
MEAN	182,2mg/L	100mg/L

Source: Own author.

Based on the results of table 6, only P3 and P4 showed to be "very hard" water (more than 350) and the other points the samples are considered "soft", and at points P3 and P4 (rainy) (200 to 350). The "hard" water does not pose problems with the potability, but presents an unpleasant taste (brackish), characteristic of the two altered points.

Alcalinidade

The alkalinity in the water indicates the amount of ions reacted in order to neutralize the hydrogen ions. Neutralizes acids, having as function the buffering of water resisting pH variations (Brasil, 2014). According to the water quality control manual, water from springs has alkalinity values in the range of 30 to 500 mg / L of CaCO3 (Brasil, 2014).

Table.7: Demonstrating Alkalinity Parameter Variations.

SAMPLES	RAINY	STRETCHING
P1	30 mg/L	26 mg/L
P2	30 mg/L	26 mg/L
P3	404 mg/L	72 mg/L

P4	332 mg/L	74 mg/L
P5	22 mg/L	22 mg/L
P6	18 mg/L	24 mg/L
MEAN	139,3mg/L	40,67mg/L

Source: Own author.

According to table 7, we can observe that according to the VMP P1 and P2 are within the standard, P3 and P4 even though they are with much higher values still are still in the VMP and this can be directly connected to the parameter hardness, because they are points that has a greater similarity, and finally P5 and P6 that are with values below, which can be justified by the drought of rains in the period. At points P1, P2, P5 and P6 we can note that both are with the values below, this is probably due to the increase of rainfall in the period causing pH variation since, it can affect the speed of its buffering function, the point P3 and P4 there was a significant decrease and remained within the VMP.

IV. CONCLUSION

The present study, with the objective of evaluating the quality of the bio-available water that is distributed to the municipality of Boquira-Ba, through the physical-chemical parameters can be concluded that based on CONAMA Resolution 357/2005 and MS Ordinance No. 2914 / P1, P2, P5 and P6 (drought period), as well as P7, P8, P11 and P12 (rainfall) presented values of pH, conductivity, resistivity, STD, turbidity, hardness and alkalinity within what is recommended by legislation, and are considered suitable for consumption by the population. The points P3 and P4, respectively tubular wells, showed values of conductivity, resistivity and hardness above the MPV by the current resolutions, this presented result can be consequence of the lack of maintenance of the structure of the well or the location and inadequate construction. The methods of analysis used were efficient for the determination of the results of the physical-chemical parameters used in the work.

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Pharmacotherapy Safety Assessment in Patients with Rheumatoid Arthritis Treated in a Regional Health Bahia

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Abstract— Rheumatoid arthritis is an autoimmune disease characterized by affect the joints causing chronic inflammation and premature death in the same. The present study is descriptive / observational and analytical, following a cross-sectional study of the association between a medical conditions (rheumatoid arthritis) of patients treated with synthetic and biological. The invitation to participate in the study was done in the following ways: in person, that is, by approaching the individual at the Regional Health Center of the Southwest Regional Health Center and by telephone, using a list of patients receiving the medicines for treatment of RA in the Specialized Component of Pharmaceutical Care in the NRS-S pharmacy. After the arrival of the individuals, they were referred to a particular room, where explanations were made of every procedure that would be performed and guidelines necessary for their participation in the research. The guests who agreed to participate signed the Free and Informed Consent Form.it was observed that of the 54 patients, only (5.7%) presented alteration in the OGT exam and (7.5%) in the CGT. Regarding the GGT analysis, 52 patients were used because of a loss that occurred during the analytical process, identifying the presence of lesions in 10 individuals, representing (19.2%) of this sample. In summary, (1.9%) of the studied population had creatinine and urea exams above the reference value, that is, characterizing a probable nephrotoxicity. In relation to the hematological cells, it was reported that (9.3%) of the population obtained erythrocytes below the reference value, as well as a decrease in leukocytes in (5.6%) of the population. And finally, the platelets were within the reference value.

According to data obtained in the study, it was possible to identify, in a general way, changes in laboratory tests, independent of the treatments used. Thus, the presence of these reactions' compromises patient safety, providing health risk factors for individuals.

Keywords— Arthritis Rheumatoid, Drug Utilization, Pharmacy.

I. INTRODUCTION

Rheumatoid arthritis (RA) is an autoimmune disease characterized by affect the joints causing chronic inflammation and premature death in the same (Oliveira, L.M et al., 2015).According to the progression of RA, the evolution of bone erosion, joint deformities, cartilage tissue death, as well as involvement with other extra articular pathologies is noticed. According to data provided by the Brazilian Society of Rheumatology, the estimate of global prevalence for the development of the disease is about 1% of the population, affecting the female sex 2 to 3 times greater than the male (Ribas et al., 2016).

The exact cause that causes the body to develop RA is still not well understood. After studying, it was allowed to expose the risk factors of the development of RA such as: environmental, smoking, alcohol consumption, among other factors (Thakur, S. et al., 2018). Early diagnosis of rheumatoid arthritis is not a very common fact. However, this identification will determine the outcome of this chronic disease, thus resulting in less damage to the body, as well as lower costs in relation to medications that will be used during treatment (Guo, Q. et al., 2018).

The choice of the treatment that will be used by patients with autoimmune diseases is performed through the disease progression profile, which will provide a better choice, promoting therapeutic adherence. With the possibility of innovations of these drugs present in the market, doctors choose the treatment not only observing in costs and benefits, but also in the safety of the individual during the treatment (Mota,H.M.L, et. al., 2010)

Gradually, over the years, the improvement of the contributions of the treatment with the use of pharmaceutical immunobiologicals was perceptible. However, it is necessary to observe and analyze the possibilities of the undesirable effects that these drugs can cause to the organism. With the need to promote safety during treatment, the Brazilian Society of Rematology has prepared a document based on review studies, which will provide a more appropriate choice for treatment that will be adopted (Shiratori, A.P, et.al, 2013). Pharmacological therapy for RA treatment may include non-steroidal anti-inflammatory drugs (NSAIDs); corticosteroids, disease course modifiers (DMARDS) and biological (Faucci, et al., 2013).

In general, the drug that is recommended in the initial phase of the treatment RA is methotrexate, because according to systematic reviews it is considered safe and effective after the diagnosis of the disease, besides having similarity to the drug leflunomide and superior to other drugs with the same action. (Imm, L. et al., 2018). However, with the complexity of the disease, the use of methotrexate alone does not guarantee an effective clinical response when compared to individuals using combinations of synthetic or biological DMARDs, such as adalimumab, infliximab, golimumab, entanercep and certolizumab (anti- TNF) (Costa, et al., 2015).

However, like any other drug that may cause adverse effects, it is not different from the medicines used to treat RA, so it is necessary to consider the possibilities of developing adverse drug reactions (ADRs) (Mota, LMH et al., 2014). Unfortunately, the pharmacotherapy adopted for regression and control of RA may present adverse reactions idiosyncratic during treatment, causing alterations in liver enzymes and hematological cells, as well as renal failure. The main manifestations are: hepatotoxicity, nephrotoxicity, myelotoxicity, among others (Mota, H.M.L et.al., 2013).

Patient safety is a key consideration in the choice of treatment (Kivitz, AJ et al., 2018). Even with all the technology and innovations present in immunobiologicals, the presence of ADRs becomes an unavoidable situation, and an increase in liver enzyme levels may occur; about 1.4% of patients may develop pancytopenia alone, 0-5% of whom need to stop therapy due to this reaction, as well as altered renal function (Neves, C. et al. 2009). According to the literature, biological drugs are considered safer when compared to synthetic use. (Kivitz, A. et al., 2018) It

is therefore necessary to observe and perform laboratory tests to prevent and control the damages that can cause to the human organism, verifying if treatment is being safe (Mota, L.M.H et al., 2012), since several factors can develop ADRs in individuals, such as: gender, age, gender, people using multiple medications, among others. Depending on the organism the reaction may trigger more discreetly the more aggressive (Bagatini, F. et al., 2011). Therefore, this study aims to evaluate the safety of pharmacotherapy used by patients with RA, through the evaluation of laboratory tests that assess renal, hepatic and hematological function, correlating with the type of treatment (synthetic and biological DMARDs) of patients with arthritis rheumatoid.

II. METHOD

The present study is descriptive / observational and analytical, following a cross-sectional study of the association between a medical condition (rheumatoid arthritis) of patients treated with synthetic and biological DMARDs.

Bahia has nine Regional Health Centers (NRS), whose purpose is to monitor the activities of regulation, sanitary surveillance and dispensing of medicines, among others. The NRS-Southwest, has a seat in the city victory of the Conquest, which has the responsibility and duty to serve 74 municipalities, serving about 1,812,416 inhabitants. The headquarters of the NRS-Southwest meets the demands of the Pharmaceutical Assistance that are the responsibility of the State, referring to the 19 municipalities that make up the micro-region of Vitória da Conquista (669,396 inhabitants). The population to be studied are patients with RA, who receive their pharmacotherapy through the specialized component of pharmaceutical care (CEAF) in this region.

The invitation to participate in the study was done in the following ways: in person, that is, by approaching the individual at the Regional Health Center of the Southwest Regional Health Center (NRS-S) and by telephone, using a list of patients receiving the medicines for treatment of RA in the Specialized Component of Pharmaceutical Care (CEAF) in the NRS-S pharmacy. After the arrival of the individuals, they were referred to a particular room, where explanations were made of every procedure that would be performed and guidelines necessary for their participation in the research. The

guests who agreed to participate signed the Free and Informed Consent Form.

The collection was carried out through the application of questionnaires, in which the volunteers answered two questionnaires, the first one that addressed more personal issues, such as: habits; frequency of medication use; how the therapy was administered, and the other about rheumatology questions. Afterwards, these participants were referred to the Central Laboratory of Vitória da Conquista, where the laboratory tests were performed, as well as the volunteers were submitted to a dental consultation in a specialized center. The research was evaluated in the year 2017 in the period from November to December.

The study was carried out with 54 patients who were enrolled in the (NRS-southwest), aged over 18 years; individuals of both sexes; diagnosed with RA (CIDs M05.0, M05.3, M05.8, M06.0, M06.8, M05.1, M05.2 and M08.0). The exclusion criteria used were bedridden individuals; hospitalized and aprisonado 15 used a therapy with biological DMARDs and 37 used synthetic DMARDs.

The data provided were taken from the project "Evaluation of the effect of treatment with biological or synthetic DMARDs on the periodontal condition in patients with rheumatoid arthritis." The project was approved by the Ethics Committee of the Faculdade Independente do Nordeste-FAINOR and by the consent of the Regional Center of the Southwest, presentations 466/12, 580/18 of the National Health Council for research on human beings (Brazil, 2012). Approved by Opinion No. 1,362,253, CAAE: 72679117.5.0000.5578.

In this study, the laboratory test was considered as a dependent variable, and the results were compared with the reference values available in the Manual of Support to the SUS Managers: Organization of the Network of Clinical Laboratories (BRASIL, 2002) and the explanatory variables were used the sociodemographic characteristics, being evaluated as follows: gender, age, marital status, occupation, type of treatment used by the individuals, ie whether it was synthetic or biological DMADS, in which an assessment will be made for check which one promotes greater security.

In this study, hepatotoxicity was considered when patients presented values higher than 40 IU / L in the ASTexams/ TGO and ALT / TGPand as well as values above 51 IU / L for the GGT examination. Already for the occurrence of nephrotoxicity, the urea would have to present values above 51 IU / L and the creatinine above 1.3 mg / dL. For the eventuality of myelotoxicity, the blood count would have to present the leucopenia, thrombocytopenia and anemia, that is, the values of references below normal. Hemocytes below 3.9 million / μL for women, 4.2 million / μL for men; leukocytes below 4000 μL and platelets below 140,000 μL; for both sexes.

For the statistical analysis, an electronic spreadsheet was used in Excel, in the 2010 Microsoft® version, in which all the data referring to the questionnaire as well as the laboratory results were added. Subsequently, for the descriptive analysis, frequency comparison and Chi-square test, all data for the statistical Epi-Info program using version 7.1.5.2 were adopted, adopting a 5% level of significance. The univariateanalysiswasthenperformed.

III. RESULTS AND DISCUSSION

Table 1 shows the sociodemographic characteristics, and it was observed that individuals with RA have a prevalence of 83.3% in the female sex, with the age group from 19 to 84 years old, the corresponding average being 50 ,8 years; with predominance of brown color (50.0%); (44.4%) of the respondents had the highest percentage of incomplete elementary education, (79.6%) of the participants living in urban areas, (63.4%) with salary income of up to one salary, most interviewees were married individuals (64.8%); (51.9%) have worked and are no longer working.

Table 1: Descriptive analysis of the population studied to evaluate the safety of pharmacotherapy in patients with rheumatoid arthritis treated in a health region of Bahia, Brazil, 2017.

Variables	Nº	(%)	Variables	Nº	(%)
Sex			HigherEducationCompleteness	2	3.7
Male	9	16.0	HigherEducationIncomplete	1	1.9
Female	45	83.3	TechnicalEducation	2	3.7
Age			NotLiterated	3	5.6
19-29	2	3.8	Do notknow	1	1.9
30-39	4	7.6	**Income²**		
40-49	12	22.4	Upto 1 salary	34	63.4
50-59	26	48.2	More than 1 salary	20	36.6
> = 60	10	18.5	**Occupation**		

Marital status			Already worked but no longer working	28	51 , 9
Married	35	64.8	Neverworked	9	16.7
Divorced	4	7.4	Currentlyworking	14	25.9
Single	10	18.5 Not	working, butnotcurrently	3	5.6
Widowed (a)	5	9.3	**Participants' background**		
Color[1]			Rural area	43	79.6
White	21	38.9	Urbanarea	11	20.4
Black	5	9.3	**Smoking**		
Yellow	0	0	I do not smoke now	50	92.6
Brown	27	50.0	Yes, daily	4	7.4
Indigenous	0	0	**Practice of physical activity ca**		
Notanswered	1	1,9	Notpractical	31	57,4
Levelofeducation			Yes	23	42,6
Complete ElementarySchool	3	5,6	**Treatment**		
ElementarySchoolIncomplete	24	44.4	Synthetic	37	68,5
High School Complete	9	16.7	Biological	15	31.5
SecondaryEducationIncomplete	9	16.7			

Source: Research data (2017).

1- Standard used according to IBGE.

2- Minimum wage equivalent to the year 2019.

This result is confirmed by other studies, affecting about three to four times the female sex, a fact explained by the hormonal issues (Azevedo, et al., 2015). Since it can affect adult life well in the productive phase, which can cause serious consequences, since normally after 10 years of illness, these carriers will be unable to carry out the work. (Silva, J. R.C., 2015). Since, aging is a major risk factor for the development of RA (Thakur, S. et al., 2018)

According to data presented in the table (92.6%) of the participants denied the act of smoking and (57, 4%) do not practice physical activity. Thus, it prevents disease progression since the smoking act is considered a risk factor for the development of RA, its long-term use causes complications to the organism in the carriers of this disease (Thakur, S. et al., 2018). In relation to the lack of physical exercises is explained due to the progression of the disease, since it causes strong joint pains, redness, swelling, as well as limiting amplitude of movements (Guo, Q. et al., 2018).

According to the analysis obtained, the most prevalent treatment was the use of synthetic DMARDs. Results are confirmed according to the obtained studies, in which the management of RA, monotherapy with MTX is recommended in the first months, but in case of failure the therapy is suggested a combination with other DMARDs aiming to provide an adequate response to treatment when compared to using MTX alone(Weinbla, M.E et al., 1999).

If the organism cannot control the progression of the disease, an evaluation will be made to prescribe biological DMARDs. It is extremely important to start treatment with synthetic DMARDs, thus avoiding the unnecessary use of biologicals since they are more expensive, but also more effective. For the management responsible for this treatment takes into account the cost-effectiveness analysis (Romão, V.C et al., 2013).

In Table 2, it was observed that of the 54 patients, only (5.7%) presented alteration in the OGT exam and (7.5%) in the CGT. Regarding the GGT analysis, 52 patients were used because of a loss that occurred during the analytical process, identifying the presence of lesions in 10 individuals, representing (19.2%) of this sample. In summary, (1.9%) of the studied population had creatinine and urea exams above the reference value, that is, characterizing a probable nephrotoxicity. In relation to the hematological cells, it was reported that (9.3%) of the population obtained erythrocytes below the reference value, as well as a decrease in leukocytes in (5.6%) of the population. And finally, the platelets were within the reference value.

Table 2: Descriptive analysis of the type of lesion found to evaluate the safety of pharmacotherapy in patients with rheumatoid arthritis treated at a health center in Bahia Victoria achievement of Brazil, 2017.

Exam	No.	(%)	Exam	No.	(%)
AST			**Urea**		
Injury	3	5.7	Injury	1	1.9
Normal	50	94.3	Normal	52	98.1
SGPT			**Erythrocytes**		
Injury	4	7.5	Injury	5	9.3
Normal	49	92.5	Normal	49	90.7
GGT			**Leukocytes**		
Injury	10	19.2	Injury	3	5.6
Normal	42	80.8	Normal	51	94.4
Creatinine			**Platelets**		
Injury	1	1.9	Injury	0	0
Normal	53	98.1	Normal	54	100

Source: Research data (2017).

In order to assess the causality of liver damage due to the use of medications, it is necessary to make a consideration regarding the clinical evaluation as well as the chronological aspects regarding the treatment, since the TGO and GGT enzymes are normally present in several tissues, or (Larrey, D. et al, 2000). Therefore, if the TGO and GGT values are altered it does not mean that the treatment caused a hepatic injury, then it needs a clinical evaluation and the request of exams to investigate this change. However, when it comes to the increase in TGP, interpretation of this alteration is different, since this test is considered a specific marker of the liver, since the enzyme is found in this tissue (Tajiri, K. et al, 2008).

For the analysis of the occurrence of hepatotoxicity, it is essential to obtain an evaluation of the hepatic markers, in which they will be found higher than their reference values, therefore, that the occurrence of hepatotoxicity induced by pharmacotherapy was defined through the set of the alterations of the enzymes TGO, TGP and GGT. Taking into account the results of this research, it is noted that only one patient had alteration of these three enzymes, and one of the drugs used by this patient was DMARD methotrexate. According to Bittencourt (2011), the manifestations of hepatic lesions caused by the treatment is 12% for the use of MTX and unfortunately in Brazil no epidemiological data on the injuries caused by the use of drugs were found.

For Neves et al. (2009), it is considered that nephrotoxicity is another important point to be evaluated, since the treatment of RA can cause a renal toxicity, which can cause a reduction of the glomerular filtration rate, consequently increasing the levels of urea and creatinine in the organism. Therefore, elderly patients or those with some renal dysfunction need to have a greater therapeutic control, since they are more likely to have nephrotoxicity. Comparing to this study, it is noticed that only one patient had altered creatinine and another individual had a change in the urea test, thus confirming with the literature, renal function alteration occurred, even though the result was statistically low.

When it comes to the adverse effects of hematological cells, five patients were altered erythrocytes (9.3%) and three with leukocytes (5.6%) outside the reference value and only platelets were unchanged. Compared with the literature, the author Hernandez-Baldizon, S. (2012) reports that the alterations may vary according to each study, but normally in the treatment of RA, the leukocytes decrease in a discrete form, as well as erythrocytes and platelets, characterizing a pancytopenia. It is important to note that this pancytopenia can occur at any stage of treatment. According to the study, only platelets were within the reference value, this fact is explained due to the incidence of only 3% to 11% of the population (Neves, C. et al., 2009).

Table 3 shows the type of lesion found in patients using synthetic or biological treatment, through alterations in laboratory tests. When correlating the type of medication that used with the laboratory changes did not present statistically significant association since the value of p was greater than 0.05. With the evaluation of the data, it can be seen that both the synthetic and biological treatments present the same risks to develop lesions. However, when correlating the types of treatments there was no significant statistical result, that is, thinking about the safety of both the synthetic and the biological patients has the same chance of developing any lesion in the body of the individuals that make use of this pharmacotherapy.

Table 3: Univariate analysis to correlate lesion with synthetic and biological treatment in patients with rheumatoid arthritis treated at a health center in Bahia of Vitoria da Conquista, Brazil, 2017.

Variables	Synthetic	(%)	Biological	(%)	p -value
TGP					
Injury	3	8.3	1	5.9	0.40
Normal	33	91.7	16	94.1	
TGO					
Injury	2	5.6	1	5.9	0.46
Normal	34	94.4	16	94.1	
GGT					
Injury	6	16.7	4	25	0.25
Normal	30	83.3	12	75	
Creatinine					
Injury	1	2.7	0.	0	0.34
Normal	36	97.3	17	100	
Urea					
Injury	0	0	1	6.3	0.15
Normal	37	100	15	93.8	
Erythrocytes					
Injury	4	10.8	1	5.9	0.31
Normal	33	89.2	16	94.1	
Leukocytes					
Injury	3	8.1	0	0	0 , 15
Normal	34	91.9	17	100	
Platelet					
Injury	37	100	17	100	---
Normal	37	100	17	100	---

* Associations statistically significant (p <0.05).

In general, the use of pharmacotherapy can cause serious damage to the body, which will compromise patient safety. With the evaluation of the prescriptions and the complementary tests can help in the identification of the ADRs coming from the treatment. It is important to point out that there are other factors that must be taken into account as the processes of transformation at both physiological and pharmacological levels (Taniguchi, C.,2014).

According to Bittencourt (2012), hepatotoxicity is one of the most common manifestations that occurs through the use of drugs, based on data from the World Health Organization, since 1963, more than three million cases have already been reported, this fact is characterized by the increase of the liver enzymes, among other manifestations. The adverse reactions that cause hepatotoxicity are the most frequent causes for the suspension of new molecules made by the industries, but it is also the most common reason for the withdrawal of the drug from the market due to its adverse reactions.

In this study, patients who used synthetic DMARDs showed changes in liver enzymes, with alterations in (8.3%) in the TGP test, (5.6%) in the ORT and (16.7%) in the GGT study population, so this result may cause the risk of developing hepatotoxicity in individuals, this fact characterizes a common adverse reaction in this type of treatment. For this reason, it is recommended to monitor the serum levels of the TGO, GGT and TGP. According to the literature, the incidence of hepatotoxicity is found in 22% of the individuals who use this pharmacotherapy. Regarding the use of the biological drugs obtained in this study, it was observed

that the SGT and PGT exams occurred in only (5.9%) of the study sample and (25%) in GGT, thus, hepatotoxicity, on the other point of view, reports that treatment using biologicals is considered more rare, since GOT and GGT are not specific liver exams. Therefore, it is important to report that the majority of reports of hepatic changes in the use of biologicals have a higher frequency in the treatment using infliximab (Toscano, AE et al., 2009).

Regarding the liver enzyme alterations present in this study, it is considered a mild transaminitis, since the Upper Limit of Normality (LSN) was lower than 3 times when compared to other studies (Katchamart, W., 2009). Although not being evaluated in this study, it is important to note that the treatment discontinuation rates that cause hepatotoxicity are very small (Curtis Jr et al., 2010).

Although the increase in transaminases is the common theme in scientific research, it is important to note that the drugs used in RA also cause nephrotoxicity, causing serious damage to the human body. According to the data obtained, there is a small change in the analyzed samples in which the creatinine and urea tests were above the reference value. According to Martins, GA, (2004), the occurrence of nephrotoxicity is considered rare, since this reaction occurs in only 2% of all the population that treats with synthetic DMARDs. Confirming with the result found in the research, creatinine alteration was observed in (2.7%) of the study population.

Even though the possibility of an individual developing a renal lesion is small, this fact does not justify that this treatment is safe, since the high dosage of MTX results in renal insufficiency, such as nephrotoxicity of any degree. Thus, it is necessary to monitor renal function before and during treatment (Wiczer, T. et al., 2015). According to the study, it was noticed that in the use of biological tests, the urea test was predominant in (6.3%) of the studied sample and for the creatinine test, the results were within the reference value. Therefore, this low incidence of nephrotoxicity is confirmed by the literature because the biological drug etanercept has been considered the safest drug in the treatment of RA when renal toxicity is treated, since it has fewer adverse reactions when compared to other DMARDs (Sugioka, Y. et al., 2008)

According to the evaluation of the treatment, it was noticed that the synthetic DMARDs caused haematological alterations, observed through the hemogram. Five of the patients had anemia (10.8%) of the study population and (8.1%) had leukopenia. Regarding the amount of platelets were within the reference values. According to the literature, synthetic DMARDs, even using combinations with other medicinal products, remain causing small adverse effects, such as hematological and

hepatic abnormalities (Bird, P. et al., 2013). Certainly, the hemogram needs to be requested to monitor hematological changes (Lee, S.W et al.,2012).

According to Mota, LMH et al (2014), hematological alterations such as pancytopenia are rarely described in the use of biological DMARDs therapy. Although there are some recommendations of the Brazilian Society of Rheumatology for the evaluation of hematological levels during treatment. Leukopenia, is considered one of the abnormalities that are normally found during the treatment using biological, although in a low amount, the red blood cells and platelets are less common to evidence some alteration. Note that the literature is confirmed by the study evaluated, since only one patient had a change in the blood count.

Previous studies have shown evidence that using biological DMARDs are considered safer than using monotherapy such as methotrexate (Kivitz, A. et al., 2018). Thus, Burmester, G.R et al. (2017), demonstrated that MTX therapy combined with anti-TNF provides a better response to treatment and safety to individuals.

According to literature, comparing the use of synthetic and biological DMARDs has shown that the treatment provides a regression of the evolution of the disease, thus improving the quality of life of the individual (Mota; Laurindo; Santos Neto., 2010). Regarding safety, pharmacotherapy used in RA provides risk factors associated with the appearance of ADRs in rheumatologic patients, despite the therapeutic benefits (Chopra, A. et al., 2015).

This result made it possible to obtain data and information to evaluate the safety of the pharmacotherapy used. However, there was a considerable loss during the analysis of the research because many of the participants did not perform the laboratory tests, nor did they respond correctly to the forms.

IV. CONCLUSION

According to data obtained in the study, it was possible to identify, in a general way, changes in laboratory tests, independent of the treatments used (synthetic and biological DMARDs). Thus, the presence of these reactions compromises patient safety, providing health risk factors for individuals.

It is important to point out that there were limitations in this study, with a small sample of individuals belonging to the regional board of the interior of Bahia. It can be verified that there were no evolution or severity assessments regarding the disease in the study, being considered an important point to be analyzed, since the individuals that use pharmacotherapy for RA may have worsening of the disease since the treatment

promotes adverse reactions.

This study highlights results on the assessment of the safety of RA patients, through access to laboratory tests, as a tool in pharmacotherapy, as it can cause serious damage to the body, and the results of laboratory tests can be evaluated to aid in the identification of some pathology.

The data found indicate a need to develop new studies within this same alignment. However, the use of synthetic and biological DMARDs has demonstrated that the treatment provides the improvement of the disease. In view of this, it is believed that these laboratory indicators may be useful for other researchers and in clinical practice, in order to increase the safety of the treatments instituted.

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Parasitological Analysis of Vegetables in Natura Marketedat the Street Markets in a City inside of Bahia

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Abstract— *The quality of human health has direct relation to the condition of food. There is great concern about the hygiene situation of foods intended for human consumption, due to the ability to transmit diseases. The general objective of this study was to evaluate the parasitological contamination of vegetables sold in street markets of Vitória da Conquista-BA. Samples of chives and arugula were analyzed, collected at the main points of commercialization of vegetables in street marketsof Vitória da Conquista, in the State of Bahia. The results showed that 100% of the arugula samples and 80% of the chive samples were contaminated by parasites. The prevalence of contamination by Entamoeba coli cysts, cysts of Endolimax nana, followed by Larvae of Strongyloidesstercoralis. The identification of these parasites hasgreat importance, since theysuggest absence of hygienic and sanitary actions and point out the vegetables analyzed as a source ofemparasitoses transmission.Vegetables are foods commonly eaten by the population. The sanitation of these organic foods, especially those ones consumed in its raw way, is a public health concern, since they, when contaminated, may contain larvae, protozoa and eggs of helminths and serve as a source of transmission of enteroparasitoses to man.*
Keywords— *Feeding. Parasitological analysis. Vegetables. Cheers.*

I. INTRODUCTION

The quality of human health has significative relationto adequate food condition, that rangs from nutritional values to favorable hygiene conditions. Foods contaminated by microorganisms are responsible for the transmission of diseases to humans. These are called Foodborne Diseases, which may cause problems such as intoxication, intestinal infection, gastroenteritis, amebiasis, giardiasis, cryptosporidiosis, toxoplasmosis, among others (Brasil, 2010).

Vegetables are natural foods widely consumed by the population and are able to be eaten, in most cases, in their raw form. However, numerous microorganisms may be transmitted by these foods, byincluding many protozoa and helminths (Luz et al., 2017; Pezzin et al., 2017). There are, on average, 107 known parasite species that may be from food source, that is, they may be present in food or water, by making possible the contamination of the individual through the ingestion of these ones (Hikal, 2017; Abougrain, 2010).

Intestinal infections caused by helminths and protozoa afflict around 2 billion people all over the world, with significative recordsin Brazil. The main clinical manifestations apparent in infected people are malnutrition, diarrhea, anemia, cognitive delay and irritability (Costa et al., 2019; Ndiaya et al., 2014).

The high incidence and variety of clinical manifestations of intestinal diseases caused by parasites configure as a global public health problem; intestinal parasitic diseases are transmitted by ingestion of larvae, eggs, oocysts or cysts (BRUM et al., 2013). Ezatpour (2013) ratifies that many societies, especially in

developing countries, regard intestinal parasitic infections as one of the major public health problems.

The main kind of contamination caused by enteroparasites in vegetables by use of water contaminated water byanimal or human fecalmaterials used in irrigation of vegetable gardens, as well asbeyondsanitationperformed in inappropriate places such as standing water tanks, of contamination originated from the fertilizer organic matter with bird feces, flies, rats and the inadequate waythat they are transported (Costa, 2015).

This study selected two vegetables for parasitological analysis: chives and arugula. The chives (*Allium fistulosum*) are usually used as a seasoning very desired by Brazilian population (Silva et al., 2015). The arugula (*Eruca sativa*) is a vegetable that its leaves are very tasted in salads, rich in potassium, sulfur, iron and vitamins A and C (CUNHA et al., 2013). Thus, the general objective of this study is to identify if there is parasitological contamination in the chives and arugula marketed in street markets of Vitória da Conquista - BA.

II. METHODOLOGY

Twenty samples of vegetables of traditional culture were collected and analyzed, by being 10 arugula (Eruca sativa) and 10 chives (Allium fistulosum). The sample units were composedby sheets grouped and lashed by a loop.

The collection was performed in the morning, in five main pointsvegetables commercialization in Vitória da Conquista, in the State of Bahia. Samples were randomly collected at the fair between the months of June and July 2019.Vegetable samples from these referred commercialization points were individually packed in clean and disposable plastic bags and transported to the Laboratory of Clinical Analyzes of the FaculdadeIndependente do Nordeste (FAINOR), where the analyzes were performed.

In the laboratory, the samples were cut and separatelyhomogenized, bydiscarding stalks and roots. Then 200 g of each vegetable was weighed and soaked in 400 ml of distilled water for half an hour. With the help of

a small brush with soft bristles, the surface of the leaves was rubbed, thenit was stirred so that the water spread all over the sample and removed the possible parasitic agents present, all procedure was performed by using disposable individual protection materials, in order to avoid possible contamination.

Then the leaves were separated for complete removal of the liquid, and then discarded at appropriate locations. The acquired liquid was filtered through a sieve covered with gauze and collected in a container. This liquid was at rest for sedimentation and then 14.0 ml of it was taken, that was centrifuged by 1,500 revolutions per minute (rpm) for at least five minutes. Discarded the supernatant and by adjusting the final volume of the sit to 0.5 ml with distilled water, and then homogenizing it. 0.05 ml of the sit was pipetted, that was analyzed by direct microscopic examination on a slide stained with lugol solution. The 10x and 40x objectives were adopted in order to identify, confirm and quantify the parasitic structures.

The reading was performed in triplicate, and the calculation of the total number of cysts, eggs and larvae in the samples was analyzed by the light of the studies of Oliveira and Germano (1992).

III. RESULTS AND DISCUSSION

The present study analyzed the presence of parasites in 20 samples of vegetables collected in five street marketsfrom Vitória da Conquista - Ba, with 10 samples of arugula and 10 samples of chives. The results showed that 100% of the arugula samples were positive for the presence of parasites, as well as 80% of the chives were also contaminated.

Contamination levels of the two varieties of vegetables showed that in both samples the prevalence of protozoa contamination predominated, by being 44.82% of Entamoeba Coli cyst in the arugula samples and 58.34% of Endolimax nana cyst in the chive samples. Followed by significant helminth contamination, 31.03% Strongyloidesstercoralis larvae in the arugula samples and 25.00% in the chive samples, according to Table 1

Table 1. Prevalence of parasites found in vegetable samples.

Prevalence		Arugula n=10 %	Chives n=10 %
Protozoa	*Entamoeba coli cysti*	44,82	0
	Endolimax nana cysti	0	58,34
	Balantidium coli trofozoite	6,90	0
	Larva of Strongyloidesstercoralis	31,03	25,0
	Larva of Hookworm	3,45	0
	Ascaris Egg	6,90	0

Helminths	*Strongyloidesstercoralis egg*	3,45	0
	Hatching Egg	3,45	0
	Tapeworm	0	8,33
Arthropoda	*Mite*	0	8,33

n = number of samples; % = frequency in percentage

Source: Prepared by the author. 2019.

It is observed that the highest prevalence of arucula contamination was by Entamoeba Coli cyst followed by Strongyloidesstercoralis larvae. (Table 1). E. coli cysts were also found in greater amount in the studies of Carminate et al. (2011), whose objective was to evaluate parasitologically the quality of the raw vegetables consumed from the fair of the municipality of Pedro Canário - ES. The authors identified E. coli as indicative of water contamination, since the producers of this region used waters from rivers that also were used for other dailynecessities.

The contamination of individuals by Entamoeba coli is not uncommon. Its prevalence in clinical exams performed with workers was described in the study by Almeida et al., (2016), also drafting a higher index of contamination by protozoa as compared to helminths, a fact observed in the present study, as it is identified larger quantities of protozoa in the vegetables.

In the works by Costa (2015), Coutinho et al. (2015) and Medeiros (2014)it was verified the presence of vegetables contaminated with Entamoeba. According tothe studies by Santos et al. (2009), although the Entamoeba histolytica species is the only pathogenic species, Entamoeba coli cysts are indicators of fecal infection. Nomura et al., (2015), reaffirms about E. coli and E. nana, which despite being commensal protozoans, their occurrence indicates fecal and oral contamination, that is determinant in the transmission of pathogenic parasites. Therefore, the description of these parasites is important, since they indicate absence of hygienic and sanitary actions.

The presence of Strongyloidesstercoralis larvae found in this research matches with other studies about the contamination of vegetables, such as Rezende et al. (2014) who has verified agreater abundance of this helminth in arugula and lettuce samples. Also in the studyperformed by Silva et al. (2015) the second largest helminth identified in the chives, were larvae of the species Strongyloidesstercoralis. According to Naves and Costa-Cruz (2013) among thenematodes, Strongyloidesstercoralis is the most aggressive because it can cause abdominal pain, vomiting, nausea, diarrhea or loss of appetite, shortness of breath, fever and skin damage.

The results found suggest conditions of cultivation and / or sanitary inadequate handling from the point of view hygienic and sanitary. Although it is not possible to say when the contamination occurred, this study observed a great exposure of the vegetables in the sales areas, by being easily accessible for any passerby, winds, dust and possible insects. No detailed information was obtained about the form of cultivation. However, it is emphasized here that the contamination of vegetables may occur throughthe water or soil, if these ones arecontaminated with human feces, and by being that one of the main waysof human beingsbe affected by these parasites occurs throughthe oral ingestion of foods containing infective forms of parasites. Whenthese ones are contaminated, they may present generic symptoms, and it maylead to death in the eventcase of non-hospital care (Rezende et al., 2014). Amorós et al. (2010) affirms that contaminated water is the main form of contamination of fresh produce.

Other causes of enteroparasite contamination in vegetables are attributed to soil contamination from organic fertilizer with fecal excrement, contact of vegetables with animals such as flies, birds and / or rats, and possible inadequacies in the ways of handling and transport (Robertson Gjerde, 2001).

Chives and arugula are commonly fertilized by poultry or cattle manure, often used as fertilizer for crop soil (Albuquerque et al, 2010). There are kinds of production in which vegetables are grown with swine manure, cattle and poultry and / or irrigated with dammed waters that has contact with these animals. This explains part of the factors that contribute to the contamination of these vegetables. Therefore, the ingestion of these ones, cultivated, preserved or inadequately prepared, affects possible dispersion of parasites (Rezende et al., 2014).

The consumption of contaminated vegetables exposes a large part of the population to possible infections caused by parasites. The control of foodborne diseases, which are the result of the fecal and oral infection cycle, has gained greater care all over the world (Cantos et al., 2004; Blaser, 2006; Käferstein; Käferstein; Abdussalam, 2009).

Graph 1 shows the index of contaminated vegetables in the street markets surveyed in Vitória da

Conquista - BA, by revealing that in all the commercial places, positive samples were collected for parasites.

Coutinho et. al (2015) consider that the street markets present a high degree of contamination risk by being exposed to the open air , that is, they are susceptible to biological alterations due to the actions of the various organisms that act above them, by including microorganisms and insects common in the urban context.

According to Reis (2014),by controlling hygiene and the level of parasitological contamibynation of vegetables is a challenge to be fulfilled. Good hygiene is one of the most effective methods for protecting against diseases transmitted by infected feedlots. As it is regulated by the Ministry of Health (Brazil, 2006), food safety is an essential factor; this means that food must not contain contaminants of a physical, chemical or biological nature or other hazards that damage the health of the consumer.

Graph 1. Percentage of contamination in street market samples.
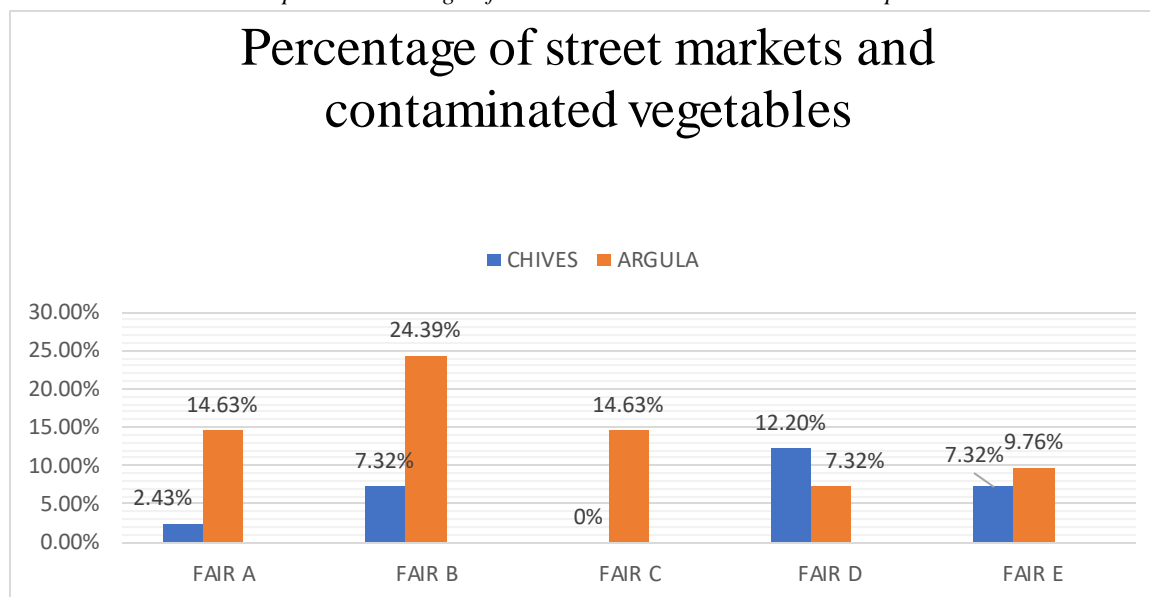
Source: Prepared by the author. 2019

According to Campos et al. (2013) arugula is a vegetable that provides several benefits to human health because it is a plant rich in proteins, vitamins A and C, and minerals such as iron and calcium. Besides being associated with a balanced diet, it stimulates the appetite and has anti-inflammatory and antioxidant effects for the living organisms. In relation to the chive, only a scientific work on this vegetable was found, by regarding the physical and chemical characteristics of this food (Silva, 2015). However, it is known that this is a vegetable very used for seasoning and preparation of food.

It is recommended that these foods marketed in street markets have a sanitary safety standard food; that is, these foods must be free of biological, physical or chemical contaminants that compromise the health of the population.

Vegetables and other perishable products with peculiar characteristics are specifically regulated by the General Coordination of Plant Quality - CGQV, a sector of the Ministry of Agriculture, Livestock and Supply, created in order to define the minimum requirements of identity and quality of these organic products and allow

the adequate verification of the vegetables offered to the consumer. Thus, inthe Normative Instruction Nº. 69, dated November 6, 2018, Article 2 about the minimum requirements of identity and quality determined are full responsibility of rural producers (BRAZIL, 2018).

However, it is visualized in Article 5 that the minimum quality requirements to be observed in a product are whether they are whole, clean, pestfree, firm, well developed physiologically, without foreign odors and free from rotand insects (BRASIL, 2018) .

By considering the quality standards mentioned above, this study will not establish quality standards for the vegetables analyzed, since, according to a study by Locatelli (2009), the factor that predominates in the evaluation of product quality is subjective, that is, it is up to the consumer. A study performed by Wandel and Bugge (2002) in Europehas verified the most important properties in the evaluation of the quality of fruits and vegetables and it was verified that the attribute of great value were those ones of taste and freshness.

Thus, it is recommended that hygienic and sanitary actions and measures should be continuously

exploited not only in the vegetableconsuming population, but also in the producing community and merchants of these foods.

IV.   FINAL CONSIDERATIONS

Vegetables are foods commonly eaten by the population. The sanitation of these organic foods, especially thoseones consumed in its raw way, is a public health concern, since they, when contaminated, may contain larvae, protozoa and eggs of helminths and serve as a source of transmission of enteroparasitoses to man.

This work aimed to evaluate parasitological contamination in arugula and chives samples marketed in five street marketsfrom Vitória da Conquista-BA. The levels of contamination of the vegetable varieties showed that in both samples the prevalence of protozoacontamination predominated, by being 44.82% of E. coli cyst in the arugula samples and 58.34% of E. nana cyst in the samples of chive. Followed by significative contaminations by helminths, 31.03% of Strongyloidesstercoralis larvae in the arugula samples and 25% in the chive samples.

The presence of protozoa, helminths, was observed in the analysis performed in this work. Therefore, the results of this work point out therequirement for orientation and inspection of cultivating crops and by distributing vegetables for consumption in order to improve the quality of these products, since these ones may be transmitting endoparasites to their final consumers.

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Evaluation of the Antimicrobial Potential of Essential Oil of the Leaf of Passiflora Edulis

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Abstract— The passion fruit of the genus Passiflora edulis generally presents three forms of use, that is, the in natural form, pharmaceutical applications, and industrial processes. Currently, research has reported the increasing use of oils extracted from passion fruit leaves for the purpose of bacterial inhibition. The objective of this work was to evaluate the antimicrobial action of Passiflora edulis leaves extract against Staphylococcus aureus, Streptococcuspyogenes and Escherichia coli microorganisms using solvents with different polarities through disc diffusion and microdilution techniques. The oil extracted from the leaves of Passiflora edulis had satisfactory performance against the isolates of gram-positive bacteria S. pyogenes, in which it presented a good antimicrobial potential of inhibition compared to the other microorganisms tested. This action can be explained by the presence of constituents of the plant that cause this effect against the pathogen, such as: the presence of flavonols, proanthocyanidins, passion, polyphenols, tannins, aldehydes, among others.
Keywords— Antimicrobian activity. Passionflower. Chemical extraction.

I. INTRODUCTION

Feeding performs a very important role in maintaining health and promotion, currently consumers are looking for foods that may obtain these characteristics that is that provides directly benefits to health. Fruits are part of this complex healthy foods network, by being considered as an integral component of a balanced diet and with increasing of its functional properties, they reinforce even more the importance of its regular ingestion (Souza, 2016).

Passion fruit is a characteristic fruit of tropical areas that has been gaining prominence in industries mainly in the pharmaceutical industry because of the variousmedicinal properties in extracts, leaves and flowers, as well as its antimicrobial and antioxidant potential presented in the pulp, leaves, seeds and bark. (Souza, 2016)

The genus Passiflora edulis is known as yellow passion fruit or passion fruit sour and is generally identified in herbaceous vines, sublining vines possessing a vigorous growth with five to ten meters, obtaining a radical systems, climbing stem, lobed and green leaves, floriferous yolk and also vegetative yolk in the axilla of the leaf, and the flowers are bisexual or unisexual. Moreover, its leaves present the presence of cyanogenic glycosides β-D-allopyranos benzyl compounds valuable for health. (Souza, 2016)

The passion fruit of the genus Passiflora edulis generally presents three forms of use, that is, in natura form, pharmaceutical applications and industrial processes. Currently research has reported the increasing use of oils extracted from passion fruit leaves for the purpose of bacterial inhibition due to a substance called Passicolthat causes inhibition of the growth of bacteria, usually Gram negative and some studies have also observed the ability to inhibit S. aureus, that is a positive bacterium by presenting great resistance for several antimicrobial agents. (Galvão, et.al; 2013)

From this it is clear that the passion fruit leaves of the genus Passiflora edulis, as well as all its fruit presents undeniable benefits to the health of the population, by demonstrating the possibility of the use of passion fruit leaves for the production of antibacterial phytotherapics by favoring both human health by use a natural drug as the sustainability of the Brazilian market. (Freitas, et al., 2017)

Desiring to define the antibacterial potential for consecutive use in the preparation of pharmaceutical formulations with the competence of making susceptible

resistant forms, this work has the objective to provide the evaluation of antimicrobial existence action of the extract ofPassiflora edulis leaves against the microorganisms Staphylococcus aureus, Streptococcuspyogenes and Escherichia coli, by using solvents with different polarities. Introduction is the initial part of the article, that outlines the delimitation of the subject that will be approached, the goals of the research and the other necessary factors to locate the article.

II. METHODOLOGY

Plant Material

The leaves were collected in a planting of Passiflora edulis in the city of Anagé - Bahia, from March to June 2018. The identification of the botanical material was performed in the herbarium of the State University of the Southwest of Bahia in the Campus of Vitória da Conquista - Ba, and an exsicata of the species was made for identificationof this one.

Place of Study

The extractive part was performed in the Institution of Higher Education FaculdadeIndependente do Nordeste - FAINOR, in the sector of health laboratories. The scope of the crude extract was based on the methodology of OLIVEIRA et al, 2016, in which modifications were made. The research was conducted in the State of Bahia, that presents a total of 417 municipalities and approximately 15,344,447 million estimated inhabitants (BRAZIL, 2017).

Method for extraction of oil

The methodology used was Clevenger, a complex that drags water vapor and / or steam distillation, by being the most used and economically possible way to extract vegetable oils. The water undergoes heating in a volumetric flask on a heating plate which then boils, the water vapors that are produced from this process are guided under pressure by giving continuity in another container, in the place where the plant material is. (PISTELLI, E. C., 2012).

The heat of the steam establishes that the cell walls untie. In view of this, the oil that is between the cells vaporizes along with the water vapors and the volatiles are guided towards the condenser by going to the cooling tube; then the collected oil is placed in a container. (PISTELLI, E. C., 2012)

Procedure

Unlike seeds and pulps, which are placed to dry in an oven at 60 ° C for 48 hours, the leaves were used green and then ground in a blender. Then, 100 g of sheets were weighed using 500 ml of distilled water that were placed in the Clevenger apparatus for extraction of the oil at 50 ° C for two hours. Finally, in the extraction of the oils, they were submitted to the QUIMIS brand rotary evaporator under a temperature of 50ºC, for total solvent separation of the water stored in an amber bottle in a refrigerator.

Biological test

In order to verify the antimicrobial action of the raw extracts of Passiflora edulis, standard microorganisms provided by the collection of FAINOR microorganisms were used to find some inhibitory activity for the development of the bacteria Klebsiella spp, Streptococcus Pyogenes and Escherichia coli. The bacteria were chosen randomly thereby aiming to determine between grampositive and gramnegative bacteria which had antimicrobial activity against the essential oil of the seeds of Passiflora edulis.

In the preparation of the inoculum, the young cultures of each bacteria were standardized in sterile saline solution (0.85% NaCl) until a turbidity compatible with the 0.5 scale agreement level of MacFarland (1x10⁸ CFU / ml) was obtained. The antimicrobial activity was done by following the in vitro paper disc diffusion method of Bauer and Kirby (1966).

Sterile filter paper discs measuring six mm of diameter were soaked with 10µL of the crude extract solution at 200,000µg / ml, so that each disk had a concentration of 1,000µg / ml. The strains were spiked in Muller-Hinton Agar medium and incubated at 37 ° C 24 hours prior to the test. Then the results were read, by measuring the space of the inhibition halo built around the disk, when occasionally present. The halo is measured in mm.

Broth macrodilution methodology for determination of Minimum Inhibitory Concentration (MIC)

The determination of MIC was performed by the CLSI test tube macrodilution method, based on the methodology of Santurio et al. (2007), with modifications. The technique was performed in tubes, by consisting initially of the preparation of serial dilutions of the oil of 1:10, 1: 100 and 1: 1000. To prepare the 1:10 dilution, 9 ml of absolute alcohol was taken together with 1 ml of essential oil. On the 1: 100 dilution the same amount of alcohol was used and 1ml of the 1:10 dilution was withdrawn, and the dilution was added 1: 100 and so on to give the 1: 1000 dilution.

Then, five tubs were prepared with serial dilutions, enumerated from 1 to 5. These tubes were composed of 8 ml of Muller-Hinton Agar liquid medium

together with 1 ml of the 1:10 dilution, 1 ml of tube 1 was transferred to tube 2, from the tube 2 to the 3 and successively to the last tube and finally 0.5 ml of the bacterial suspension that were added in all tubes, thus having a final volume of 8.5 ml. This process was performed in each tube by containing the dilutions.

The control tubes were prepared, where the same ones were divided into three and followed as the following way: for the positive control, 4 ml of the bacterial suspension was added with 4 ml of Muller-Hinton Agar medium; for the negative control was added 4 ml of bacterial suspension with 4 ml of the antibiotic prepared; in the third tube only the pure Muller-Hinton Agar medium was added. For finalization of the technique, 10µl of the broth that was clear was seeded to know precisely the exact concentration of the oil.

III.   RESULTS AND DISCUSSION

Table.1. Antibacterial activity of Passiflora edulis leaf essential oil

Microorganism	Halos formed by oil (mm)	Innibition Halos (mm) Reference values *		
		**R	I	S
Klebsiellaspp	5	≤ 14	15-17	≥ 18
Escherichia coli	0	≤15	16-20	≥21
Streptococcus pyogenes	13	≤11	12-23	≥24

* Reference values taken from the manual for Antibiogram by Kirby & Bauer disc diffusion technique. ** R - Resistant; S - Sensitive; I - Intermediate.

As described in Table 1 above, according to the studies performed, it was found that in the diffusion test tubes by using the plaque method, it was verified that the essential oil of the Passiflora edulis leaf was able to inhibit with intermediate halo the bacteriua Streptococcus pyogenes, with the formation of the inhibition halo (13mm) around the disc that was impregnated with the essential oil. As compared with the other microorganisms tested, the results evidenced that the leaf essential oil had no antibacterial potential activity to inhibit the growth of Klebsiella spp and Escherichia coli, with halos of 5 mm and 0 mm respectively, by being considered resistant to the oil of Passiflora edulis.
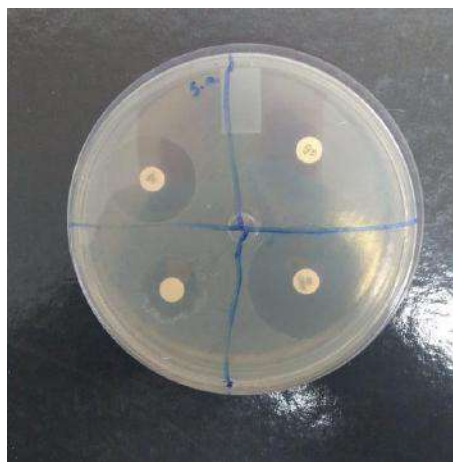
Fig.1. Verification of the inhibition halo of Passiflora edulis leaves bythe disk diffusion technique of Streptococcus pyogenes.

This sensitivity of Streptococcus pyogenes was studied by Cushnie (2016), in which the presence of flavonols, secondary metabolite of the plant in question, is mentioned. This metabolite presents a great bactericidal activity due to the different mechanisms of action that lead to the aggregation effect in all the bacterial tissues, by being resolutive against a gama of gram positive bacteria, such as Streptococcus pyogenes, Staphylococcus aureus, Lactobacillus acidophilus, among others .

Another metabolite present in the evaluated plant are the proanthocyanidins, derived from primary metabolites that inhibit the growth of several gram positive pathogens with characteristic of cocci and in pairs. (Caillet, 2014) Researches report the inhibition of grampositive bacteria before the leaves of Passiflora edulis due to the strong presence of a substance known as Passicol, however, it does not show any inhibition in relation to gramnegative bacteria, as it is the case of resistance of Klebsiella spp and Escherichia coli (Petry 2011, Silva 2017, Silva 2014).

Phytochemical tests performed by Ferrari (2015) with hydroalcoholic extracts of the aerial parts, such as the leaves, established that the studied plant presents as secondary metabolites, condensed tannins, baphenes, flavones, flavonols, flavonols, among others. It is hoped that with these phytochemicals, they will increase plant defense against pathogens and may therefore to result in biological activities (Johnson 2018; Kannan 2012).

The antimicrobial properties of certain classes of Passiflora edulis constituents, such as polyphenols, are related to their ability for suppressing microbial virulence

factors such as biofilm, adhesion and neutralization of bacterial toxins (Daglia, 2012).

However, some research has influenced that the lack of antimicrobial activity of Passiflora edulis essential oil with gramnegative bacteria (Klebsiella spp. And Escherichia coli.) are due to the inability of forming complexes with soluble proteins present in the walls of membranes of these bacteria, that is,by being impossible to break the lipophilic membranes of the same ones. (Laupland 2012;Leitao 2016;Lugato2014)
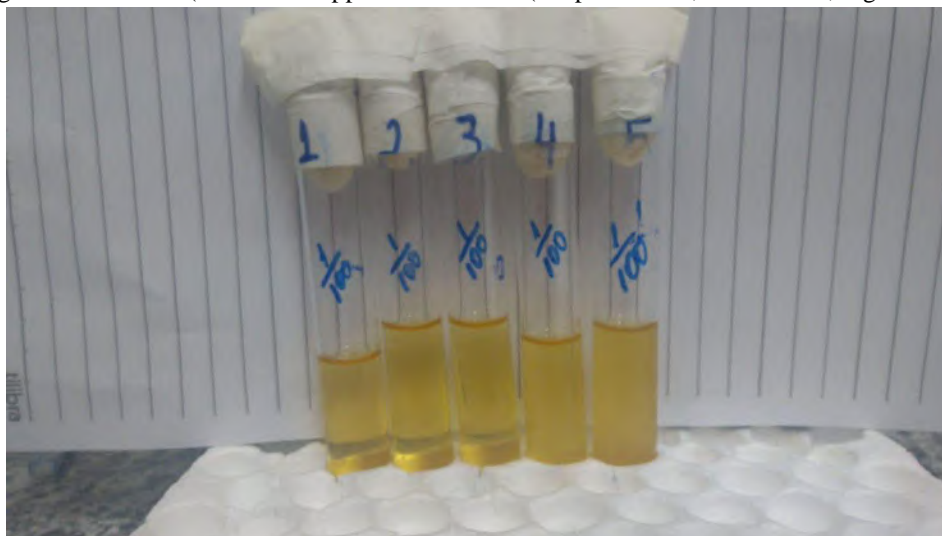
Fig.2: Verification of the CIM of Passiflora edulis leaves by the macrodilution techniqueon Streptococcus pyogenes.

Macrodilution analyzes confirmed that the essential oil of Passiflora edulis seed presented an effective response against clinical isolates of Streptococcus pyogenes. In the 1:10 dilution there was no growth in any of the 5 tubes, in the 1: 100 dilution there was no growth only in the first one. From the second tube to the fifth, there was growth. As it had growth in the 1: 100 dilution, consequently in the 1: 1000 would also be seen growth.

The concentration measure (or concentration average) is studied for the ability to cause some inhibition in the growth of the test microorganism. That is, in the 1:10 dilution is the lowest concentration of the oil of Passiflora edulis leaf capable of causing the bacteria Streptococcus pyogenes deathas it is exposed to that concentration. Thus, it is possible to emphasize the positive power of the oil extracted from the leaves of Passiflora edulis concerning to the bacterial sensitivity when contacting with the oil. In all experiments positive and negative control of medium and microbial growth with the inoculum was adequate.

According to Nkhata (2012) the essential oil of Passiflora edulis has antibacterial activity due to its chemical constitution, with the presence of tannins, aldehydes, saponins and glycosides that are associated with its potential. According to Nascimento (2010), the antimicrobial activity also results from the composition and concentration of the species or essential oil in question, of the type, of the microorganism in question,

the composition of the substrate, the processing and the storage condition, among others.

The essential oil of Passiflora edulis Sims is described as a volatile, lipophilic substance, usually odoriferous and liquid, by belonging to the secondary metabolism plants. It may have activity attributed to antibacterial and antifungal, as well as in the sectors of perfumery, personal hygiene and cosmetics. (Simões& Spitzer, 2004, Costa, 2008)

The combination of natural products with antibiotics enriches the disintegration of bacterial membranes through the formation of a complex by agents associated with this structure (Pimentel 2015; Serpa2012). The natural products associated with antibiotics, exerces an activity against many bacterial species, either increasing the activity of the antibiotic itself or decreasing the natural resistance of the bacteria. Thus, due to this specificity, these compounds are classified as modifiers of antibiotic activity (Siebra, 2016; Shahidi, 2013).

Passiflora edulis has large medicinal properties, such as Arrais (2012) mentions in its studies, antiinflammatory, sedative, healing, antimicrobial and antidiarrheal (KRIEF, 2014) Medicinal plants are more and more being used in the popular medium, by fact of people are more and more seeking the use of herbal medicine as auxiliary therapy, or even, by taking the place of advances in medicine. Currently, in Brazil, there is phytotherapy in the Unified Health System (UHS), incorporated by the Ministry of Health, thathas the goalof

increasing the applicability of medicinal plants in the day by day of the population. (2006)

Klebsiella spp and Escherichia coli are opportunistic bacteria that cause serious infections by leading to a high degree of morbidity and mortality mainly in immunocompromised patients. Because they have the ability to arrest themselves to local cells, they are responsible for the greatergama of urinary tract infections. (RONALD, 2013) Streptococcus pyogenes, with high virulence and morbidity and mortality, is a species of grampositive cocci, that can be found in the upper airways and cause infections (Walker 2013).

In this respect, the phytochemicals that are found in plants and may make some clinical office against these pathogens, they have importance in the arsenal of antimicrobial agents, since the durability of any antibiotic is limited and, in turn, the public is more and more clarified with the problems of superprescription and the indiscriminate use of antibiotics (Alves, 2013).

Paterson (2015) affirms that there is nowadays a large scale of natural compounds that are available with the exemption of medical prescription, in drugstores, herbal and general food stores. Thus, the research of plant extracts with antimicrobial action presents an exit for combating pathogenic microorganisms, thus leading to the search for new chemical molecules derived from plant species as a promising source of new antimicrobial agents (Nunes 2013; Oliveira 2016)

IV.   CONCLUSION

Before this study, it was observed that the oil extracted from the leaves of Passiflora edulis had satisfactory performance against the isolates of gram-positive S. pyogenes bacteria, in which it presented a good antimicrobial potential of inhibition compared to the other microorganisms tested. This action can be explained by the presence of plant constituents that cause this effect against the pathogen, such as: presence of flavonols, proanthocyanidins, passicol, polyphenols, tannins, aldehydes, saponins and glycosides, among others, which generate high bactericidal activity, suppression of factors of virulence and complexation with the structures of the bacteria. Thus, the leaf oil from Passiflora edulis can be used as a source for the treatment of infections caused by S. pyogenes, obviously, by requiring more embracing clinical studies to certify its antimicrobial potential.

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Skin Disease Detection And Classification

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Abstract—Skin diseases are most commonly occurring in people of all ages and are caused by bacteria, infection or radiation. These diseases have various dangerous effects on the skin and keep on spreading over time. A patient can recover from skin diseases if it is detected and treated in the early stages and this can achieve cure ratios of over 95%. Hence, it is important to identify these diseases at their initial stage to control them from spreading. Skin diseases are primarily diagnosed visually, beginning with an initial clinical screening and followed potentially by dermoscopic analysis. Such a system is often prone to errors. The main idea of this project is to improve the accuracy of diagnostic systems by using Image Processing and classification techniques. In the proposed system, an image captured on camera is taken as input. This image will be pre-processed in order to make it suitable for segmentation by using Contrast Enhancement and Grayscale Conversion. Global Thresholding technique is used to segment the pre-processed image through which the actual affected region is obtained. Texture features, such as Energy, Entropy, Contrast, IDM, are extracted from the segmented image using Grey Level Co-occurrence Matrix. Image Quality Assessment features such as MSE and PSNR are extracted. The extracted texture features will be used to detect the presence of skin disease and classify the disease as melanoma, leprosy or eczema, if present, using the Decision tree technique.

Keywords— Global Thresholding, Grey Level Co-occurrence Matrix, Histogram Equalization, Image Processing, Texture features.

I. INTRODUCTION

1.1. Skin Diseases

Skin is the largest and most sensitive part of the human body which protects our inner vital parts and organs from the outside environment, hence avoiding contact with bacteria and viruses. Skin also helps in body temperature regulation. The skin consists of cells, pigmentation, blood vessels, and other components. It is comprised of 3 main layers, namely, the epidermis, the dermis, and the hypodermis.

Epidermis, being the outermost skin layer, forms a waterproof and protective sheath around the body's surface. The dermis, found beneath the epidermis, comprises of connective tissues and protects the body from stress and strain. A basement membrane tightly joins the dermis with the epidermis. The hypodermis, also called subcutaneous tissue, is not actually a part of theskin and lies below the dermis. It attaches the skin to the underlying bone and muscle and also supplies blood vessels and nerves to it.

Skin diseases occur commonly among humans. They are usually caused by factors like different organism's cells, a different diet, and internal and external factors, such as the hierarchical genetic group of cells, hormones, and immune system of conditions. These factors may act together or in a sequence of skin disease. There are chronic and incurable diseases, like eczema and psoriasis, and malignant diseases like malignant melanoma. Recent researchers have found the availability of cures for these diseases if they are detected in the early stages.

Atopic dermatitis, commonly called eczema, is a long-term skin disease whose common symptoms are dry and itchy skin, rashes on the face, inside the elbows, behind the knees, and on the hands and feet.

Hansen's disease, commonly called leprosy, is caused by slow-growing bacteria and can affect the body and facial parts like nerves, skin, eyes and nose lining.

Melanoma is severe and life-threatening skin cancer. The "ABCD's" of moles detected on the skin are Asymmetry, Border, Colour, and Diameter. Asymmetry implies that the shape of one half does not match the other half. Border means the edges of the mole are ragged, blurred, or irregular. Colour is uneven and may include shades of black, brown, and tan. The diameter of mole implies a change in size.

1.2. Skin Disease Detection System

Skin diseases are primarily diagnosed visually, beginning with an initial clinical screening and followed potentially by dermoscopic analysis. To ascertain what type of skin disease a person has, they must visit a dermatologist. The dermatologist then performs visual analysis using various tests, some of which include:

1. Patch test: Known allergens are applied to a patch of skin and left for some time. The skin is then tested for a reaction.

2. Biopsy: Skin is removed using a scalpel, a blade or a biposy tool and taken to a laboratory for analysis.

3.Culture: Skin of affected area or hair or nails are cultured to determine which microorganism is causing the infection. Such a system is often time consuming and requires a number of expert professionals. Since there are people involved in this process, it is prone to human errors. This system is also quite expensive as laboratories charge a lot of fees for the tests.

A skin disease detection and classification system is a system used for detecting whether a disease is present or not, and then classifying the type of disease, if present. The classification is based on decisions taken using the features extracted through the feature extraction methods.

In order to identify whether a disease is present or not, the system must be trained to recognize normal conditions of system activity. There are two main phases for this purpose: training phase (building a profile using data about a particular disease) and testing phase (comparing the current image data with the trained image data).

Md Nafiul Alam et al., "Automatic Detection and Severity Measurement of Eczema Using Image Processing", suggested an automatic eczema detection and severity measurement model using image processing and computer algorithm. The system basically allowed patients to take an image of the affected skin area and identify and determine the severity of eczema. This system included image segmentation, feature extraction, and statistical classification to identify and differentiate between mild and severe eczema. Once the eczema type was identified, a severity index was assigned to that image. Several common segmentation methods, like Otsu's, watershed, and region growing segmentation, were implemented, and since none of these methods gave correct outputs, color-based segmentation using k-means clustering was used. Feature extraction was based on color features, texture features, and border features and the classification was done using the SVM classifier method.

Benefits of this system were it provided a faster and easier way of detection of eczema, and its severity if detected. Its

main limitation was that the system could be more accurate if the image database had a large number of calibrated images.[2]

Sumithra R. et al., "Segmentation and Classification of Skin Lesions for Disease Diagnosis", suggested a system for automatic segmentation and classification of skin lesions. Initially, skin images were pre-processed to remove visible skin hair and noise. These filtered images were then segmented using Region growing segmentation methodand feature extraction of color and texture features was performed. Based on the extracted features, the images were classified as a particular disease using Support Vector Machine(SVM) and K-Nearest Neighbour(KNN) classifier methods. The advantage that this system provides is better performance results by fusion of SVM and KNN methods instead of using either one of both.

Its disadvantage is that classification system performance reduces due to the effect of some classes, thereby affecting the overall performance of the system.[3]

Sheha et al.(March 2012) suggested an automated system for discrimination between melanocytic nevi and malignant melanoma avoiding segmentation process using texture analysis. Texture analysis refers to the characterization of regions in an image by their texture content. The study used 102 images from skin diseases Atlases and dermoscopy clinics. The process had 4 phases. First was pre-processing, which included resizing of images and RGB to grey conversion. The second phase was feature extraction done using grey level co-occurrence matrix (GLCM). Next phase was feature selection, which used The Fisher score ranking to select the most important texture features. The last phase was classification, using Multilayer Perceptron (MLPs). The advantage of this method was that it had a high accuracy of 93%.

In conclusion, this work showed that the combination between the co-occurrence matrix and ANN is a promising technique for discrimination between malignant melanoma and melanocytic nevi dermoscopy images.[4]

Table 1: Comparison of human skin diseases detection models

Title	Algorithms Used	Accuracy	Advantages	Disadvantages	Number of diseases classified
Classification of Skin Disease Using multi SVM Classifier	-C-means -Watershed -GLCM, IQA -Multi-SVM classifier using Matlab	High	-Gives high quality results even with a smaller training dataset	-Time complexity is high	2
Automatic and severity Measurement of Eczema Using Image Processing	-Region growing segmentation -Color based segmentation -Texture, color and	High	-A faster and easier way of detection with high accuracy	-Image database lowers the accuracy level	1

	border based feature extraction -SVM classification				
Segmentation and Classification of Skin Lesions for Disease Diagnosis	-Region growing segmentation -Color and texture based feature extraction -SVM and KNN classification	Moderate	-Provides better performance results using a fusion of SVM and KNN methods	-Due to some classification classes, performance reduced -Either method alone couldn't perform better than the fusion of both	1
Automatic Detection of Melanoma Skin Cancer	-Fisher score ranking -Multi Layer Perceptron classifier method	High	-Gives better performance by skipping the segmentation method	-Can give errors if correct features are not selected	1

II. SYSTEM DESIGN
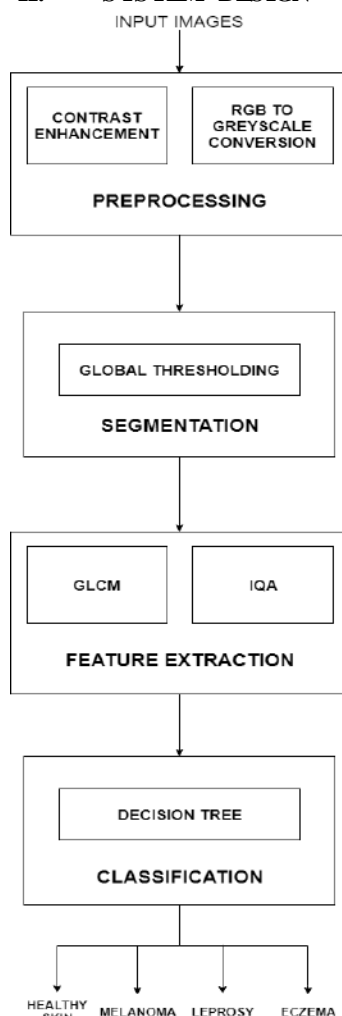
Fig. 1: flow diagram of the proposed system

2.1 Proposed System

The proposed idea aims at developing a system to provide early and easy detection of skin diseases, if any, using image processing and classification techniques. Here, the image data will be pre-processed and given to the segmentation algorithm. The segmented data will be passed to feature extraction methods, and the features thus extracted will be used by the classification algorithm to detect the presence of skin disease.

2.2 System Flow

The system takes as input an image of the affected skin region and feeds it to the pre-processing techniques, namely, Contrast enhancement in order to improve clarity and contrast of the image, followed by RGB to Grayscale conversion. The processed image is segmented in order to distinguish the actual affected part(foreground) from the remaining area(background). Next, the segmented image is sent for feature extraction. These features, in turn, will be used as input to classify which disease the image is referring to.

2.2.1 Image pre-processing

Image pre-processing consist of two sub-processes, Contrast Enhancement, and Grayscale Conversion. A raw binary image is converted into the RGB (red/green/blue) Matrix form. The RGB Matrix is first processed for Contrast Enhancement and converted to contrast enhanced RGB Matrix, this is done so as to distinguish each pixel with its neighbour. Contrast enhancement is performed using Histogram equalization[5]. The contrast enhanced RGB Matrix is converted into Grayscale Matrix[6].

2.2.2 Segmentation

Thresholding

The selection process is called Thresholding. Image Thresholding is a simple technique to partition an image into a foreground and background. It is one of the simplest approaches for image segmentation based on intensity levels. Thresholding can be implemented locally or globally.

Global Thresholding

Global thresholding[7] partitions an image into objects and background. It is the simplest of all thresholding. Segmentation is then achieved by scanning each pixel and

labeling it as background or foreground depending on the grey level of that pixel.

2.2.3 Feature Extraction

This feature extraction is the process where we will be representing a raw image in a reduced form to help decision making pattern detection or classifications. The process involves reducing the amount of the resources which are being required to describe that in the larger sets of the data.

This process is widely used in machine learning. This is the general terms of the methods where we can construct combinations of the variable to get along with these problems while we can describe the data with high accuracy. Hence, we have divided this process into two methods for better feature extraction:

1. GLCM (Grey Level Co-occurrence Matrix)

In this method,the texture of the image is analyzed. The grey level co-occurrence matrix[8] is created by counting the number of times each pair of those specific values in a specified spatial relationship occur in the image. The texture features extracted from the grey level co-occurrence matrix are energy, entropy, contrast, IDM, correlation, and ASM.

2. Image Quality Assessment.

Image quality assessment[9] is one of the quality assessment methods.These are defined by the Full reference method. Image Quality Assessment Features MSE(Mean Square Error) and PSNR(Peak Signal to Noise Ratio) are extracted from the segmented image.

Full-reference method

Full reference method metric will always try to access the quality of the test images by calculating and comparing this with the referenced images, which can then be assumed to be having the perfect qualities.

This metric is the mean squared error (MSE), computed by averaging the squared intensity differences of distorted and reference image pixels, along with the related quantity of peak signal-to-noise ratio (PSNR).

2.2.4 Classification

Classification is the process of identifying to which category the input data belongs.

Decision Trees

Decision trees[10] use a tree like structure in which decisions and their possible outcomes are represented. A decision tree has a root node which is divided further into child nodes. A decision tree has three types of nodes: chance nodes, decision nodes, and end nodes.A chance

node, denoted by a circle, represents the probabilities of certain results. A decision node, represented by a square, shows a decision to be made, and an end node shows the final outcome of a decision path.

ID3 Algorithm

In decision tree learning, ID3 (Iterative Dichotomiser 3) [11] is an algorithm used to construct a decision tree for a given dataset.In the beginning, set S is the root node. At each level of the tree, it iterates through every unused attribute of the set S and calculates the entropy(S) or information gain IG(S) of that attribute. It then selects the attribute which has the smallest entropy or largest information gain value. The set S is then split or partitioned by the selected attribute to produce subsets of the data.

III. RESULTS

The system proposed is a Skin Disease Detection System. This system uses images of skin captured with a camera to detect if it is healthy or not; if not, then classified as Melanoma, Eczema or Leprosy. The proposed system uses image processing and machine learning techniques. The process begins with pre-processing an input image using contrast enhancement and grayscale conversion. The contrast enhanced image is converted to a grayscale image. Global Value Thresholding technique is used to segment the grayscale image through which the actual affected region is obtained.

Output images of each of the above mentioned processes are mentioned displayed in the GUI in Fig 4. Grey Level Co-occurrence Matrix is created from the segmented image and Texture features such as Energy, Entropy, Contrast, IDM, correlation and homogeneity are extracted from it. Image Quality Assessment Features MSE(Mean Square Error) and PSNR(Peak Signal to Noise Ratio) are extracted from the segmented image. The values of all the features calculated are displayed in the GUI as well.

The texture features are used to classify the test images. The accuracy calculated using 45 test images is 87%, giving an error of 6 out of 45 images.

Input Image:

Fig 2: melanoma input image

Pre-processing:

(a)   (b)
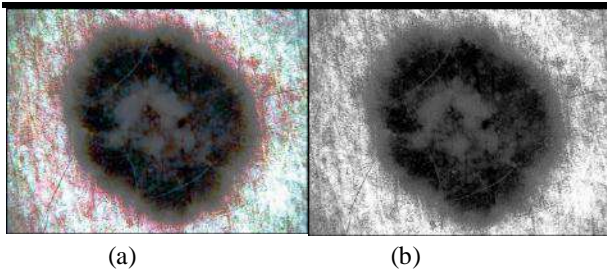
Fig. 3:   (a) contrast enhancement using histogram equalization
(b) grayscale conversion

Segmentation:
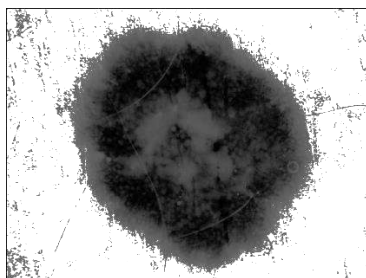
Fig 3: Segmentation using global thresholding
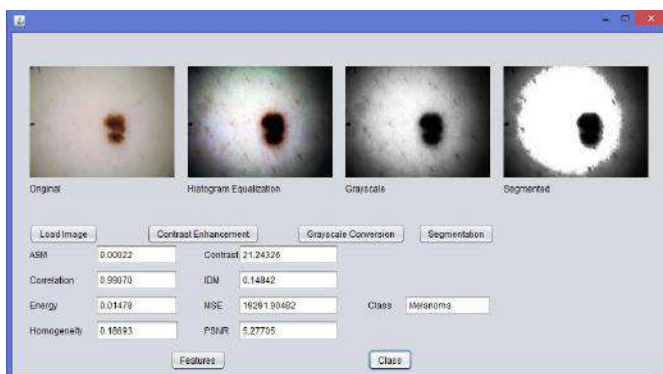
Fig 4: GUI for the system

IV.   CONCLUSION

The system proposed is a Skin Disease Detection System. This system uses images of skin captured with a camera to detect if it is healthy or not; if not, then classified as Melanoma, Eczema or Leprosy.

The proposed system uses image processing and machine learning techniques. The process begins with pre-processing an input image using contrast enhancement and grayscale conversion. Global Value Thresholding technique is used to segment the pre-processed image through which the actual affected region is obtained. Features, such as Energy, Entropy, Contrast, IDM, Correlation, and ASM are extracted from the segmented image using Grey Level Co-occurrence Matrix. Image Quality Assessment features like MSE and PSNR are also extracted. These features will then

be used to classify the image as healthy or into one of the 3 diseases: Melanoma, Eczema, and Leprosy.

This system can be used by dermatologists to give a better diagnosis and treatment to the patients. The system can be used to diagnose skin diseases at a lower cost. In future, this system can be improved to detect and classify more diseases as well as their severity.

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Analysis of Environmental Management Company acting on the State of Pernambuco-Brazil

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Abstract— This paper presents an analysis of environmental management of companies operating in the state of Pernambuco, considering the concepts and models for adoption of practices that lead to eco-efficiency as a way of estimating the legacy for future generations. Data were collected with the application of a quantitative survey, completed by the managers of the companies selected for sampling. There is recognition that it's necessary a change in the conduct of business by legal force, to protect the image of the company to respond to the demands of society, in order to enable growth economic and environmental protection, but actions taken as a main point gain legal compliance, still showing up they are at early stage on track towards sustainable local development. The results showed the adoption of environmental management practices that consider employee participation as key to improving their performance, recognize the importance of environmental education and give focus to the management of waste and consumption of natural resources like water and energy.

Keywords— Environment, Ecology, Business, Sustainability, Eco-efficiency, Environmental law.

I. INTRODUCTION

According Once living in a society, being this capitalist, it is inevitable to coexist with business organizations, which, inserted in the cultural, social and natural environment cannot avoid the responsibility of living with a low negative impact, continuity of the business, satisfying the needs of society and without damage to the environment. In this context, given its importance to mankind and the capitalist world, we must consider the contribution of the thinking of the Austrian economist,

administrator and professor Joseph Shumpeter and his theory of the economic cycle (Curie, 2011), according to which the reason for the economy to emerge from a state of equilibrium and to enter into a boom (expansion process) is the emergence of some innovation from an economic point of view that considerably alters the preconditions of equilibrium. Examples of innovations that change the state of equilibrium, the introduction of a new consumer goods on the market, the discovery of a new method of production or commercialization of consumer goods the conquest of new sources of raw materials or even the alteration of the structure of the current market, such as the breaking of a monopoly. These are, therefore, evidences that the companies are part of the environment and that are in constant interaction and their decisions have repercussions throughout the productive chain and outside it, like a wave, demonstrating the amplitude of this interconnection.

Historical evidence reveals that at all times of his existence man has never seen himself as part of the environment and has never relinquished his most superfluous desires in the name of nature, seeing it as an inexhaustible source of inputs for his activities (Curie 2011). What has changed over the years has not been man's posture, but the power to destroy his tools. In the midst of so many transformations, one of the few views that remains unchanged concerns natural resources. Influenced by the capitalist logic of utility, the human being reinforced the instrumentalist view with which he always looked at nature, identifying as resource only that which results in profit. In the view of environmentalists, natural resources comprise all the necessary conditions

for life. As the name implies, the industrial revolution has profoundly modified the previous mode of production, accelerating the rate of extraction of resources. Therefore, the action of man has gained much more destructive contours after the introduction of the machines, contributing to the rapid depletion of ecosystems.

All this analysis is based on the anthropocentric Western thought, which believes "nature is at the service of man", whose way is to respect it and use it with rationality. It is to migrate from the anthropocentric model, called "shallow ecology," according to which human beings are seen above or outside nature as the source of all values, while nature is given a simply instrumental, "use" value to the so-called "deep ecology", which sees the world as a network of interconnected and interdependent phenomena. Thus, we have a new paradigm, where we must see the world as an integrated whole, and not as dissociated parts. Deep ecological perception recognizes the fundamental interdependence of all phenomena, and the fact that, as individuals and societies, they are all embedded in a cyclical process of nature, and all are dependent on this process. It would then be coherent to think of sustainable local development management. Consider the definition of sustainability, given by Lester Brown of the World watch Institute, a sustainable society is one that meets their needs without diminishing the prospects of future generations (Capra, 2006).

After all, it is urgent that our civilization realize that historical processes are not necessarily linear, so as to be able to reverse the current escalation of socioenvironmental degradation, associated with our "globalizing" Cartesian mechanistic model of development. At this dawn of the millennium, humanity is going through a singular and decisive historical moment, marked by an environmental crisis that has its origins in an economic model, conceived mainly from the 18th century, whose support tripod based on capital, labor and natural resources shows signs of exhaustion. While the first two are still far from what might be called harmonious coexistence, the last component of this tripod, natural resources, has rarely been taken into account in any relevant way (Curie, 2002). The challenge, therefore, would be to develop sustainable businesses, compatible with economic reality. So, the path is more "simple", contrary to what the defenders of nature preach, since it is not necessary to "stop the world" to preserve nature, but to change the way of seeing and relating to it, making possible thus, the continuity of life on the planet.

In the broad sense, there is a need for an environmental reeducation, based on the tripod of sustainability or triple bottom line. The term triple bottom line was created by the British thinker John Elkington in 2008, according to which it only makes sense to think about sustainable development when environmental, social and economic aspects are taken into account (Curie, 2011). This represents a challenge to the harmonious relationship between society, organizations and the environment where they are inserted, enabling social development, financial return and environmental preservation. Under the umbrella of the economic relationship between companies and the environment, it is necessary to concentrate the analysis under the concept of eco-efficiency that presupposes the efficient use of natural resources, reducing economic and environmental impacts, benefiting, besides the environment, the performance business economics (Curie 2011). Under the umbrella of the economic relationship between companies and the environment, it is necessary to concentrate the analysis under the concept of eco-efficiency that presupposes the efficient use of natural resources, reducing economic and environmental impacts, benefiting, besides the environment, the performance business economics.

The state of Pernambuco stands out in the national scenario as one of the largest centers of economic development in Brazil. This is because the state progresses having a strategic focus on decentralizing development and meeting the demands of the most vulnerable segments of the population, from the Interior to the Coast, not forgetting the economic vocations of each region. The Economic Development Agency of Pernambuco - AD-Diper, points out the implementation of 1,049 new companies in the Interior, in the period 2007/2010. Another major driving force of the state is the Port Complex of Suape, one of the largest investments in infrastructure of the State Government. In the 13,500 hectares of the complex, 120 companies are already installed, another 30 are under construction, and another 20 are due by the end of 2015. It is the main business attraction center of Northeast Brazil.

This study addresses the environmental sustainability issue as an undisputed necessity in the current business management in the state of Pernambuco. Thus, the focus of this research was the environmental management model adopted considering ecoefficiency. Thus, it was defined in the perspective studied in this research, to address issues related to legal compliance, organizational strategy and market recognition. It aimed to study the depth of the environmental issue in business management in Pernambuco, with the implementation and maintenance of environmental management and the results achieved with the current model. Therefore, within this context, the objective of this study was to identify the reason that motivated the adoption of environmental

management practices in companies in Pernambuco; whether arising from a strategic decision, whether to meet market demand, whether to meet legal requirement or other reason to be clarified. The results showed the adoption of environmental management practices of the evaluated companies, which considered the participation of the employees as fundamental to the improvement of their performance and recognized the importance of environmental education and showed great performance in the management of waste and consumption of natural resources such as water and energy. Therefore, every enterprise, especially industrial, should consider in its model of environmental management, these four elements (water, energy and waste effluents), in order to mitigate their impacts, preventing pollution and depletion of natural resources and, achieving, as a return, the guarantee of business continuity.

II. THEORETICAL FRAMEWORK

2.1. Environmental sustainability and eco-efficiency

The term sustainability is increasingly present in everyday business activities and in the perception of society. The most widespread concept is that stated in the 1987 Brundtland Report (Azevedo 1988), that sustainable development must meet the needs of present generations without compromising the needs of future generations. From this publication, the term sustainability or sustainable development has gained global dimensions. Since then, several other derivations and definitions have emerged, keeping the central focus on the challenge of balancing economic growth, environmental protection and social development. The greater acceptance and understanding of the term sustainability have influenced the behavior of companies around the world, since they have faced not only economic but also environmental and social problems. Such problems have drawn the attention of society, the press, governments, Non-Governmental Organizations - NGOs, which result in new laws. Such changes have repercussions in the economic, political and social environment where the company operates and creates guidelines and limitations that demand changes in its management, to enable business continuity. Thus, the traditional view of the company must disappear, otherwise it will be subject to (Donaire 1999). The dissemination of sustainability in organizations occurs through the adoption of environmental management. The role of senior management is key to supporting and ensuring that initiatives towards environmental protection and change of responsibilities are implemented and maintained. New approaches have emerged for proactive companies to strengthen, through senior management, the organization's commitment to sustainability (Sanches

2000). Likewise, participatory management can influence the understanding and commitment of employees, since they are included and interfere in decision making, providing lasting results.

From the point of view of environmental management, it is also necessary to understand and meet the meaning of the term ecoefficiency, which represents the idea that both economic efficiency and environmental efficiency need to be achieved simultaneously in business management. In this sense, several studies and publications (Bergesen et al. 2009,GCP 1998, OECD 2001) have confirmed that practicing eco-efficiency, in fact improves environmental performance and can bring economic results, among which the following stand out: reducing operating costs, improving production processes, reducing vulnerability and risks, strengthening the institutional image, increasing the motivation of employees, greater possibility of generating revenue, with the possibility of conquering new markets. Among the various concepts adopted by industry, eco-efficiency is one of the most accepted, both in private and public sector. Eco-efficiency is therefore to do more with less, achieving economic and ecological gains in parallel, without one having to be sacrificed to benefit the other. For example, eco-efficiency can be achieved by improving resource and material use processes and energy efficiency, reducing risks to the environment and human health by developing products that "fit" into ecological cycles, producing products that are more easily recyclable or extending its functionality / durability. This "win-win" aspect has contributed to their acceptance by decision-makers. In 1992, the United Nations Conference on Environment and Development, held in Rio de Janeiro, known as ECO-92 or RIO-92, brought the concept of eco-efficiency as the tool to be used for companies to evaluate and improve their environmental performance, contemplating its operations, products and services (Schmidheiny 1992).

The popularity of eco-efficiency can be attributed to the ease with which it unites business objectives with value creation for environmental management. In short, there is no difference between a competitive company and an eco-efficient company, since eco-efficiency is a fundamental concept of productivity that is commonly measured outputs obtained from incoming inputs, so that it unites two types of efficiency: the economic and the environmental. Its objective is to maximize economic and environmental benefits, while minimizing risks and related costs. It is a characteristic or quality that can be used and applied to decisions regarding any kind of product, process, service and activity. The result of a decision should be an

improvement in the production process that makes it more eco-efficient or a product or service that is more eco-efficient than the previous one. This justifies the position of eco-efficiency as a broader context of sustainable development. Recently, eco-efficiency represents better decision-making, to reduce the economic and environmental costs of human activity, providing social value with environmental and economic gains. To reach this threshold, means and ways must be found to support decision-makers through the provision of performance monitoring tools and demonstration of tangible results.

2.2. Water, common good or natural resource?

The analysis of water must be made considering that the volume of fresh water on the Earth's surface is fixed, so that as the population grows, there is less and less water available per person. Lack of water is the main barrier to development and an important reason why so many poor people in the world remain poor. Most of our water comes from the aquifers, which renew very slowly. Industry is the second largest user of water (21% of the world's total) and although demand is limited in quantity, almost everything is consumed and the result is that the water gets so polluted that it cannot be reused as easily. Industrial effluents, as one of the outputs of industrial processes, also need to be considered, since their disposal, if done improperly, will contribute greatly to the pollution of the receiving body and therefore to aggravate the situation of the resource water, where it is seen, is a finite resource. Based on the premise that the industry uses 21% of the fresh water consumed on the planet, there is the fear that industrialization aggravates the problem of water pollution. In developing countries, about 70% of industrial waste is dumped into the water without treatment, polluting both underground and surface supplies. Among the substances discharged into rivers, lakes and aquifers are organic pollutants and heavy metals such as lead and mercury and persistent organic pollutants – POPs. Such substances are discarded or penetrated into the soil, they can cross all layers and reach the aquifers (Clarker and King 2005).

Hydropower, a global source of renewable energy, produces about one-fifth of the world's electricity. It is considered clean energy because it does not produce greenhouse gases or pollutants associated with the burning of fuels and is well accepted by the population, which is not the case with others, such as with nuclear power plants. It happens that the reservoirs required by large plants waste a lot of renewable water resources due to evaporation. It happens that the reservoirs required by large plants waste a lot of renewable water resources due to evaporation. Therefore, every enterprise, especially industrial, should consider in its model of environmental management, these four elements (water, energy and waste effluents), in order to mitigate their impacts, preventing pollution and depletion of natural resources and, achieving, as a return, the guarantee of business continuity. It is estimated that Brazil concentrates between 12% and 16% of the total water resources of the planet Earth, which are not distributed homogeneously and are threatened by socioeconomic factors. In the Northeast, there is a shortage of surface water, which is aggravated by problems such as lack of basic sanitation and contamination by tropical disease transmitters (Clarker and King 2005).

The water situation in Brazil involves problems of quantity and quality, deforestation, sewage disposal, river channeling and construction of dams, erosion, and discharge of toxic substances that act to reduce aquatic biodiversity, compromise public supply, increase costs and make water management very complex. Brazil has two major challenges, namely ensuring adequate water supply in small municipalities (up to 20,000 inhabitants) and large metropolitan areas, where, in addition to scarcity, they face growing risks of contamination. Freshwater is key to sustainable development, economic growth and poverty alleviation (Clarker and King 2005).

2.3. Management aspects of solid waste

One of the main products of the human relationship with the environment and present in the various phases of the production chain and also in the post-consumption of the industrial era, in the broad sense, is the waste, more recently called waste. The industrial era intensified its generation and emission, in solid or pasty form, liquid, gas, sound, visual, giving negative contribution, with the phenomenon of the pollution. Thus, it is necessary to consider the definition of pollution, found in art. 3, item III of Law 6.938/81 of the National Environmental Policy, degradation of environmental quality resulting from activities that either indirectly affect the health, safety and well-being of the population, as well as create adverse conditions for social and economic activities , adversely affect the biota, affect the aesthetic or sanitary conditions of the environment, release materials or energy in disagreement with established environmental standards (Kruglianskas 2009). Garbage disposed of without any treatment can pollute the soil, altering its physical, chemical and biological characteristics; it can also contaminate the water through physical pollution (increased turbidity, formation of sludge banks or inert sediments, temperature gradient variations etc. (eg percolation of slurry through the mass of waste to surface or groundwater), biological (eg by the use of industrial

wastes such as non-biodegradable detergents and toxic wastes, intensive use of herbicides, fungicides, etc.), biochemistry high coliform count and presence of residues that can influence the quality of life of the beings that inhabit the aquatic environment) and radioactive (Lima 1995).

At the heart of the environmental problems of today's world is the poor management of solid waste, which can cause not only serious environmental damage, but also health. These problems come basically from two factors: increasing amount of waste generated and discarded in the environment and quality of this waste, since substances with increasingly complex chemical chains of difficult degradation are produced (Negromonte 2002). In this sense, Lima (1995) introduced the concepts of inexhaustibility and irreversibility of the garbage, based on the origin of the same, because, the increase in the production of urban garbage is directly linked to the population increase and the intensity of the industrialization, irreversible processes, thus, the problems generated by garbage in the environment are irreversible, if we do nothing to contain them. There is no doubt that sustainable development is the way to meet the needs of the present without compromising the ability of future generations to meet their needs. This reflects a process of change in which the exploitation of natural resources, the orientation of investments, the direction of technological development and institutional change are in accordance with the current needs, not forgetting the future (Azevedo 1988).

2.4. Environmental law and public policy

From the legal point of view, one has to say that, as society began to become more conscious, it began to perceive the importance of the environment and not only of nature as a source of wealth, from which emerged environmentalist movements and the specialized media began to to exert pressure in a way that began to occur conflicts related to environmental issues, starting to demand from the legislator a focus hitherto little known, provoking the emergence of Environmental Law. The Environmental Law to be the instrument of adaptation of the policies of growth and has the task of accomplishing the common good, within the community in which give. Social, political, economic, etc. are fundamental to order the development of the various forms of social adaptation. Therefore, organizations from the point of view of environmental management need to conduct their actions in line with legal requirements. Environmental law is the instrument for adjusting growth policies. The importance of environmental law was embodied in the constitutional

text of 1988 and has been exalted in the higher courts that have been deciding (Freitas 2000):

"Everyone has the right to an ecologically balanced environment. It is a third-generation right (or a brand-new dimension) that assists every human being (RTJ 158/205-206). It is incumbent upon the State and the collectivity itself to defend and preserve, for the benefit of present and future generations, this right of collective ownership and individual trans character (RTJ 164/158-161). The fulfillment of this burden, which cannot be renounced, represents the guarantee that grave intergenerational conflicts will not be established within the community, marked by disrespect for the duty of solidarity, which is imposed on all, in the protection of this common good of the people in general. Doutrina. ECONOMIC ACTIVITY CAN NOT BE EXERCISED IN DISARMONION WITH THE PRINCIPLES INTENDED TO MAKE EFFECTIVE PROTECTION FOR THE ENVIRONMENT." (adi-mc 3540 / DF – RELATOR MINISTRO Celso de Mello, j. 01/09/2005, Pleno, DJ 03/02/2006).

The Rapporteur, Minister Celso de Mello, the importance of environmental protection and the maintenance of natural resources (Freitas 2000):

"The safety of the environment cannot be compromised by business interests or dependent on purely economic motives, especially if economic activity, considered as the constitutional discipline that governs it, is subordinated, among other general principles, to that which privileges the 'defense of the environment' (CF, art. 170, VI), which translates into a broad and comprehensive concept of the notions of the natural environment, the cultural environment, the artificial environment (urban space), and the working environment. Doctrine. The legal instruments of a legal nature and constitutional nature aim to enable the effective protection of the environment, so that they do not alter the properties and attributes inherent to them, which would cause unacceptable impairment of the health, safety, culture, work and well-being of the population, in addition to causing serious ecological damages to environmental patrimony, considered in its physical or natural aspect".

Among the principles that govern environmental law, it is worth noting the "Principle of Sustainable Development" that includes the human, physical, economic, political, cultural and social dimensions, in harmony with environmental protection. As an indispensable requirement, all should cooperate to eradicate poverty in order to reduce disparities in living standards and better meet the needs of the majority of the world's population. The TRF from 5ª Region recognized that (Freitas 2000):

> "The Constitution of 1988, by consecrating the defense of the environment as a principle of the economic order and establishing that everyone has the right to an ecologically balanced environment, essential to the healthy quality of life and vital for present and future generations, sustainable economic development." (TRF 5ª Region, Apelação Cível nº 209609/SE, j. 20/11/2001, DJ 08/04/2002, Relator Desembargador Federal Paulo Gadelha).

The Federal Constitution of 1988, innovating, brought a specific chapter focused on the environment, defining it as the right of all and being the right of all, gives it the nature of good of common use of the people and essential to the healthy quality of life, and it is incumbent upon the public power and the community to ensure and preserve for the next generations to make good use of and freely enjoy a balanced environment. The right to life, as a fundamental right, including as a principle of environmental law, and guaranteed by the dignity of the human person, gains a significant strengthening in the right to an environmentally balanced environment. The Government of Brazil has instituted some public policies in order to materialize the protection of the environment and enable it to remain balanced, (Freitas 2000):

Law 6938/81 that instituted the National Policy of the Environment created the National System of the Environment – SISNAMA and provides, among others, the need for an environmental license for potentially polluting activities. CONAMA Resolution 237/97 defines licensing as an administrative procedure, whereby the competent environmental agency permits the location, installation, expansion and operation of enterprises and activities that use environmental resources, considered to be effective or potentially polluting, or those that, in any form, may environmental degradation, taking into account the legal and regulatory provisions and applicable technical standards.

The **Law 9433/97** instituted the National Water Resources Policy and created the National Water Resources Management System, which provides, among others, the need to grant rights to use water resources.

The **Law 9605/98** instituted the Environmental Crimes Law, whose purpose is to repress the damage effectively caused to the environment, but also to prevent it, by collaborating so that it does not occur. This law, in its art. 3, solved an old problem of criminal responsibility, which establishes punishment for the legal person, since it represents the "whole", and not only the singular, as it was before, when only the agent (employee) was punished, (Freitas 2000):

> "This law, in its art. 3, solved an old problem of criminal responsibility, which establishes punishment for the legal person, since it represents the "whole", and not only the singular, as it was before, when only the agent (employee) was punished.
>
> Single paragraph. The liability of legal entities does not exclude that of natural persons, authors, coauthors or participants of the same fact".

The Law 12,305/2010 introduced the National Solid Waste Policy to regulate the integrated management and solid waste management, making use of principles, objectives and instruments that make feasible, and assigning responsibilities to generators, public power and individuals or responsible for, directly or indirectly, the generation of solid waste and those that develop actions related to solid waste management. The law brings a modern approach and presents three important concepts, (Freitas 2000):

a) Integrated solid waste management: includes all actions aimed at finding solutions for solid waste. Integrated management involves waste from health, construction, mining, ports, airports and borders, industrial and agroforestry, shared responsibility for the product life cycle and reverse logistics. This concept brings a holistic idea.

b) Responsibility shared by the product life cycle: covers manufacturers, importers, distributors and traders, consumers and holders of public services of urban cleaning and solid waste management. Shared responsibility is related to non-generation, reduction, reuse and recycling, according to art. 9 of the said law.

c) Reverse logistics: return of products after use by the consumer, independent of the public service of urban cleaning and waste management, mandatory for pesticides, waste and packaging; Batteries; tires; lubricating oils, their residues and packaging; fluorescent lamps, sodium and mercury vapor and mixed light; electronic

products and their components; and products sold in plastic, metal or glass packaging, and other products and packaging, considering, as a priority, the degree and extent of the impact on public health and the environment of the waste generated.

Extensive and comprehensive is the range of legal texts published in Brazil, for the study in question, we have selected the constitutional text and the laws that deal with the National Policy on the Environment, Environmental Crimes and the National Policy on Solid Waste to endorse the importance of management and the responsibility of business managers.

2.5. Environmental management and certification

A new vision of the companies in relation to the environment has been outlined over time, since it must be considered that each historical period has its particularities as to the form of production and commercialization (use of labor, raw materials, technologies , transportation and communications, etc.) and that organizations are built within a socio-historical format and these are the result of values built by a society at a given time and that serve as a reference for people's action (Vasconcelos 2003). Until the sixties, the "social paradigm of exclusion" prevailed, in the conviction that the sources of natural resources would be infinite and that the free market would maximize social welfare. Because conventional economic theory dealt only with the allocation of scarce resources, and nature was not considered a limiting factor, this paradigm considered the environment to be irrelevant to the economy (Corrêa 1998). The concept of corporate environmental management appears as the set of defined and systematized practices applied by a particular enterprise with the purpose of reducing and controlling environmental impacts (Teodoro 2002). Also, as a way to stimulate the adoption of environmental management in companies, the ISO14001 - Environmental Management System, with auditable requirements applicable to any type of organization, irrespective of the area of activity, emerges at the end of the 1980s. In Brazil, there was a great evolution in the number of certificates issued, having a peak in 2006 and a new peak from 2010 and remaining at the same level the years 2011 and 2012 (Claro 2003).

2.6. Environmental management: strategic decision or legal obligation?

The Brundtl and Report, published in 1987, stated that the company of the new millennium could not be oblivious to the social and ecological problems of the places where it operates. Characterized by responsibility, the business posture began to include monitoring the impact of its activities on the community and the planet. The British John Elkington (Curie 2011) coined the term triple bottom line, so that it only makes sense to think about sustainable development when environmental, social and economic aspects are taken into account. There is no denying that 21st century environmental awareness has changed business practices. Environmental awareness has changed the world of business. The 21st century buyer uses their power of choice. The customer is increasingly demanding, seeks to know about the manufacturer, whether the company fights child labor, adopts recycling practices or promotes reforestation. The company of the 21st century will also have to respond to the growing demands of investors and society for transparency. The new leaders must be prepared to divulge the socio-environmental effects of their activities. Aware of these requirements, several companies present sustainability reports. Finally, the corporate patrimony is no longer defined based on the evaluation of its equipment and real estate; values such as reputation, credibility and socio-environmental responsibility promise to define the success of the great companies of the 21st century. Sustainable environmental management is a decisive factor, increasing competitiveness in the new business world. Environmental management can be defined as the management arm that reduces the impact of economic activities on nature. It must be present in all the projects of an organization, from its planning and execution until its complete deactivation (Curie 2011). On November 27, 1997, the International Chamber of Commerce (ICC) defined a series of environmental management principles, recognizing that environmental protection is among the top priorities to be pursued by any type of business (Donaire 1999).

In the business environment, reputation has been preponderant for its acceptance before society, so that companies are increasingly seeking the balance between social and functional, since every business initiative has an impact on profit and the world. There is no way to ignore the new commitment of companies, which goes from an ethical, economic and market awareness. The corporate world realized that companies, as social agents are part of the society that houses and conditions their existence. Therefore, they do not exist by themselves, since they depend on the web of connections present in the markets (Kruglianskas 2009). Converting the company into a socially responsible organization is not the task of a single manager, since in addition to capital investment, it needs organizational values that support this philosophy. In order for this management model to be

institutionalized, it is necessary to conquer the employees and share with them the new business vision for the formation of a management culture that strengthens sustainability.

Good environmental governance practices go beyond business efficiency and financial results. Environmental governance is the ultimate collective mechanism for addressing the impact of a company's activities on the environment. Thus, according to the UK environmental agency, environmental governance describes the company's management of its environmental impacts, risks, performance and opportunities. Although it is part of corporate governance, it deals with global issues, such as the environment, and has its origin recognized from the evolution of four stages: the first phase was called the "Age of Conformity", characterized simply by legal obedience; the second phase was the result of the 1984 environmental disaster in the city of Bhopal, India, with 42 tons of toxic gas leaking and the death of about 25,000 since then. This accident was the warning that changes need to happen in corporate governance practices. The third phase demands that corporate environmentalism go beyond conformity, not enough to meet but go beyond, serving as a model for the corporate world. At this stage, terms emerged, among which eco-efficiency. It is believed to be in the fourth phase, whose key word is sustainable development. And companies should not just do their "homework", but take sustainable development seriously. The principles that are applied effectively will lead the company to sustainable development can be exemplified as follows: zero residue, systemic thinking, and looking out (Kruglianskas 2009).

To become environmentally more accountable, and to face this global reality, companies need to take these "green issues" to the top management meeting, adopting a governance system focused on the environment. This is a relatively new discussion and, in fact, an efficient model of environmental governance should be mandatory for all companies from the outset. The implementation of environmental governance proved to be feasible not only for environmental issues, but also to provide financial benefits to any type of company. This may reflect in the engagement of the productive chain manufacturer, industries of all kinds, suppliers, distributors, traders, employees, customers, consumers and, why not, the whole society (Matos 2003).

It is through people, therefore, that companies can implement their actions and achieve results, and the focus of this analysis rests on the identification of the role of people in the model of environmental management adopted by companies operating in the state of Pernambuco.

2.7. Challenges of economic growth in Pernambuco

The state of Pernambuco grew two percentage points above the national average by the middle of 2012 and had lower growth at the end of 2013. Investments totaling R $ 100 billion between 2007 and 2016 are mainly concentrated in industrial projects - 67.3%, real estate projects - 14.4% and services and commerce - 67.3%. Thus, a productive profile emerges that marks a new economic cycle driven by industry, especially petrochemicals, petroleum, shipbuilding, automobile industry, pharmaco-chemistry and steel industry, as well as redefining traditional segments, expanding services and supporting production and expansion of trade and social and personal services (Cunha 2013). The state of Pernambuco has chronic water shortage. This is a major drawback in the state's industrial development. However, much of the drinking water in the state is consumed by industries. Therefore, the conscious management of this resource is a great challenge for the managers of the industries of Pernambuco.

In Pernambuco, 11 municipalities are the largest generators of waste, with only 39 industries, responsible for the generation of 79.25% of the waste generated in the State. Considering waste with destination (inside and outside the industry), that is, excluding 5.4% of waste with no defined destination, it can be highlighted (CPRH 2003):

• The main form of waste disposal is the "Use in boiler" (54.3% waste intended for), being the sugarcane bagasse responsible for 99.9% of this destination.

• For fertirrigation, 25.5% of the waste destined is sent and 100% represented by the vinasse / vinasse of sugar mills.

• About 9.5% are destined for incorporation in agricultural soil and are represented mainly by sand + bagacilho, filter cake and boiler ash.

• Approximately 7.26% of the waste destined is reused / recovered / recycled, of which about 48.5% is recycled, recovered or reused within the companies themselves; 40% are sent for reuse/recovery/recycling outside the companies and 11.5% are directed to intermediate scrap yards.

• About 0.88% are sent to municipal, private, third-party or own landfills/dumps. Of these, we can highlight:

• 43% for its own industrial landfill.

• 35% for municipal dump.

• 18% for private dump.

Of the main destinations mentioned above, one can highlight the reuse/recycling/ recovery as the main destination of 81% of the hazardous waste with

destination, of which 58.5% is recovered/reused/recycled externally and 41.5% internally. From the figures presented, it is perceived that control over the waste generated in the State is very incipient and that without adequate disposal, this is, being sent to municipal or private dumps, as this is an inadequate form of final disposal of solid waste characterized by simple discharge onto the soil, without measures to protect the environment or public health, has negative consequences for both human and animal health and the environment. Analyzing the Energy Balance of Pernambuco, it was verified that, despite renewable sources (hydroelectricity, charcoal, firewood, alcohol and sugar cane bagasse), they still contribute the largest share of total energy supply; this energetics come, year after year, reducing their contribution. In turn, non-renewable sources (oil and natural gas derivatives) have been increasing their share, thus showing that the priority over the last years has been, and it is to encourage "dirty" fuels to meet the state's energy demand.

In the Pharaonic complex Suape Industrial and Port is being implemented a pole of thermoelectric plants to fossil fuels (Costa 2015). It is observed that the state of Pernambuco has great challenges to reconcile economic development with sustainability and eco-responsibility.

III. METHODOLOGY

3.1. Approach of the research carried out

Initially, institutions such as the Federation of Industries of Pernambuco - FIEPE, the National Industry Service - SENAI and the State Environmental Agency were consulted regarding the availability of information on companies located in the state of Pernambuco that would allow the identification of a study group. According to the information available in the respective databases, there was no way to identify which companies had environmental management implemented or not. From then on, the criterion for choosing companies participating in the Environmental Sustainability Award of the FIEPE System was adopted, in addition to those that admittedly have an environmental system implemented or certified. To enable the investigation of environmental management in companies, the following research questionnaire was applied:

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MASTERS MANAGEMENT OF SUSTAINABLE LOCAL DEVELOPMENT
QUANTITATIVE RESEARCH QUESTIONNAIRE

1-Company:

1.1- Activity: (   ) Industry (indicate type _____) (   ) Service (indicate type _____)
1.2- Number of employees (own + outsourced)_____
1.3- SIZE: (   ) Small   (   ) Middle   (   ) Large
1.4- Is your company multinational? (   ) Yes   (   ) No
1.5- Where it is installed? City: _____ - PE

2-Environmental Management System - EMS:

2.1- Year of implementation of EMS _____
2.2- What motivated the deployment?
(   ) Legal requirement   (   ) Recognition of the market   (   ) Determination of the matrix
(   ) Other, explain:_____
2.3- The implementation of the EMS? (   ) Yes   (   ) No
2.4- Today, the EMS has? (   ) YES   (   ) No
2.5- What was the employee's participation in the implementation of the EMS?
(   ) Active (helped build the model)   (   ) Passive (received guidelines to be followed)
2.6- What is the EMS focus?
(   ) Waste   (   ) water   (   ) Energy   (   ) Effluents   (   ) Emissions   (   ) All
2.7-In relative terms, what has been achieved with the EMS since its implementation?
(   ) Reduction of waste generation in _____%
(   ) Increased shipment of materials for recycling in _____%
(   ) Reduction of water consumption in _____%
(   ) Increased reuse of water in _____%
(   ) Reduction of effluent generation for treatment in _____%

(   ) Increased utilization of treated effluent in Reduction of effluent generation for treatment in _____%

(   ) Reduction of energy consumption in _____%

(   ) Reduction of emissions in _____%

2.8- What is the main gain that the EMS brought to the company?

(   ) Legal compliance   (   ) Certification   (   ) Awards   (   ) Increase in market share

(   ) Other, explain:_____

2.9- The EMS has some environmental education program? (   ) Yes   (   ) No

2.10- The environmental education program includes:

(   ) regular trainings   (   ) internal commission of the environment   (   ) workshops / experiences

(   ) Other, explain: _____   (   ) não aplicável

2.11- How do you rate employees' contribution to SGA success??

(   ) Directly related   (   ) makes no difference (   ) I cannot say

The research was designed in order to make it possible to know the information to be provided, without the need of identification of the company.

3.2. Instruments for data collection

The questionnaire was sent online to the 34 companies selected for the investigation, because they work in the State of Pernambuco (capital, metropolitan region and countryside), amongst them, large, medium and small companies, independently of having environmental certification, which are recognized as having environmental management, as well as those that participated or were highlighted in the Environmental Sustainability Award of the FIEPE System, in the 2011 and 2012 cycles. The data were collected using a questionnaire for quantitative research, sent to each company surveyed between November 2013 and February 2014, and answered by the environmental manager or equivalent. 56% of the questionnaires issued were returned, which served as the basis for the environmental management analysis of companies operating in the state of Pernambuco, considering the ecoefficiency. Two of the companies surveyed did not respond to the survey, but forwarded an electronic message informing them that it was impossible to respond to the questionnaire. No small business responded to the survey.

3.3.Categories of analysis

The categories of analysis considered were:

a) Age of the management system implemented - calculated according to the period in which the management system was implemented in the company;

b) Company size - informed by the company when completing the survey;

c) Number of employees - informed by the company when completing the survey;

d) Employee participation level - informed by the company when completing the survey;

e) Environmental management focus - informed by the company when the research is completed;

f) Motivation of the implantation - informed by the company when completing the research;

g) Legal compliance - informed by the company when completing the survey;

The objective was to verify if there is any correlation between the period in which it was implemented, the adopted model, the activities developed and the size of the company, as well as the number of employees and the level of participation regarding eco-efficiency of the current environmental management and the international initiatives and tools offered in the last three decades. Thus, the analysis made it possible to reach conclusions about the subject under investigation, in order to stimulate other organizations to implement an environmental management model.

3.4. Research locus and sampling

The locus of the research were companies operating in the State of Pernambuco, and, admittedly, have an environmental management system, regardless of whether they are certified, among them, those that participated or were featured in the Environmental Sustainability Award of the Federation of Industries of Pernambuco - FIEPE in editions 2011 and 2012, contemplating small, medium and large companies, throughout the state. The companies surveyed operate in the following activities: food, beverage, chemical, metallurgical, naval, paper, service, sugar and energy industries, and necessarily have a unit in operation in the state of Pernambuco, representing a sample of 34 companies.

IV.   RESULTS AND DISCUSSIONS

The analysis was categorized based on the responses received, representing 56% of the companies that contributed to the present study. In alphabetical order, respondents spontaneously answered the survey, companies that operate in the Food, Beverages, Footwear, Civil Construction, Energy, Consulting, Fibers and Pet, Cargo Handling, Sanitation, Steel, Sugar and Energy sectors, representing 56% of companies. Are companies that are installed in the state of Pernambuco, national and multinational, medium and large sizes. Among the companies surveyed, a balance was observed in relation to the number of employees. Regarding the size, none of the companies surveyed. There was a predominance of large companies. The consignment was made by the person responsible for completing. For reference, the classification of the National Economic and Social Development Bank - BNDES, based on the annual gross operating revenue. 100% of the medium-sized companies that replied to the questionnaire are Nationals. Regarding the origin, among the companies surveyed, there was a predominance of national companies for the Response In case, as shown in Figure 3. Seeking to expand the scope, the universe surveyed went beyond the city of Recife and metropolitan region, contemplated companies that work in the capital, metropolitan region and interior of the state, characterizing a diversified sample A range of 17 years was observed in relation to the adoption of the environmental management system (EMS).

The adoption of environmental management in the companies surveyed took place in the late 1990s and early 21st century, reverberating about a decade after the initiatives of German companies to include the ecological dimension in the management of their businesses. Compared with the evolution of ISO14001 certificates in Brazil it is possible to observe that the year 2004 coincides with the first period of high incidence of issuance of certificates. The companies stated that the motivation for the implementation of environmental management was the recognition of the market followed by the determination of the matrix and also the legal requirement.

Among the reasons for the implementation of environmental management, it is possible to find a correlation with the motives identified by Donaire (1999) for the implementation of environmental protection in the company, especially legal requirements, market pressure and company or image safeguard. The need for support for the implementation of changes was evident, with the predominance of the use of consultancy in the majority of replies sent. It was observed that external support is no longer used with the maturing of environmental management, with most companies declaring that they do not have consulting at this stage. The employees had an active participation in the process of implementing environmental management, suggesting that there may be a possibly greater commitment on the part of the latter regarding the implementation of environmental management.

The employees' role in the implementation of environmental management and in the maintenance of the actions that allow their continuity is declared and recognized by the companies surveyed, whether in a passive or active way. Comparing with the Principles of Environmental Management presented by the International Chamber of Commerce - ICC (Donaire 1999) in which one sees the Personal Education: Educate, train and motivate the personnel, in the sense that they can carry out tasks of responsible way with respect to the environment.

Among the options to indicate the focus of environmental management: waste - water - energy - effluent - emissions - all show that the "all" option prevails and among the responses, the highlight has been, in this sequence: "wastes", followed of "water", "effluents" and energy.

It was possible to observe predominance in waste, water, energy and effluents, in the environmental management of the companies surveyed, corroborating with the Environmental Management Principles, presented by the International Chamber of Commerce - ICC, which sees Equipment and Operationalization: Develop, design and operate machinery and equipment taking into account the efficient use of water, energy and raw materials, sustainable use of renewable resources, minimization of negative impacts on the environment and generation of pollution and responsible and safe use of waste (Donaire, 1999). When questioned about the results achieved, most companies stated that they could not disclose the information. Of those who responded, we highlight the Reduction of Waste Generation, followed by Reduction of Water Consumption and Reduction of Energy Consumption. It was also highlighted, the Increase of Recycling, followed by the Use of Water and Effluent Treatment.

Regarding the paradigms of eco-efficiency as presented by Curi (2011), it was possible to verify alignment regarding the reduction of energy consumption, recycling of materials, reduction of litter, use of clean energy sources and rational use with greater efficiency of the raw materials of the companies surveyed. It was also highlighted the importance of water, as Clarke and King points out (2005) and waste, as highlighted by Negromonte (2002). When questioned about the main gain that the environmental management brought to the

company, it was verified the highlight of the indication of "Legal Compliance" as the main gain that the SGA brought to the company. Here is confirmation of the importance of legislation to regulate and delimit the performance of companies and the need for environmental management as a tool to achieve legal compliance, and understanding the need to make effective environmental protection. Most of the companies declared to have environmental education program. Among the main environmental education actions adopted, we highlight the Periodic Training, followed by Workshops Experiences and the implementation of an Internal Commission for the Environment. All companies unanimously recognize that employees contribute directly to the success of environmental management. Among the many benefits of education is the conscious change in behavior, which is achieved through acquired knowledge and its practical application. Investing in environmental education is one of the principles that underpin environmental management.

It was verified that not all companies have certification, although they have an environmental management system implemented. Important is the finding that companies that adopt environmental management are not necessarily linked to certification. However, it has been shown that environmental management is a decisive factor, increasing competitiveness in the new world of business (Donaire 1999). The fact that environmental management is positioned in the organizational structure at the level of the Board of Directors and management shows that companies recognize their importance. Most of the companies declared to have environmental license. It was verified that, although there has been an incentive program in the state of Pernambuco to attract companies, in particular to Suape Industrial and Port Complex, the control and the requirement of licenses and grants is maintained, to guarantee the protection of the environment. Most of them predominate the Operation License - LO and Funding and Release Grants. License renewal occurs annually. Most of the companies declared to meet, all the conditions of the license. The issue of the license is predominantly paid for industrial installations. The indication of gratuity was associated to the issuance of an Installation License - IL. The service activity does not require environmental licensing, so the indication of not applicable. According to data from the National Industry Confederation (CNI), micro and small enterprises account for about 95% of the total and have the potential to impact in proportion to the remaining 5%, represented by medium and large industries. The fact that there is no response from micro and small enterprises

implies that the level of commitment of these organizations is low and, therefore, they may not even be able to understand the importance of environmental management. Regarding the responses received from medium and large companies, none reported the adoption of action that demonstrates going beyond compliance or protection or ecoefficiency, overcoming its borders and acting in a way to positively impact with environmental action that compensates for what uses of natural resource, what receives of incentive of the state and what it discards in the environment. In this sense, they can be actions of execution of projects developed in the academy to improve the living conditions of less favored cities of the interior regions of the state, related to alternative energies (e.g., solar), water capture (e.g., erns), among others.Or, action developed by the company's technical staff to meet the needs of poor communities and, at the same time, contribute to the preservation or improvement of the environment.

V.   CONCLUSION

In the companies studied, it was observed that the adoption of environmental management is strongly linked to compliance with the legislation, besides being a strategic decision and to seek to meet the demands of the market, avoiding at all cost's problems with supervision. The sample included companies operating in the capital, metropolitan region and the interior of the state and, according to the answers analyzed, it was not possible to observe that the companies of the Metropolitan Region of Recife-RMR, because they are closer to environmental agencies / inspection agencies, are more required in terms of legal compliance.

In the universe surveyed, there were companies of small, medium and large sizes of different areas of activity (Food, Beverages, Footwear, Civil Construction, Energy, Consulting, Fibers and Pet, Cargo Handling, Sanitation, Steel, Sugar and Energy) and, according to the answers analyzed, it was not possible to conclude that the industry, in all areas of activity (textile, chemical, food, etc.) is more in demand than the service company. For all those who carry out potentially polluting activity, licenses are issued, whose predominant renewal term is annual and is paid.

Practically, the unanimity of the answers showed that the labor force participated in the process of implementing environmental management, either actively or passively. It was also observed that there is investment in environmental education programs so that employees are trained and contribute to the development of environmental management, however, limited to training.

Although most of the companies surveyed have omitted the numerical results achieved with their environmental programs, they indicated that there were gains from actions aimed at reducing waste generation, energy and water consumption, and also from effluent treatment and waste disposal.

In environmental management, according to the responses analyzed, it was possible to verify the participation of the employees in the implementation and in the reach of the results, as well as, it was observed that the external support predominates in the initial phase and that is smaller after its implantation and consolidation.

It should be noted that, although there is a stimulus to the adoption of environmental management by conferring an international certificate, the companies surveyed have demonstrated that their environmental management is not necessarily linked to certification or a standard model. There is a mix of different models that have emerged in the last three decades.

The environmental legacy of companies operating in Pernambuco is partially controlled, in terms of medium and large companies, with initiatives focused on legal compliance, waste control, energy and water consumption and environmental education practice, in line with eco-efficiency paradigms, however to a limited extent.

The concept of sustainability is present in the management models adopted, most of them, although in the most basic form, that is the conformity (Age of the conformity - Age of the protection - Ecoefficiency - Environmental Sustainability), being applicable to any type of company, regardless of size or area of operation, without the need to be linked to a certification, with the participation of employees and inserted in strategic management, being able to be more daring or less restricted, more creative and less rigid, to better meet the needs and contribute to the development, effectively, sustainable.

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Profile and Behavior of Organic Products Consumer in Brazil

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Abstract— *Organic agriculture simply way can be understood as a model of food production management that reconciles good environmental practices in farming, aiming at maintaining a high level of biodiversity, preserving natural resources in order to obtain healthy food without residual chemicals. In this context, demanding for quality of life, a large number of consumers are modifying their consumption habits by inserting organic foods into their daily lives. However, there are few studies that reveal the profile and behavior of organic products consumer and in particular which factors may favor the expansion of the consumption of this type of food. Thus, in order to answer to these gaps in the retail market, a descriptive exploratory survey was conducted from June to August 2017 with 138 consumers, at the time they made the purchase of organic products. The study showed that the consumption of organic products in the sampling performed presented similar levels between the genders, as well as did not show variation in the consumption in relation to the age group. The organic products most preferred by consumers were tomatoes, potatoes and lettuce. The factors that limited consumption were the price that was classified as high, the difficulty of easily finding the desired product and the lack of promotions. The study also revealed that the factors that influenced the consumer behavior of organic products were the level of education, as they advanced in education, the consumption also advanced, as well as the consumer behavior of the family arrangement, and it was observed that as the number of people and economic income increased, the consumption of these products also increased. The adoption strategies shared between the retail trade that involve the adjustment of prices of organic products to the reality of consumers, the purchase of local production as a way of price reducing, and educational marketing campaigns can favor the*

commerce of organic products in the classes of lower purchasing power.

Keywords—Organic agriculture, Organic products trade, Consumer, Marketing, Paraná Coast.

I. INTRODUCTION

Organic agriculture is a global system of agricultural management and food production combining the best environmental practices, a high degree of biodiversity, preservation of natural resources, application of high standards for the animal well being and a production method the respects the preferences of certain consumers for products obtained through natural substances and processes, with the objective of obtaining healthier and more nutritious foods without chemicals that deteriorate the soil (RAMESH; SINGH; RAO, 2005; MAZZOLENI, OLIVEIRA, 2010; MORAES et al. 2015).

The organic agriculture in the last decades shows an average growth of 20% per year in Brazil, both in production and in trade, it moved values close to R$ 2 billion per year. This growth has been driven by the demand of the Brazilian population for food that results in better health conditions (SILVA; SOUSA, 2013; MAPA, 2015).

The organic consumers are identified as a different marketing segment from the consumers of conventional products, because this group of consumers considers the forms of production, the benefits derived from this production, as well as they valorize the origin certification of the product consumed (CRUVINEL et al., 2017; STEFANO, 2013; ETINGOFF, 2017).

Despite the constant increase in trade of organic products, when compared to other countries, the Brazilian consumption is still low, and has potential for growth. Among the factors that can help the growth of consumption and consequently the organic products trade,

it can be mentioned marketing strategies based on the marketing mix (MORAES et al., 2015, ANACLETO et al., 2017).

Marketing is a process designed to identify and satisfy customers' needs and desires through the creation of appropriate products and services that, through forms of exchange, generate value and satisfaction for the parties involved (KOTLER; KELLER, 2012). The marketing mix also referred to "4 Ps" is described by Kotler (2009), as being the set of factors that can define the success or failure of the insertion of a product in the market, and it is referred to four macro factors: product, price, place and promotion.

The marketing mix can be defined as a set of tools, actions and decisions that an entrepreneur will adopt for a product to reach the intended audience more easily (KOTLER; KELLER, 2012).

The correct diagnosis of the marketing mix allows the entrepreneur to analyze each one of the elements that influence the company's sales strategy (product, price, place and promotion) and obtain a concrete action plan to be implemented in order to achieve the objectives of the organization (COBRA, 2015). In addition, the market-based assumptions of the marketing mix represent a valuable tool for consumer performance and it is perfectly applicable to the organic trade sector (KOTLER, 2009; TERRAZZAN; VALARINI, 2009; MORAES et al., 2015).

The consumer behavior is a relevant factor in business processes, understanding consumer attitudes and behavior as well as the factors that can influence purchasing behavior reflects opportunities to meet the desires and needs of the customers, and in this context it is urgent the realization of studies that seek the understanding of what the consumer of organic products wants (COBRA, 2015).

Paraná Coast is a region that has the favorable conditions for organic agriculture, but despite the growth of activity in field, and the region has a population of more than 250 thousand inhabitants, practically all the production is carried to other cities, especially Curitiba, the largest city in the State and with the largest number of consumers and in this context, there are no researches that denote the reasons for this occurrence.

Thus, in fact that there is little research on the analysis of consumer behavior of organic food in Brazil (TERRAZZAN; VALARINI, 2009), and still on a smaller scale in Paraná Coast (ANACLETO et al., 2017), the present study aimed to identify the profile and behavior of organic vegetable consumers in Paraná Coast, specifically responding to the following questions:

• What was the socioeconomic profile of the organic products consumer in Paraná Coast?

• What were the most preferred organic products to buy?

• What were the levels of consumer satisfaction in relation to organic products?

• What were the factors that influenced the consumer behavior of organic products?

II.   MATERIAL AND METHODS

The present study was performed according to what was proposed by Anacleto et al. (2017) being classified as exploratory-descriptive research, and it obeyed the following steps.

Initially semi-structured interviews were carried out from June to August of 2017 with consumers of organic products in the almost all cities of Paraná Coast, namely: Paranaguá, Matinhos, Guaratuba, Morretes and Antonina.

The region was chosen because according to Anacleto et al. (2017) the regional population is more than 250,000 inhabitants and the average per capita income is R$ 765.85 and the region receives annually around two million vacationers who remain in the region for more than two months, in addition to these, the polo city of the region currently has the seventh largest financial collection in the State, and it is classified as a medium-sized city, and this region shows per capita conditions similar to other 160 cities in Brazil.

The sample was 138 consumers and met the marketing research and consumer profile guidelines when the population was unknown (MALHOTRA, 2010) and it was carried out when the consumer was in the retail establishments which commercialized organic products.

In order to identify the consumers' profile, information on gender, marital status and education was collected as proposed by Malhotra (2010).

The age classification was performed as adopted by IBGE (2015), and the for the income classification it was used the Brazilian Economic Classification Criterion, as proposed by ABEP (2013) and endorsed by Anacleto et al. (2017).

The consumption behavior was established from data on frequency, motivation and preferential purchase products (MALHOTRA, 2010; ANACLETO et al., 2017).

The non-parametric Mann-Whitney and Kruskal-Wallis tests were used to evaluate the correlations between the consumer profile and behavior, followed by the average multiple comparison test of Dunn, at a significance level of 5% ($p < 0.05$).

The existence of correlation between the consumption and the analyzed variables (age, gender, income and school education) was investigated using Spearman's correlation coefficient (HAIR et al., 2009).

The normality of the data, according to one proposed by Hair et al. (2009) was analyzed by the Kolmogorov-Smirnov test, and the test results (p <0.05) led to the decision to use non-parametric tests.

The marketing mix (price, place, promotion and product) was evaluated considering the level of consumer satisfaction with the offer of the region. The respondents were questioned about the preferred purchase places, as well as three potential factors that make buying difficult and which would lead them to buy more organic products, ranking them hierarchically (1 to 3).

In order to evaluate the level of consumer satisfaction of organic products, it was adopted the Kano Model of attractive and obligatory quality (KANO, 1984).

According to Anacleto et al. (2017), this model identifies which attributes the customer classifies as mandatory and prerequisite for consumption. It also classifies the satisfaction obtained in post-consumption, in the following categories:

i) If the prerequisite expectation scale before purchase is greater than the post-purchase satisfaction scale, the product requirements must be improved (negative attributes).

ii) If the pre and post purchase attributes are equated, it will only prevent the customer from being dissatisfied (neutral attributes).

iii) If the prerequisites before the purchase are lower than the post-consumer satisfaction, it means that the product is at optimal levels in relation to the market (positive attributes) and meets the consumers' needs and desires.

III. RESULTS

The consumption of organic products in Paraná Coast presented a slight predominance in the female gender (n = 52%), however, a significant statistical difference was not detected in the annual frequency of consumption among genders (Mann-Whitney Test = p <0.001) (Table 1).

The predominant purchasing age groups (56.52%) were between 20 and 39 years old, but no correlation was observed between the age of the consumer and the number of times per year these people purchased organic products for their alimentation (Table 1).

Education was a decisive factor for the consumption of organic products in Paraná Coast, presenting statistically significant differences in consumption after post-graduation (Table 1).

Related to the marital status, a strong tendency to increase consumption was observed as the interviewees progressed in the family arrangement and constituted marital relations, as well as the presence of dependents (Table 1).

The economic class showed a slight tendency to increase consumption as income increased (Table 1).

Table 1 - Characterization of the population sample evaluated in a consumer profile study of organic vegetables in Paraná Coast (N = 138, June to August, 2017).

Evaluated criterion	Total of respondents	Frequency of organic vegetables consumption per month (average ± standard deviation)
Gender		
Female	73	$17,25 \pm 7,93$ [a]
Male	65	$19,54 \pm 8,07$ [a]
Mann-Whitney Test p – significance value (p < 0.05)		$p < 0,001$
Age (years old)		
< 20	0	-
20 a 29	40	$16,83 \pm 8,38$ [a]
30 a 39	38	$18,29 \pm 7,29$ [a]
40 a 49	17	$19,12 \pm 9,05$ [a]
50 a 59	25	$20,28 \pm 7,74$ [a]
60 a 69	15	$18,93 \pm 9,02$ [a]
> 69	3	$15,00 \pm 5,00$ [a]
r – Spearman Correlation Coefficient; p – significance value (p < 0.05)		$r = 0,393$; $p < 0,001$
School education		
Elementary School	12	$15,00 \pm 8,82$ [a]
High School	65	$15,00 \pm 7,35$ [a]
Graduation	53	$15,00 \pm 8,19$ [a]
Post-Graduation	8	$30,00 \pm 4,63$ [b]
r – Spearman Correlation Coefficient; p – significance value (p < 0.05)		$r = 0,153$; $p = 0,033$
Marital Status		
Single	51	$15,71 \pm 8,91$ [a]
married or stable union	67	$20,92 \pm 7,12$ [b]
Divorced	14	$13,71 \pm 3,52$ [a]
Widower	6	$11,67 \pm 2,58$ [a]
Kruskal-Wallis Test		$p = 0,060$
Socioeconomic classification		
Up to R$ 599,00	0	-
From R$600 to R$1.349	11	$15,91 \pm 7,35$ [a]
From R$1.350 to	24	$17,71 \pm 8,72$ [a]

R$2.249		
From R$ 2.250 to R$3.999	43	17,40 ± 7,75a
From R$4.000 to R$ 7.799	40	19,80 ± 8,18ab
From R$7.800 to R$18.799	15	21,00 ± 8,06ab
r – Spearman Correlation Coefficient; p – significance value (p < 0.05)	r = 0,043; p = 0,621	

The main organic products that the consumer from Paraná Coast would like to acquire, but have difficulties to find in the market were tomato, lettuce and potato (Table 2).

Table 2 - Organic vegetables that the consumer from Paraná Coast would like to consume but does not find in the market (N = 138, June to August, 2017).

Raking	Vegetables	%	Raking	Vegetables	%
1	Tomato	7,26	16	Sweet potato	3,18
2	Lettuce	5,58	17	Garlic	3,00
3	Potato	5,58	18	Broccoli	2,94
4	Chayote	4,74	19	Cabbage	2,88
5	Carrot	4,62	20	Pumpkin	2,64
6	Strawberry	4,56	21	String bean	2,64
7	Caulliflower	4,50	22	Onion	2,40
8	Zucchini	4,32	23	Sugar-beet	2,28
9	Cucumber	4,32	24	Okra	2,04
10	Watercress	3,96	25	Chive	1,86
11	Spinach	3,90	26	Orange	1,74
12	Cassava	3,72	27	Chicory	1,56
13	Rucula	3,72	28	Green Pepper	1,26
14	Eggplant	3,42	29	Plum	1,14
15	Greencabbage	3,24	30	Apple	0,96

Question with simultaneous choices

In relation to the marketing mix, consumer dissatisfaction was predominant in the factors related to the 4Ps of marketing (price, place, promotions and product), and the highest levels of discontent were observed in the attributes associated to the price and how easy to find the product for consumption (Table 3).

Table 3 - Index of satisfaction of attractive and obligatory quality of the consumer in relation to the marketing mix of the organic products trade – Kano Model (1984) (n = 138); (Paraná Coast, June to August 2017).

		Prerequisite to consumption (average grade)	Satisfaction post-purchase (average grade)	Attribute Index	Attribute Raking	DMS*
Price	Price	4,91 a	2,91 b	-2,00	Negative	0.26897
Place	Easily to find	4,78 a	2,82 b	-1,96	Negative	0.26553
	Form of shelf exposure	3,59 a	3,02 b	-0,57	Negative	0.19433
	Finding the desired amount	4,44 a	3,05 b	-1,39	Negative	0.25136
	Service Quality	4,63 a	3,51 b	-1,12	Negative	0.19659
Promotion	Promotion	4,78 a	2,89 b	-1,89	Negative	0.23943
Product	Product Quality	4,88 a	3,40 b	-1,48	Negative	0.23211
	Product Appearance	4,53 a	3,34 b	-1,19	Negative	0.25892
	Packaging appearance	3,95 a	3,28 b	-0,67	Negative	0.28061
	Origin information	4,62 a	3,37 b	-1,25	Negative	0.19673
	Number of units per package	3,64 a	2,94 a	-0,70	Negative	0.19089
	Vegetables Standard	3,43 a	2,93 b	-0,50	Negative	0.25440

ization

The producer's fairs due to the practicality were the most preferred place for the consumer to buy organic products in Paraná Coast, followed by the large supermarket chains (Table 4).

Table 4 - Purchase place for consumers of organic vegetables in Paraná Coast (N = 138, June to August, 2017).

Purchase place	%
Producers's Fairs	53,59
Supermarket (Large Chains)	17,65
Neighborhood market	12,42
Greengrocers	9,80
Municipal market	4,25
Stores specialized in organic products	2,29

IV. DISCUSSION

The study revealed that gender and age are not factors that affect consumer behavior for organic products in Paraná Coast. However, the marital status of the consumer can be classified under the conditions analyzed as a factor of consumption influence.

Apparently the family arrangement is a decisive factor in the purchase and investment processes of the family, Rocha and Barros (2006) emphasize that decisions about family security are most often taken in the direction of the future planning, and takes into account the prudence, which can also be expressed both in the construction of a patrimony for the continuity of the family nucleus, guaranteed thanks to the preventive and calculated action of the decisions related to the family issues.

In this context, organic food is perceived as products of better quality and that influence health over time, as also described by Krischke and Tomiello (2009), which reveals that consumers of organic products as they progress in the composition of the family arrangements seek to protect future generations through the right food, in addition to over time they include in the family culture the similarity by this type of production.

The family arrangement favors the consumption of organic products, and this factor is enhanced as the growth of the number of people in the family, as well as the school education of the consumers increases, this factor may be due to the greater concern with family health.

Financial income also appears to be an influential factor in the consumption of organic products, since it was perceived a moderate tendency to increase consumption as income rose, in this context according to Blackwell et al. (2015) there is a portion of consumers

who are predisposed to pay a higher price as long as they have access to the desired product with quality. In this perspective, Moretti (2014) highlights the values added to organic products as a result of being an ecological and healthy product. However, in the lower income classes, this trend cannot be observed, since it would compromise the family budget.

The assumptions described above can be confirmed in relation to the market mix, and the highest levels of dissatisfaction were perceived in the attribute related to the price that was classified as high.

According to Kotler (2009), in all market segments, the price is the first factor that influences levels of satisfaction with a purchase of the vast majority of consumers. The lower purchasing power families naturally seek to make the choices among the available products, those that are more easily perceived as a good cost equation in relation to the benefit, and so it adjusts to the choices to the consumer with this economic reality.

In this context, for the organic products can reach a wider range of consumers, it is necessary that retailers promote a series of adjustments that contribute to this popularization of organic products.

Studies carried out in Paraná Coast for products not classified as first necessity (ANACLETO et al., 2017) revealed the need to adapt the marketing prices to the reality of regional wages. Apparently these issues may also be associated to the marketing context of organic products. Thus, apparently a challenge for traders is the adequacy of the price aligned with the reality of the region, and the reduction of the cost difference between conventional foods.

The retailers with greater marketing power as described by Moretti (2014) generally offer organic products with a much higher price when compared to the free markets that exist in the several cities of the region, thus the reduction of the margins of profitability linked to the use of promotions can create a more favorable environment for consumption of organic products, benefiting the population and without reducing the profitability of the retailers that according to Cobra (2015); Cruvinel et al. (2017); Etingoff (2017) may have the reduced profit margin offset by the quantity of products commercialized, resulting in a win-win relationship.

The commercialization of the local production by the retail chain seems to be an important alternative in the strengthening of the regional trade of organic products, since according to Anacleto et al. (2017), most of organic products production in the coast is taken to large commercial centers especially CEASA in Curitiba, where

they are acquired by regional retailers who seek in that distribution center the products to be marketed.

The approximation between retailers and producers, according to Cobra (2015), Cruvinel et al. (2017) and Etingoff (2017) creates a collaborative environment, and could result in a remarkable business opportunity, where cost reduction for transportation logistics can result in better price paid to the producer, lower purchase cost to the retailer and lower final consumer price, as also described by Blackwell et al. (2015).

Once the price factor has less influence with the consumers other shared strategies can also be adopted to make consumption easier. Awakening interest in a particular product can be classified as the first obstacle to experimentation, as the consumer has access to information on the advantages of the product, arises the curiosity for experimentation. The buying process can then be touched, and with the experience of the first purchase, repetition can occur if the organic product presents high satisfaction in the consumer's perception.

According to Moraes et al. (2015) it is necessary to create a favorable scenario, among the practical actions that can be taken in the medium and short term, highlight educational activities, advertising relating the importance of the sustainable factor of organic products with health and environment and quality of life, which may be relevant factors in the interests of consumers who are unaware of the benefits of this productive system in the search for more information.

Other factors besides the price should also be considered by the retailers chain in meeting the expectations and desires of organic product consumers when proposing marketing actions, factors reported as reasons for dissatisfaction as the difficulty of finding the products in retail establishments, the products appearance that were classified as negative and the almost absence of promotions related to this type of commerce, and especially that marketing actions could reach the target audience that actually attends the retail establishments and promote the decision for the purchase.

Although the consumer with lower income is apparently an unfavorable factor for consumption, it should be emphasized that incentive actions favoring consumption, such as the appropriate price for the region, the offer of promotions and educational campaigns, linked to the trade of products produced by local producers , can result in a scenario where the end consumer can be benefited with food with easier access, fairer price and higher quality can represent advances in the consumption by the classes of less economic power.

In a general scenario, it is possible to emphasize that a targeted and properly formulated marketing strategy has

the purpose of overcoming customer expectations at the time of purchase, generating new product acquisitions and, consequently, customer loyalty (VIEIRA, 2012).

Thus, in addition to the agro-ecological fairs, the alternatives of purchase places are one of the factors that can potentiate consumption and as described by Cruvinel et al. (2017) greater supply results in practicality to the consumer, and Anacleto et al. (2017), emphasizes that the local production trade from direct contact between the producer and retailer, benefits the consumer and can result in consumer loyalty conscious.

V. CONCLUSION

The study showed that the consumption of organic products in the sampling performed presented similar levels between the genders, as well as did not present variation in the consumption in relation to the age group.

The organic products most preferred by consumers were tomatoes, potatoes and lettuce, and the factors limiting the increase in consumption were the price classified as high, the difficulty of finding the products easily and the absence of promotions.

The study revealed that the factors the influenced the consumer behavior of organic products were school education at the highest levels, family arrangement and economic income.

The adoption of shared strategies among the retail trade that involve, the adjustment of prices of organic products to the reality of consumers, the purchase of local production as a way of reducing the prices, and educational marketing campaigns that can favor the commerce of organic products in the classes with lower purchasing power.

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Technometric Analysis of The Capabilities of The Photovoltaic Manufacturing Industry in Indonesia

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Abstract— *Mapping the technological capabilities of the solar sell manufacturing industry in Indonesia has been carried out. The survey results show that there are still many solar cell manufacturing industries in the midle - downstream, namely the solar module and PV systems. Map analysis of the solar cell industry's technological capabilities is limited to the solar module industry. The analysis uses a technology management approach in terms of technoware, humanware, infoware and organware. From the results of the analysis it was found that in terms of technoware, 1 industry has used integrated automation and 2 industries use automation (level 5). In Organeware, 4 out of 10 Indonesian solar module industries have succeeded in targeting the Export market (level 5), the rest in the national market with TKDN rules (levels 4 and 2). While in Humanware, the R & D parameters there are 2 industries that have collaborated with R & D abroad (level 5), while from the HR parameter there are 7 industries having HR in 5 skills (level 5).*

Keywords— *Technology capabilities, technoware, humanware, infoware, organware.*

I. INTRODUCTION

Plans for the development of solar power plants 2015-2025 in Indonesia, have been regulated in Presidential Regulation Number 22 of 2017 concerning the General Plan for National Energy (RUEN) [1]. In the RUEN it was stated that the target of the PLTS development plan for the 2015-2025 period was 6500 MW. To achieve the target of PLTS development above, the activities carried out include:

1. Enforce the obligation to use solar cells at a minimum of 30% of the roof area for all Government buildings.
2. Enforce the obligation to use solar cells at a minimum of 25% of the roof area of luxury homes, residential complexes, apartments, complexes through Building Construction Permits (IMB).

3. Facilitating the establishment of the PLTS upstream downstream industry.

This paper will discuss the capabilities of the PLTS upstream downstream manufacturing industry in Indonesia. As it is known that the development of photovoltaic technology follows the development of material technology related to the photoelectric properties of various types of material found, one of which is from semiconductor material elements. The uniqueness of semiconductor material is the presence of free electrons in the outermost layers of the atoms that are used to absorb photon energy from sunlight to move to the cell junction so that it can generate electric current.

The development of solar cell efficiency in the last 40 years can be seen in Figure 1 [2]. The trend of developing solar cell technology in the future is how to make solar cells more efficient, considering that the efficiency that can be achieved is still below 50%.
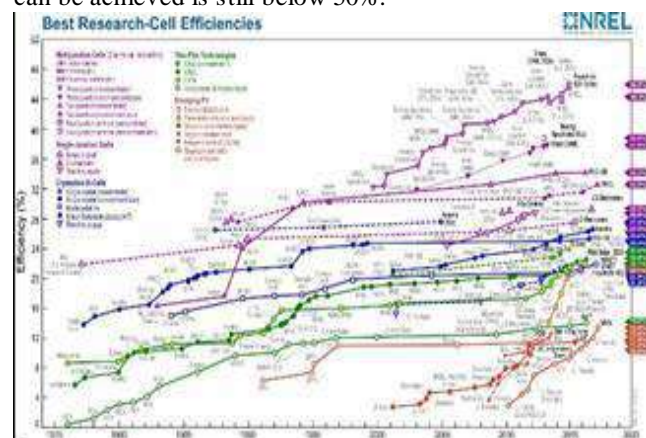
Fig.1: The development of increased solar cell efficiency

II. METHODOLOGY

The method used in compiling a map of domestic industry capabilities is to collect data and information which will then be processed with descriptive analysis. Data collection information is done by:

a) Interview, this method is carried out to collect data and information through question and

answer using both the prepared questionnaire form and open discussion. Interviews were carried out on key respondents from respondents, starting from supervisor level respondents to directors.

b) Observation, this method is done to collect data and information directly in the field through direct visits to several factory locations.

c) Questionnaire, this method is done to collect data and information using open and closed questionnaire form, FGD (Focus Group Discussion) involving all stakeholders in the photovoltaic industry

III.   TECHNOLOGY AND SOLAR CELL PRODUCTION CHAINS

The industrial production process PV includes four technical stages, Silicon, Wafers/Ingots, PV Cells, and PV Modules [3]. Then the deployment of the PV system requires combining the modules with complementary equipment (such as batteries or inverters) into integrated systems which, once installed, can generate power. Figure 2..
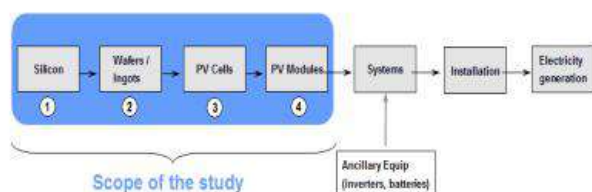
Fig.2. PV Supply Chain

Companies that comprise the value chain of the solar photovoltaic industry are categorized as (1) upstream: silicon materials and silicon wafer, (2) midstream: solar cells and solar photovoltaic modules, and (3) downstream: solar photovoltaic systems. This paper, the value chain of Silicon-based solar module production process can be divided into 4 (four) stages, which can be described into industrial clusters, as follows [4]:

Fig. 3. Value chain for solar module production processes

1.   Silicon   Purification   and   Manufacture   of Polycrystalline Silicon

The first link in the solar module industry, is the Silicon purification industry. At this stage the Si element is separated from other elements to reach a purity level of 98% called metallurgic grade (MG-Si) [5]. The metallurgical level (MG-Si) is then purified again to reach Silicon level solar (Solar Grade Silicon = SoG-Si) which has a purity level of 99.9% Si through Siemens, Silana, fluidized bed methods, and other methods related to metallurgical process. The output of this whole process is a polycrystalline silicon material that will be used in the next process in the solar module industry chain.

2.   Manufacture of Silicon Ingots and Wafer Cutting

The second link in the solar module industry, is the industry of making silicon crystal ingots. The most commonly used polycrystal ingot manufacturing methods are molding or casting methods. This process is done by inserting polycrystal ore Pure silicon into the mold (molding) and heating it in the furnace until it melts at a temperature of 1100 0C. After that the silicone fluid is lowered slowly until it undergoes a crystallization process. The process starts from liquid silicone to form crystalline solids. This silicon can take up to 2 days (see Figure 2.5) to Silicon solids reaching room temperature. This process requires considerable energy (energy intensive) to maintain temperature and reduce it slowly. So that the crystalline manufacturing industry requires very cheap energy resources to achieve economies of scale, which is around US $ 0.04 / kWh (4m cents US dollars per kWh). Products or output from this industry are Silicon polycrystal solid ingots (Figure 3.15) [6].
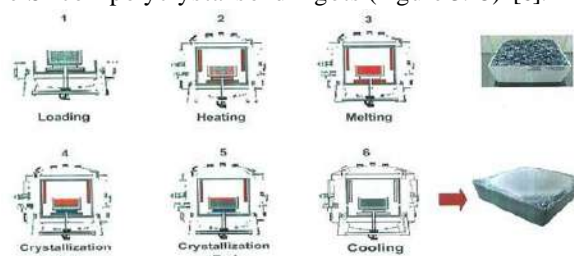
Fig.4. Multi Crystalline Ingot Furnace- Process Steps

3.   Making Silicon Solar Cells

The third link in the solar module industry, is the industry of making solar cells themselves. Solar cells are basically a diode made from crystals Silicon which has a different charge (positive and negative) [7].
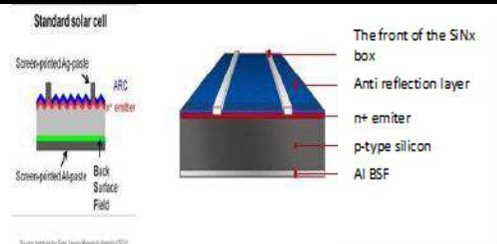
(Souerce : Institute for Solar Energy Research Hamelin)

Fig. 5. Al-BSF Standard P-type Standard Solar Cell Cross Section

4. Making Solar Modules

The fourth link is the making of a solar module that is assembling solar cells as the main raw material with other materials consisting of: 1. lead-plated thick copper strips of 0.1 and 0.3 mm, 2. flux, 3. tempered glass, 4. EVA polymer, 5. terminating cable, 6. frame anodized aluminum, 7. Polyvinyl Fluoride polymers, 8. laminated materials, 9. rubber gaskets, and 10. junction boxes. Fabrication of solar modules is carried out through the main stages: tabbing, matrixing, testing I, lay-up, laminating, inspection, testing II, framing, installation of junction boxes, then final testing.
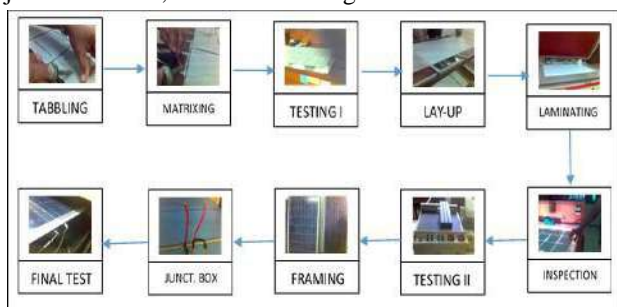
Fig. 6. The process of making a Solar Module

IV. MAP OF INDUSTRY CAPABILITY IN INDONESIA

From the results of a survey of several industries that are members of the solar cell industry association in Indonesia (APAMSI), currently developing is still in the downstream industry, namely in the position of the 4th stage (making solar modules). The survey was conducted on 10 (ten) solar module industries which are part of the APAMSI association, and all of their positions are still as solar cell module manufacturing industries. The method used in making solar modules, each industry is also different, related to the production system technology used. Some components are still imported and some parts are produced domestically by manual, semi-manual and automation. The survey results show that from 10 (ten) components of the raw material for solar module production, only two (2) components are produced in Indonesia, namely frame and junction box, the rest are imported from abroad. The names of manufacturers and

production capacity of the 10 industries are shown in Table 1.

Tabel 1. Indonesian Solar Module Manufacturing Capacity

No.	Company	Location	Capacity/year
1	PT Adyawinsa Electrikal & Power	Kaw.Ind. Jababeka II	45 MWp.
2	PT Azet Surya Lestari	Bintaro Tangerang	30 MWp.
3	PT LEN Industri (Persero)	Bandung	50 MWp.
4	PT Surya Utama Putra	Kab. Bandung	45 MWp.
5	PT Swadaya Prima Utama	Kab. Karawang	50 MWp.
6	PT Wijaya Energi Intrade	Jakarta	30 MWp.
7	PT Sankeindo	Tangerang	45 MWp.
8	PT Jembo Energindo	Tangerang	60 MWp.
9	PT Sky Energy Indonesia	Gunungputri Bogor	100 MWp.
10	PT Canadian Solar Indonesia	Tangerang	60 MWp.
		Jumlah	**515 MWp.**

According to Sharif, technology resources can be discerned into four components: technoware, humanware, inforware, and orgaware [8]. In this classification, technoware refers to the tangible and palpable part of the machineries; humanware refers to human skills needed to realize the potential of technoware; orgaware refers to the support net of principles, practices and arrangements that govern the effective use of technoware by the humanware; and, inforware refers to accumulated knowledge needed to realize the full potential of the technoware, humanware, and orgaware. The discussion on the technological capabilities of Indonesia's PLTS component industry includes aspects of Technoware (T), Humanware (H), Infoware (I) and Orgaware (O), which are limited and focused on technoware (T), market parameters (O), human resources and R & D (H). The capability of these four parameters is an important factor in the development of the PV industry towards upstream (solar cells) in Indonesia. The(10) ten companies were assessed to find out the latest conditions in their technological capabilities. Capability assessment is described in numbers from 1 to a maximum value of 5.

Technoware Analysis.

From the survey results obtained information that the solar cell technology used in Indonesia, the raw material for solar modules is generally BSF (Back Surface Field). Solar modules produced by domestic industries generally use manual (technology), semi-manual, motorization, automation, precision control, scan sensor applications, computerization, testing techniques, and integrated. Not all Indonesian solar module industries use the technology in full depending on the investment capabilities and markets of targeted products. An assessment of the sophistication of technoware includes the a various technologies in the solar module system which include:

Bagian depan Kotak SiNx

Lapisan anti refleksi

n+ emiter

p-type silicon

Al BSF

- Motorization,
- Precision control / use of sensors,
- Automation,

- Computerization
- Testing and facilities
- Integration system.

Humanware Analysis

For the humanware aspect, it will be seen from the aspects of skills and knowledge - human resource creativity, assessed separately. Aspects of skills and expertise are assessed from the presence of experts in fields:

- Manufacturing,
- Marketing and after sales,
- Standardization,
- New product innovation
- Community development and
- R & D.

Knowledge and creativity aspects are assessed from the existence and scale of R & D activities which include:

- R & D for competitiveness is done alone,
- R & D for product development is done alone,
- Domestic R & D cooperation,
- R & D cooperation with OEM,
- Overseas R & D cooperation (besides OEM).

Infoware Analysis

Inforware is a company information device that is indicated by reference documents such as design, blue print, specifications, operating manuals, maintenance and repairs. Inforware is useful in accelerating productive activities, learning and for resource efficiency and time The infoware component was not analyzed because the 10 companies surveyed tended to have the same infoware (I) capability.

Orgaware Analysis

The sophistication of orgaware is represented by the market capabilities of solar modules produced by the company, including:

- Government markets,
- BUMN Market,
- Retail Market,
- National Private Markets and
- Export market.

The results of mapping the technology capabilities of the Indonesian solar module industry can be seen in Table 2.

Tabel 2. The results of mapping the technology capabilities of the Indonesian solar module industry

No	Perusahaan	Pasar		Technoware		R & D		Sumberdaya Manusia	
		Kemampuan		Kemampuan		Kemampuan		Kemampuan	
1.	PT LEN	Pemerintah, BUMN, Ritail, Swasta Nasional	4	Motorisasi, Kontrol presisi, Sensor-sensor, Fasilitas testing	4	Daya saing sendiri, pengembangan sendiri, kerjasama dalam negeri	3	Manufakturing, Pemasaran, After sales, standarisasi, inovasi produk baru	5
2	PT WIKA	Pemerintah, BUMN, Retail, Swasta Nasional	4	Motorisasi, Kontrol presisi, Sensor-sensor, Fasilitas testing	4	Daya saing sendiri, pengembangan sendiri, kerjasama dalam negeri	3	Manufakturing, Pemasaran, After sales, standarisasi, inovasi produk baru, R&D.	5
3	PT ADYAWINSA	Pemerintah, Retail	2	Motorisasi, Kontrol presisi, Sensor-sensor, fasilitas testing	4	Daya saing sendiri, pengembangan sendiri	2	Manufakturing, Pemasaran, After sales, standarisasi	4
4	PT CANADIAN	Pemerintah, BUMN, Retail, Swasta Nasional, Ekspor	5	Motorisasi, Otomasi, Kontrol presisi, Sensor-sensor, Komputerisasi, Fasilitas testing, Terintegrasi	5	Daya saing sendiri, pengembangan sendiri, kerjasama OEM	3	Manufakturing, Pemasaran, standarisasi, inovasi produk baru	4
5	PT AZET	Pemerintah, BUMN, Ritail,	5	Motorisasi, kontrol presisi, menggunakan	4	Daya saing sendiri, pengembangan sendiri, kerjasama	3	Manufakturing, Pemasaran, After sales,	5

		Swasta Nasional, Export		sensor-sensor, fasilitas testing		dalam negeri		standarisasi, inovasi produk baru		
6	PT Surya Utama Putra	Pemerintah, BUMN, Ritail, Swasta Nasional	4	Motorisasi, kontrol presisi, Sensor-sensor, fasilitas testing	4	Daya saing sendiri, pengembangan sendiri, kerjasama dalam negeri	3	Manufakturing, Pemasaran, After sales, standarisasi, inovasi produk baru		5
7	PT Swadaya Prima Utama	Pemerintah, BUMN, Ritail, Swasta Nasional	4	Motorisasi, Kontrol presisi, Sensor-sensor, Fasilitas testing	4	Daya saing sendiri, pengembangan sendiri, kerjasama dalam negeri Kerja Sama luar negeri.	4	Manufakturing, Pemasaran, After sales, standarisasi, inovasi produk baru		5
8	PT Sankeindo	Pemerintah, BUMN, Ritail, Swasta Nasional	4	Motorisasi, Kontrol presisi, Sensor-sensor, Fasilitas testing Otomasi.	5	Daya saing sendiri, Pengembangan sendiri, Kerjasama dalam negeri	3	Manufakturing, Pemasaran, After sales, standarisasi, inovasi produk baru, R&D.		5
9	PT Sky Energy	Pemerintah, BUMN, Ritail, Swasta Nasional Export.	5	Motorisasi, Kontrol presisi, Sensor-sensor, Fasilitas testing Otomasi.	5	Daya saing sendiri, Pengembangan sendiri, Kerjasama dalam negeri Kerjasama luar negeri	4	Manufakturing, Pemasaran, After sales, standarisasi, inovasi produk baru		5
10	PT Jembo Energindo	Pemerintah, BUMN, Ritail, Swasta Nasional Export	5	Motorisasi, Kontrol presisi, Sensor-sensor, Fasilitas testing	4	Daya saing sendiri, Pengembangan sendiri, Kerjasama dalam negeri	3	Manufakturing, Pemasaran, After sales, standarisasi.		4

From Table 2 above, it is known that 4 of the 10 Indonesian solar module industries have succeeded in targeting the Export market (level 5), the rest in the national market with TKDN rules (levels 4 and 2).
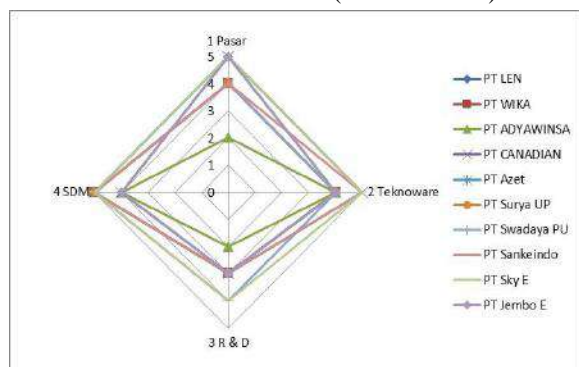
(Source: Field survey results).

Fig. 7. Spider diagram of Indonesia's Solar Module Industry Capabilities

In terms of technoware, 1 industry has used integrated automation (level 5), 2 industries use automation (level 5). While in the R & D parameters there are 2 industries that have collaborated with R & D abroad (level 5), while from the HR parameter there are 7 industries having minimum HR in 5 skills (level 5). The description of the technology capabilities of the PVP component industry, especially solar modules from several companies / industries in Indonesia with the above assessment can be seen through the illustration in Figure 7.

V.   CONCLUSION

To conclude from this paper, it can be concluded that:
➢ In the technological capabilities of the photovoltaic industry, Indonesia is still playing in the midle - downstream sector, namely the PVP industry integrator, solar module assembly industry, and other supporting component industries.

➢ The solar module assembly industry in Indonesia has 10 manufacturers (9 industries incorporated in APAMSI), producing solar modules from 2 Wp to 400 Wp

➢ In the upstream sector starting from the manufacture of wafers and cells, in Indonesia there is still no industry that handles so that for the needs of these components the solar module industry is still importing from abroad.

➢ Of the 8 (eight) components of the raw material for solar module production, only two (2) components are produced in Indonesia, namely frame and junction box, the rest are imported from abroad.

➢ Looking at the results of mapping the technology capabilities of the 10 solar module industries above, Indonesia has enough market support, technoware, R & D and HR in the development of the votovoltaic upstream industry (solar cell industry).

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Training and Acting of the Pedagogue at the Federal Institute of Education of Piauí

Formação E Atuação Do Pedagogo no Instituto Federal De Educação Do Piauí

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Abstract— *Pedagogues play an important role in Vocational and Technological Education and other forms of education. His work is developed in the School aiming at success in the learning teaching process. The purpose of this study is to discuss the identity of the pedagogical professional, regarding their training and performance. Its identity is related to the dialectic movement mediated by the relationships established in its activity and with its peers. The research is literature review and empirical with the use of questionnaire. As a theoretical basis, it was supported by the works ofCiampa (2005), Hall (2007), Dubar (2005), Nóvoa (2002) and legislations among others referenced in this work. The results point out that the pedagogue has been carrying out various activities that characterize him as a professional with a generalist function, and that his identity is constituted by the dialectical movement and in constant transformation.*
Keywords— *Training. Professional identity. Professional performance.*

Resumo— *O pedagogodesempenha um papel importante na Educação Profissional e Tecnológica e em outras modalidades de ensino. Seu trabalho é desenvolvido na Escola objetivandoêxito no processo ensino aprendizagem. Este estudo tem como objetivo discutir a identidade do profissional pedagogo, no que tange sua formação e atuação. Sua identidade está relacionada ao movimento dialéticomediado pelas relações estabelecidas em sua atividade e com seus pares.A Pesquisa é de revisão de literatura e empírica com a utilização de questionário. Como base teórica amparou-se nos trabalhos deCiampa (2005),Hall(2007), Dubar (2005),Nóvoa (2002) e legislações dentre outros referenciados neste trabalho. Os resultados apontam que o pedagogo vem exercendo várias atividades que o caracteriza como um profissional de função generalista, e que sua identidade se constitui no movimento dialético e em constante transformação.*
Palavras chave— *Formação. Identidade profissional. Atuação profissional.*

I. INTRODUÇÃO

Nas últimas décadas no Brasil, a pesquisa em educação tem avançado na perspectiva de contribuir com as bases epistemológicas para formação docente e de pedagogos, que está inserido em uma prática educativa escolar. As produções teóricas e acadêmicas tratam da educação, em que o ser humano é visto como produtor de sua própria existência. Ao transformar a natureza pela atividade, utilizando-se de instrumentos o homem realiza o trabalho, tornando-se um ser histórico, social e cultural, dessa forma, modifica a natureza externa e interna, num processo dialético de construção de sua identidade com a realidade objetiva e subjetiva pelo processo educativo e pelo trabalho.

Neste contexto, as instituições formativas buscam como resultado de pesquisas perspectivar políticas públicas educacionais que visem a melhoria de práticas educativas que valorizem os profissionais da educação e com isso produzem identidade e significados em sua área de atuação.A concepção de identidade parte do pressuposto de que ao longo da nossa vida assumimos concomitantemente diversos papéis mediante ações que realizamos e que são nomeadas e determinadas pela sociedade, assim agimos mediante as determinações sociais e as expectativas dos outros, assim, a identidade é algo construído histórico, social e cultural.

Nessa perspectiva, a construção da identidade do pedagogo do Instituto Federal do Piauí (IFPI) se desenvolve nessa dialética mediante as expectativas mediadas pelo trabalho, reconhecimento e a sua prática profissional na relação com os docentes, discentes e comunidade escolar. Sendo assim, o contexto do trabalho do pedagogo é multideterminado e dinâmico pelas relações que se estabelecem destes com a realidade em que atua.

Os conhecimentos produzidos no movimento da prática incorporam novas concepções acerca do seu papel social como pedagogo profissional da educação, constituindo-se em um processo que incorpora em suas atividades novas concepções sobre sua profissão, produzindo significados e sentidos que contribuem para a identidade do pedagogo do IFPI e, também colabora para a construção da identidade da instituição de ensino, consoante as problemáticas sociais que se manifestam no universo da escola, sendo esse um *lócus* de aprendizagem com um público de contextos econômicos, sociais e culturais que se inter-relacionam dialeticamente.

Nessa direção, o processo de desenvolvimento profissional do pedagogo se constrói na prática educativa cotidiana, que supere os aspectos técnicos e perpasse uma prática que alcance a dimensão afetiva e social do discente, pela mediação de uma aprendizagem significativa, que coaduna com a tese de Marques e Carvalho (2017) ao afirmar que as práticas educativas bem-sucedidas [...] afeta positivamente alunos (de alegria) e professores no desempenho de suas atividades, da qual o pedagogo é parte integrante dessa ação pois sua atividade consiste na mediação entre o trabalho docente e discente.

O presente trabalho é norteado a partir da seguinte inquietação: Como o pedagogo constrói sua identidade profissional na perspectiva de sua atuação e formação?

O interesse em estudar a temática identidade profissional, formação e atuação do pedagogo, justifica-se pela relação profissional do pesquisador, suas memórias de vida escolar e das vivências como pedagogo do IFPI. Assim, motivado por essa temática visa resultados que colaborem na pratica dos profissionais em educação do IFPI, sobretudo os pedagogos.

Tem-se como objetivo geral compreender a construção do processo de construção identitária dos (as) pedagogos (as) do IFPI. De modo especifico buscou-se verificar como se desenvolve a prática profissional do pedagogo e sua perspectiva com relação ao desenvolvimento profissional.

Destarte, o resultado da pesquisa possibilita uma reflexão crítica sobre o objeto em estudo, de forma a colaborar com a prática educativa do pedagogo e demais profissionais da educação.
Este artigo está dividido em três partes: 1) A Identidade Profissional do Pedagogo; 2) Traçando os aspectos metodológicos e 3) Atuação Profissional do Pedagogo.

1 A Identidade profissional do Pedagogo

No cenário socioeconômico político e cultural contemporâneo em que as mudanças são rápidas e constantes, desaparecem o mito de uma identidade estável e única e abre-se caminho para a construção de novas identidades e a produção de novos sujeitos através rupturas e recomposições. Esse processo produz o sujeito pós-moderno, conceptualizado como não tendo uma identidade fixa, essencial ou permanente. (HALL, 2007).

A formação e atuação se relacionam na composição da identidade social e profissional do pedagogo e de outros profissionais da educação. Essa relação é dialética, pois para Dubar (2007) a identidade profissional se configura numa esfera específica de um campo de trabalho impetrado pelas identidades individuais, em ato de pertença.

Consoante, as relações sociais que estabelecemos no ambiente de trabalho e fora dele produz novas realidades e novas necessidades que vão apontando para o surgimento de outras possibilidades, que estruturam-se na forma de significados, que ora se confrontam, pois segundo Ciampa (2005) sempre há a pressuposição de uma identidade, ou seja, ao assumir determinados papéis, estes já estão previamente definidos. Portanto, as identidades pressupostas são idealizações realizadas por outros e assumidas por sujeitos de certa coletividade.

Destarte para Hall (2006) as identidades, rompem ou se juntam aos anteriores num processo constante de desestruturação e reestruturação. Circunstâncias, históricas, econômicas, socais, éticas, afetivas, institucionais, individuais e coletivas, interagem a nível macro e micro, modificando, fragmentando, deslocando, desarticulando o estabelecido, criando outras perspectivas e gestando novas possibilidades para as identidades individuais e profissionais. Existe, em suma, na vida moderna, uma diversidade de posições que nos estão disponíveis – posições que podemos ocupar ou não.

Para o autor supracitado, a identidade e a diferença são processos produzidos cultural e socialmente, não são naturais, não se constituem essências. É através da linguagem que criamos a identidade e a diferença, e lhes atribuímos sentido. A identidade e a diferença só podem ser entendidas dentro de um sistema de significação (representação) que lhes confere sentido através da linguagem. Diferentes fatos e atitudes adquirem diferentes significados a partir das representações que deles são feitas.

Assim, dialogando com Ciampa (2005, p.12) "[...] a identidade se processa na interação social, implicando necessariamente, atividade e consciência". Dessa forma, a atividade se desenvolve através de uma ação, trabalho que nessa concepção humaniza o homem de acordo com Marx é o processo da vida real das pessoas. A atividade humaniza o homem, a partir do pressuposto de que por ela o homem se diferencia dos demais animais, constituindo sua singularidade humana e

conforme Leontiev (1977, p. 3) "a característica constituinte da atividade é que ela tem um *objeto*", que nesse movimento do homem com o objeto se traduz numa relação dialética constituidora do humano.

Para Ciampa (2005), a relação social que estabelecemos com os outros confere à identidade uma espécie de síntese da articulação da igualdade e da diferença, ou seja, identidade tanto pressupõe o sentimento de pertencimento, na qualidade do que é idêntico quanto pressupõe reconhecer-se como alguém diferente, como único, singular; com isso, afirmamos que a nossa singularidade é constituída socialmente. Ou ainda, considerar que a identidade é articulação da igualdade e da diferença é afirmar que cada indivíduo constitui uma identidade que é pessoal, mas que foi construída mediante a relação com os outros, pois é tomando por base os outros que nos reconhecemos como diferentes.

Ainda segundo o autor, a identidade é questão social e não natural. O autor explica que, durante a nossa vida, assumimos vários papéis sociais, o papel de filha, de mãe, de mulher, de supervisora, de esposa, de amiga, dentre outros. De acordo com este autor, "o papel é uma atividade padronizada previamente" (CIAMPA, 2005, p. 135).

A identidade pressupõe movimento, atividade, trabalho e que nas relações sociais que estabelecemos com o meio, criamos possibilidades de estar sempre em articulando a igualdade e a diferença

ParaCiampa (2005), pode-se afirmar que mesmo a identidade humana sendo metamorfose e que se processa numa relação dialética entre atividade, consciência e meio, conduz o homem a constituição identitária. Esta se desvela num dinamismo, onde as possibilidades de ultrapassar a "mesmice", e processar a objetividade humana produz sua subjetividade, contudo nem sempre se caminha rumo à produção de sua autonomia e emancipação.

Assim, o processo de construção da identidade do pedagogo, pode se constituir na relação dialética estabelecida com seus pares, nas condições materiais em que realiza seu trabalho, nos elos que formam com a comunidade e as atividades que desenvolvem no seu cotidiano.

II. TRAÇANDO OS ASPECTOS METODOLÓGICOS

Do ponto de vista metodológico, o processo de operacionalização da investigação para o alcance dos objetivos propostos foi composto por uma sequência de momentos: levantamento das fontes referentes ao objeto da investigação; a coleta dos dados; a análise e discussão dos resultados.

Nessa perspectiva, a pesquisa enquadra-se em uma abordagem qualitativa de pesquisa do tipo explicativo, devido abranger aspectos importantes como a visão holística, ou seja, a compreensão das inter-relações que emergem no contexto escolar (GIL, 2008). A modalidade de pesquisa qualitativa se preocupa com um nível de realidade que nem sempre pode ser quantificada, ou seja, com um universo de significados, motivações, aspirações, crenças, valores e atitudes, correspondentes a um espaço mais profundo das relações, dos processos e dos fenômenos que não podem ser reduzidos à operacionalização das variáveis (MINAYO, 2002).

Para o levantamento das informações, realizou-se consultas a fontes, como artigos científicos e documentos, recorrendo-se à pesquisa bibliográfica no âmbito da reflexão teórica e a pesquisa *online* por meio de acesso a banco de dados científicos com registros de dissertações, teses, e artigos qualificados pela CAPES etc. Essas fontes e documentos explorados durante o desenvolvimento da investigação, permitiu instrumentalizar os processos específicos da pesquisa e para a consecução dos objetivos.

Utilizou-se para coleta de dados, o questionário fechado, que no entender de GonzálezRey(2012) é mais comum quando se tem como objetivo obter informações objetivas que seja suscetível de descrição e que possa adquirir diferentes significados no curso da pesquisa, por meio de sua relação com outras informações. Quanto ao questionário com perguntas abertas, GonzalezRey(2012) sinaliza que assim como a entrevista, esse instrumento permite que o sujeito se expresse de livre e mais espontâneo.

A pesquisa de campo foi realizada no Instituto Federal de Educação (IFPI),em três *Campus* diferentes. Os sujeitos que integraram o universo pesquisado foram três pedagogos. A opção pela escolha destes baseou-se nos critérios de tempo de experiência na Educação Básica e experiência profissional, no mínimo 2 anos como pedagogo na instituição investigada.

Os dados coletados foram organizados e interpretados, de acordo com a técnica de análise de conteúdo proposto por Bardin (2009), que consiste em identificar, categorizar os elementos fundamentais da palavra dita ou escrita, compreendendo de modo interpretativo as entrelinhas dos discursos.

2.1 RESULTADOS E DISCUSSÕES

Segundo Pádua (2000) a análise de dados é uma etapa da investigação de suma importância, pois através dessa atividade há condições de evidenciar a criatividade do pesquisador, classificando e organizando as

informações coletadas, estabelecendo relações existentes entre os dados.

Na intenção de identificar como o pedagogo técnico do IFPI, constrói sua identidade e se constitui profissionalmente, e verificar quais fatores do cotidiano, do trabalho pedagógico fora da sala de aula, são importantes na construção da identidade do Pedagogo, obteve-se informações que se organizaram em quatro eixos: **Atuação profissional do pedagogo; Desenvolvimento profissional do pedagogo; Construção da identidade profissional do pedagogo e dificuldades no exercício da profissão**.

Assim, para preservar os nomes dos interlocutores, mantidos em sigilo por questões éticas, utilizou-se de pseudônimos: Rubi, Diamante e Esmeralda. O quadro a seguir mostra o perfil dos interlocutores.

QUADRO 01: Perfil dos interlocutores

SUJEITO	IDADE	FORMAÇÃO/TITULAÇÃO	TEMPO DE TRABALHO NO IFPI	TEMPO DE SERVIÇO EM OUTRA INSTITUIÇÃO
Rubi	28 anos	Graduada em Pedagogia e Especialista em Gestão	02 anos e 08 meses	08 meses de docência na educação básica rede municipal de Timon - MA
Diamante	40 anos	Licenciatura em Pedagogia e Especialista em Supervisão do Ensino Aprendizagem	03 anos	16 anos de docência na educação básica
Esmeralda	43 anos	Licenciatura em Pedagogia e Especialista em Psicologia Clínica e Mestre em Educação – Educação especial na perspectiva da educação inclusiva.	01 ano e 6 meses	24 anos de docência na Educação Infantil, Supervisão, Coordenação e docência no ensino superior

Como se observa do quadro 01, todos os interlocutores possuem experiência na docência das séries iniciais do Ensino Fundamental, o que significam que os conhecimentos adquiridos na profissão são relevantes para o desenvolvimento profissional. Além disso, a formação de pós-graduados *lato sensu* e *stricto sensu* sinaliza a preocupação dos interlocutores com seu comprometimento com sua atividade profissional que pode ser exercida com mais autonomia. No entender de Nóvoa (2002), durante a formação continuada e o exercício profissional o docente consolida seus conhecimentos e aprendizagens que dão especificidade ao seu trabalho.

Dessa maneira, percebe-se uma relação entre a formação e a atuação do pedagogo para a constituição da sua identidade profissional, advinda de sua atividade na docência e de sua mediação enquanto pedagogo, também enriquecida pela mediação que este faz com os demais profissionais da educação e discentes, o que para Ciampa (2005, p. 75) "[...] o significado socialmente compartilhado define, explica, legitima a realidade - e a nova identidade".

III. ATUAÇÃO PROFISSIONAL DO PEDAGOGO

O perfil do pedagogo está pautado em resolução e diretrizes que norteiam o seu conhecimento técnico e científico. Este é movido por atividades que consolidam sua ação profissional, como se pode verificar nos relatos a seguir:

"[...] *atividades de acompanhamento do trabalho docente de forma a contribuir para o desenvolvimento de uma prática docente reflexiva, crítica e criativa.* [...] *acompanhamento do desempenho escolar discente, de forma que o mesmo se perceba como sujeito ativo no processo de aprendizagem. Esse trabalho também tem como uma de suas principais atividades buscar formas de articular toda a comunidade escolar (docentes, alunos, pais)*". (RUBI)

"*Participação em colegiados, reuniões de conselhos, comissões e implantação de cursos, reuniões de planejamento da instituição e aplicação de projetos, análises de desempenho acadêmico do aluno, entre outros*". (DIAMANTE)

"*atendimento a alunos e pais de alunos; atendimento aos pais e familiares, articulação e participação em Conselhos de Classe, acompanhamento das notas dos alunos, através de boletins e*

encaminhamentos cabíveis, elaboração de pareceres pedagógicos, conforme demandas, articulação, organização e participação nas reuniões de pais, orientação aos docentes, organização de encontros pedagógicos, busca de alternativas e articulação da inclusão dos alunos público-alvo da Educação Especial; participação das reuniões internas, quando solicitado, coordenação e participação em grupos de estudo e orientação a alunos do PIBIC". (ESMERALDA)

As atividades mencionadas confirmam o que está disposto nas Diretrizes Curriculares do Pedagogo (2006), que consistem em atividades de acompanhamento e apoio escolar, planejamento, execução e avaliação de atividades educativas.

Chama a atenção nos relatos à importância da presença do pedagogo nos espaços deliberativos: *"Participação em colegiados, reuniões de conselhos, comissões e implantação de cursos [...]"* (DIAMANTE). *"[...] organização e participação nas reuniões de pais [...]"* (ESMERALDA).Sobre isso, Ciampa (2005) diz que a constituição da identidade do indivíduo está movida por questões políticas, condições sociais e institucionais, onde o mesmo se insere.

A partir dos relatos dos interlocutores é possível verificar que a amplitude de seu trabalho, pela diversidade de atividades movimentada pela relação dialética entre seus pares, no que tange a participação em colegiados e comissões, reuniões de pais, ainda que contribua para formação de sua identidade, percebe-se que os mesmos estão sempre se constituindo, pois são nesses espaços do cotidiano que o pedagogo se afirma como profissional o que corrobora com a tese deCiampa (2005, p. 90) quando afirma que *"[...] o indivíduo isolado é uma abstração [...] a identidade se concretiza na atividade social. O Mundo, criação humana, é o lugar do homem. Uma identidade que não se realiza na relação com o próximo é fictícia, é abstrata é falsa".*

3.1 Desenvolvimento profissional do pedagogo

O contexto brasileiro, comparado com outros países da América Latina, formação e desenvolvimento profissional ainda está distante, porque o próprio País é carente de política pública educacional e programas em formação continuada e permanente, porém o desenvolvimento profissional implica desenvolvimento pessoal.

Partindo desse entendimento, o sujeito consciente de sua ação é impelido por condições objetivas para realizar de modo favorável sua atividade. Desse modo, formação e desenvolvimento profissional estão interligados.

Como se pode observar no relato de Rubi há um inconformismo com a falta de formação ofertada pela instituição: *"Infelizmente o IFPI não oferece formação continuada aos pedagogos [...] não oportunizando um momento de formação (já que muitas vezes esses encontros se perdem em discussões meramente técnicas do trabalho do pedagogo) e reflexão crítica sobre nossa prática".*

Dessa forma, a reflexão crítica, segundo Liberali (2004), representa estágio mais desenvolvido de consciência, permitindo o reconhecimento por parte do professor do seu estado de alheamento quanto ao divórcio da teoria e da prática, por exemplo, ou quanto ao contexto sócio histórico vivido por ele. Com isso, a capacidade de analisar a realidade social, política, histórica se torna urgente e necessária, para nos tornar aptos a elaborar posicionamentos diante dos acontecimentos com vistas à transformação social.

Desse modo, identifica-se que o cotidiano do trabalho do pedagogo com seus dilemas e desafios, às vezes não superados, possibilita esse profissional o sentimento de reconhecimento e dessa forma demonstra capacidade suficiente para lidar com diversos perfis de alunos, e professores num contexto heterogêneo.

Na redefinição de sua profissão, o pedagogo direciona sua ação para garantir sua realização pessoal e profissional, assim os entrevistados fizeram a seguintes sugestões: *"[...] Possíveis formações em relação aos alunos que chegam e estão em situações de vulnerabilidade, são deficientes, então é necessária uma adequação no atendimento que de certa forma será diferenciado".* (DIAMANTE).*"Seria interessante à oferta de doutorados profissionais (a exemplo do que já acontece com o Metrado) e fóruns da equipe pedagógica, para troca de experiência e busca conjunta de alternativas para superação dos desafios surgidos no cotidiano".*(ESMERALDA).

Partindo desse pressuposto de que o IFPI, lócus de trabalho dos interlocutores da pesquisa, ainda não oferece uma formação continuada, no âmbito do trabalho, esse pensamento traduz a ideia de que há uma necessidade de elaborar propostas formativas para promover o desenvolvimento profissional.

3.2 Construção da identidade profissional do pedagogo e obstáculos no exercício da profissão

Discutir a identidade docente, saberes e significados, traz novas possibilidades de reflexão sobre o cotidiano escolar, bem como novas possibilidades de construção e reconstrução de novas práticas docentes. Ciampa (2000) diz que sempre há a pressuposição de uma identidade, ou seja, ao assumir determinados papéis estes já estão puramente definidos. As identidades pressupostas são idealizações realizadas por outros, e é assumida por sujeitos de certa coletividade.

Nesse sentido, pensar sobre a atuação profissional do pedagogo e perceber suas dificuldades no trabalho, torna-se uma realidade imprescindível para reflexão e ressignificação de sua identidade. Com relação ao trabalho realizado e suas contribuições para a constituição profissional, os entrevistados afirmaram que:

"[...] *contribui na medida que me faz refletir sobre a minha prática enquanto pedagoga, quando me deparo com problemas oriundos da prática docente, ou mesmo da comunidade escolar em geral que me fazem refletir sobre minha pratica*". (RUBI)

"*Contribui no sentido que o setor onde trabalho é de onde sai o planejamento da parte educacional e necessariamente são as atribuições corretas para o pedagogo assumir e desenvolver. Portanto, ajuda na desenvoltura profissional, conferindo capacidade resolutiva e prática no atendimento aos recursos humanos*". (DIAMANTE)

"*Pelas trocas proporcionadas pelos colegas de equipe, de um modo geral, mais experientes quanto às especificidades do trabalho do IFPI, em especial com a Educação Profissional*". (ESMERALDA).

Nos relatos ficou evidente que o pedagogo reconstroem o significado de sua atuação profissional: [...] *fazem refletir sobre minha pratica*". (RUBI). O pedagogo estar atento às possibilidades de sentir-se útil: *ajuda na desenvoltura profissional, conferindo capacidade resolutiva e prática no atendimento aos recursos humanos*". (DIAMANTE). E, há no exercícioda profissãotrocar os conhecimentos com outros profissionais, como afirmou Esmeralda:"*Pelas trocas proporcionadas pelos colegas de equipe, de um modo geral, mais experientes*[...]". Esses relatos confirmam o que conclui Romanowski (2007, p. 38) "portanto, o significado de profissão engloba o fazer, o pensar e o declarar sobre o que se faz. Representa, ao mesmo tempo, o meio que cada sujeito produz sua própria subsistência".

Verifica-se que a construção da identidade do pedagogo é permanente e variável, e se desencadeia de várias formas, depende do contexto de trabalho e das relações sociais que estabelece no ambiente de trabalho e seu envolvimento na ação de acompanhamento pedagógico docente e discente.

No que se referem aos obstáculos no trabalho, obteve-se os seguintes relatos:

"[...] *muitas vezes não consigo desempenhar minha função principal de pedagogo, que é a formação contínua docente, porque fico 'presa' à atividades meramente burocráticas, tais como organização de reuniões, relatórios e outros documentos. Outra dificuldade é que geralmente no IFPI, como um todo, o trabalho do pedagogo é visto como voltado unicamente para resolver os problemas de aprendizagem dos alunos. Soma-se a isso, o fato de não termos uma formação continuada em serviço, se tivéssemos essa formação conseguiríamos resolver as dificuldades citadas anteriormente*". (RUBI)

"*Incompreensão das regras estabelecidas pela instituição e que já não são mais adequadas; Outras regras que não são cumpridas por docentes e técnicos; Falta de recursos mais específicos; Formação específica para o coordenador pedagógico; delimitação do trabalho pedagógico; necessidade de instrumentais para realizar o trabalho e volume de trabalho inadequado*". (DIAMANTE)

"*A incompreensão geral (inclusive de membros da própria equipe pedagógica) acerca do papel do pedagogo e mais amplamente do setor pedagógico e suas possibilidades de contribuição para o êxito educacional*". (ESMERALDA)

É importante destacar que o pedagogo, no seu trabalho diário também atende a exigências de ordem burocrática e filosófica, tais como Elaboração e reformulação de Projetos Políticos Pedagógicos de Cursos, Elaboração de Projeto Político Institucional, participação em colegiados, em Núcleos Docentes Estruturantes, comissões de avaliações de projetos de pesquisa, ensino e extensão. Além disso, participam de discussão de normas internas, conselho de classe, adequação de regimentos internos e participação em órgão de deliberação colegiada na administração superior, conforme ressaltam os depoimentos.

O relato de Rubi sinaliza a consciência de suas atribuições, no entanto, há um falta de identificação na atuação, pois a mesma se reduz as atividades burocráticas: "[...] *muitas vezes não consigo desempenhar minha função principal de pedagogo,* [...], *porque fico 'presa' à atividades meramente burocráticas.* Essa fala contrapõe-se com o pensamento de Ciampa (2005, p. 36), quando afirma que "identidade é metamorfose é transformação" e ainda neste sentido Ibiapina, (2017, p. 315), afirma

[…] refletir é movimento do pensamento que gera autoconhecimento e autoconsciência […] que embasam as ações e para a produção de um novo agir, qualitativamente superior e com mais poder transformativo.

Observa-se também no relato de Diamante ao se referir a falta de "[...] *delimitação do trabalho pedagógico* [...]" e no relato de Esmeralda: "*a incompreensão geral (inclusive de membros da própria equipe pedagógica) acerca do papel do pedagogo* [...]" deixam evidenteque as atribuições do pedagogo, ainda não são suficientes nas suas condições materiais de exercício da profissão, suficiente para construção de sua identidade profissional de acordo com a sua perspectiva no tocante a um direcionamento que possibilite um bem estar na profissão.

As falas de Rubi e Diamante, respectivamente: "[...]*não termos uma formação continuada em serviço, se tivéssemos essa formação conseguiríamos resolver as dificuldades citadas anteriormente*". "*Formação específica para o coordenador pedagógico* [...]" deixam explicitas a necessidade de uma formação profissional em serviço.

A construção da identidade de pedagogo que também se dar na trajetória profissional, revelados na exposição das dificuldades no exercício do trabalho dos sujeitos entrevistados, confirma a assertiva de que "[...] uma identidade humana é sempre negação do que a nega" (CIAMPA, 2005, p. 38).

Pelos relatos foi possível observar e analisar que a crise de identidade na Educação afeta não somente os docentes, mas outros profissionais da educação como os pedagogos técnicos, seja por falta de formação inicial fortalecida, seja por ausência ou mesmo presença de formação contínua a fim de atender as demandas presentes na comunidade estudantil (docentes, discentes, pais e responsáveis por alunos).

IV.   CONSIDERAÇÕES FINAIS

Constatou-se de modo parcial que o mundo objetivo mediado na relação entre o sujeito e seu meio social, historicamente construído, está relacionado ao homem e a natureza, conjugados com as categorias educação e trabalho, de acordo com os estudos de Dubar (2007), Ciampa (2005), em consonância com os resultados dos questionários aplicados. Contudo, as respostas dos interlocutores se confrontam e se afirmam com as expectativas dos mesmos e com inquietações, no que se referem a atuação profissional.

Conclui-se através dos dados que as expectativas de atuação não foram atingidas, devido a atuação generalizante do pedagogo no IFPI, bem como a existência de inconformismo em relação a ausência de programa de formação continuada não ofertada pela instituição, o que sobremaneira contribui e afeta a produção da sua identidade profissional, no sentido de atuação e formação que culminam com uma crise identitária desses profissionais, por não apresentar um recorte especifico de atuação desse sujeito no seu campo de trabalho.

Foi possível também durante a pesquisa, identificar a forte influência do social, através da categoria mediação entre o individual e o coletivo na construção de suas identidades profissionais. Nesse sentido, concebe-se identidade como algo em movimento, em transformação, denominada de Ciampa (2005) por metamorfose.

Assim, este estudo aponta para a necessidade de políticas de formação continuada, no âmbito do IFPI, no sentido de reorganizar a atividade profissional do pedagogo, pois para Dubar (2005) a identidade profissional se configura num determinado campo de trabalho, que possibilita de mudança dialético homem, sociedade, natureza, trabalho e atividade.

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Data Analysis of Educational Indicators in Brazil

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Abstract—The implementation of teaching and learning assessment to evaluate educational systemscan be consideredindispensable to Governmentsdue to the necessity for planning education public policies. In Brazil, the National Institute of Studies and Educational Research Anísio Teixeira (Instituto Nacional de Estudos e PesquisasEducacionaisAnísio Teixeira – Inep) evaluates annually about 6 million students of 71 thousand units of public and private education, in more than five thousand Brazilian'scities.This article presents a data analysis on the educational indicators of Tocantins State in Brazil. The data were collected on the website of Inep. The students' grades investigated in this work are from the5º year of public and private elementary schools of Tocantins State, in 2015.The research's objective is to analyze the Inep indicators of "teacher effort", "teacher formation adequacy", and "teacher regularity". These indicators were correlated with the students' average grade in the BraziliantestofPortugueselanguage and Mathematics. To achieve the purpose of this study, analytics software tools, statistics methods, and machine learning algorithms,were usedto statistically mine the database.This analysis allowed identifying teachers' indicators with statistical significancerelated to the schools that had better performance in the Inep Test.The results are being used by the Tocantins Brazilian Government to plan education public policies.
Keywords— Educational indicators; Brazilian InepTest; public policies.

I. INTRODUCTION

The contemporary society has the inexorable demand to an efficient education, which makes possible new ways to learn and to construct knowledge.One of the waysto improve education quality in Brazil,by the Education Ministry (MEC),is the implementation of external evaluations.For instance, theSystem of Evaluation of the Elementary School (Sistema de Avaliação da EducaçãoBásica – Saeb), created in 2007 by INEP, has the purposeto measure the quality of the student learning, by means ofan index of elementary school development (Índice de Desenvolvimento da EducaçãoBásica– IDEB).

The second section of this article presents the importance of the educational indicators and external evaluations, as essential to the Brazilian educational system.These evaluations and indices serve to observe and to monitor the results presented for diverse educational indicators.In this study, the indicators of "teacher effort", "teacher formation adequacy" and "teacher regularity" are analyzed. Pontes (2012) strengthens that these results serve to diagnosis the weak and strong points of the learning of the students.

In the third section, the process of Data Mining is depicted, according to Silva and Silva (2014),the data is transformed in a process of integration and preprocessing to be better structuralized, sanitized, selected and standardized.At the end, the results and the final considerations are presentedas an outline of this inquiry.

II. EDUCATIONAL INDICATORS – INEP

To know indepth the Brazilian educational system, MEC/INEP create the Saeb, in 1990. In 1995, the Saeb started to carry out evaluations by sampling each two years.The purpose was diagnosis the situation of the students learning in a varied of education stages, by stipulating reference matricesand scales of proficiency.

Following, the Saeb was constituted into two instruments: the National Evaluation of the Basic Teaching (Avaliação Nacional da EducaçãoBásica–Aneb) and the National Evaluation of the Pertaining to school Income (Avaliação Nacional do Rendimento Escolar–Anresc).TheAneb evaluates students of 5º and 9º years of Basic Teachingand third grade of High School, in disciplines of PortugueseLanguage and Mathematical, by sampling the Education Nets, in each unit of the Federation.In contrast, the Anresc, better known as "Brazil Test", evaluates the students of 5º and 9º years of Basic Teaching of the public net (county, state and federal), in urban and agricultural zones, in a census form.The Anresc evaluates schools with twenty or more students registered by year.

The Brazil Test evaluates the Portuguese language school performance (focus on reading), and Mathematics (emphasizes problem solving).INEP defined a curriculum cut through the construction of Reference Matrices, containing the set of contents and skills to be evaluated in

each area of knowledge, for students in the 5th and 9th grade of Elementary School.

According to the MEC / INEP (2013, page 7), in the elaboration of the Reference Matrices of Portuguese Language and Mathematics of the Brazil Test:

Inepwas based on the National Curricular Parameters and a national consultation on the curricula proposed by the State Secretariats of Education and by some municipal networks. Network teachers were also consulted and the most used textbooks for the evaluated years were also examined.

In order to achieve student performance results, tests are developed using a numerical value, established by proficiency levels. The information about the conduct of the items (questions) used in the tests are previously constructed, and based on the Model of the Response of the Item (Teoria da Respostaao Item - TRI).

For a better understanding of this procedure, MEC / INEP (2017, p.17) clarifies that:

In the Brazil Test, the proficiency scale is constructed for each of the areas of knowledge evaluated and ranges from 0 to 500 points. It is divided into 25-point intervals, which are called proficiency levels. Each level comprises a set of skills that the students probably dominate it.

The levels of proficiency of Portuguese Language in the 2015 Brazil Test of the 5th year of Elementary Education starts with level 0 (performance lower than 125) and goes to level 9 (performance greater or equal to 325). In Mathematics, the level is also beginning at level 0 (performance less than 125), but goes up to level 10 (performance greater or equal to 325). At each level the skills expected to be developed by the students are described.

From the analysis of student proficiency, the need to measure the student learning aroused. However, measuring learning is a complex task, since education is wide-ranging, involving a range of variables, from population to cultural, social and economic aspects. Thus, requiring an in-depth analysis of an enormous amount of information. In this case, educational indicators are important means in the search for this information.

When referring to the meaning of indicator, Pontes (2012, p. 13) points out that "it is a value calculated according to strict criteria and it represents a specific dimension of interest" (educational, in our case). In this sense, the indicator is a measurable resource, which allows us to analyze the extent to which the planned objectives and goals were achieved.

The next step was the creation of the IDEB in 2007, which is a good indicator to measure the quality of education, since it uses extremely important benchmarks in educational evaluation:

1) The calculation of student performance in external evaluations (Anresc and Aneb) of Portuguese Language and Mathematics;

2) The rate of students' income, identified by the School Census, in which the flow of students is perceived through the successive years spent in elementary school.

The IDEB calculation considers the multiplication of note 1) times note 2).

The Education Development Plan (PDE), defined by the MEC in 2007, establishes that, by 2022, Brazil will reach an Idebof 6.0, which is the same average grade point for countries of the Organization for Economic Cooperation and Development (OECD).

It was therefore essential for the Brazilian educational system to monitor the data presented by IDEB, in order to verify the real needs of the school, in the quest to raise the quality of teaching. Therefore, analyzing the data presented by the students' performance in the Brazil Test is fundamental for the investigation of the students' quality of teaching.

2.1 The Brazil Test in Tocantins

The state education system of Tocantins, as it happened throughout Brazil, began to monitor the students' performance in Brazil Test together with the IDEB results, to carry out the planning of pedagogical actions aimed at improving the quality of teaching. The State Plan of Education of Tocantins - PEE / TO, regulated by Law No. 2,977, of July 8, 2015, defines in Goal 23, "to guarantee the quality of elementary school in all stages, levels and modalities of teaching, with improved school flow and learning "(STATE EDUCATION PLAN, 2015, page 47).

This PEE / TO Goal is of fundamental importance to school management, since it provides data collection of school needs, for the control and monitoring of actions, in order to analyze whether school management consolidates the full, administrative and financial autonomy, and if the pedagogical dimensions are based on solid and effective planning, aimed at improving the quality of teaching.

The performance of the 5th grade students of the Tocantins state education system, in a total of 157 participating schools, had an average of 199.03 proficiency in Portuguese and an average of 209.93 proficiency in Mathematics.

As previously stated, Inep defined in dividing the performance of students in the Brazil Test based on proficiency levels. In the case of the Tocantins State network, schools were between levels 2 to 5. Level 5 (performance greater than or equal to 225 and less than 250), Level 4 (performance greater or equal to 200 and less than 225) , Level 3 (performance greater than or

equal to 175 and less than 200), and Level 2 (performance greater than or equal to 150 and less than 175).

From this perspective, we can see that the performance of the students in the State school system is far from desirable, since in Portuguese, there are four levels to reach the ideal level, and in Mathematics, there are five levels missing.

Thus, in the accomplishment of this research work, the data analysis on the educational indicators of the Tocantins has the objective to find a relation between the attributes: effort of the teacher, regularity of the teacher, adequacy of the teacher formation, quantity of students in the school (whether urban or rural). These attributes were correlated to the average of proficiency in Portuguese Language and Mathematics of the Brazil Test, by school, of the 5th year of Elementary School, of the state teaching network of Tocantins, in 2015. The purpose is to provide knowledge about the performance of the students in the external evaluations, together with Seduc / TO and other educational bodies, in order to base the planning of educational public policies.

Thus, in the accomplishment of this research, the work for the analysis of data was directed on the educational pointers of the Tocantins with the objective to find a relation between the attributes:effort of the teacher, regularity of the teacher, adequacy of the formation of the teacher, amount of students registered for pertaining to school, in relation to the average of proficiency in Language Portuguese and Mathematical of the Brazil Test, for school, of 5º year of Basic Teaching, the state net of education of the Tocantins, in the year of 2015. The purpose is to give knowledge to the educational Tocantins systemand other agencies on the performance of the students in the external evaluations, with intention to substantiate the planning of educational public politics.

2.1.1 Indicator of Teaching Effort

The Teaching Effort consists of the effort made by teachers of Brazilian elementary school in the exercise of their profession. By means of this indicator, INEP (2014) classifies the teacher of each school in levels, which ranges from 1 to 6.The higher the level, the greater the effort undertaken by the teacher. The items in the sequence below present the levels of the teacher effort indicator, according to the features of each teacher:

Level 1 - Teacher who, in general, has up to 25 students and acts in a single working shift, school and stage.

Level 2 - Teacher who usually has between 25 and 150 students and acts in a single working shift, school and stage.

Level 3 - Teacher who usually has between 25 and 300 students and acts in one or two working shifts in a single school and stage.

Level 4 - Teacher who usually has between 50 and 400 students and works in two working shifts, in one or two schools and in two stages.

Level 5 - Teacher who, in general, has more than 300 students and works in three working shifts, in two or three schools and in two stages or three stages.

Level 5 - Teacher who, in general, has more than 300 students and works in three working shifts, in two or three schools and in two stages or three stages.

Level 6 - Teacher who, in general, has more than 400 students and works in three working shifts, in two or three schools and in two stages or three stages. (INEP, 2014, p.6).

Thus, from the data available on the INEP website in relation to the Elementary School teacher, the teaching effort is also related to the following characteristics: number of teaching schools, number of work shifts, number of students attended and number of stages in which you teach.

2.1.2 Indicator of regularity of the teacher

According to INEP (2015), this indicator aims to evaluate the regularity of the teaching staff in elementary schools, based on the observation of the permanence of teachers in schools in the last five years. For the teacher of each school, a score was assigned in order to be valued: the total number of years in which the teacher worked in the school in the last 5 years, the teacher's actuation in the school in more recent years and the actuation in consecutive years.

The Teacher Regularity Indicator varies from 0 (zero) to 5 (five). Thus, the closer the index is to zero, the more irregular is the teacher's job linkage to the school and the closer to five, the more regular is the teacher's job linkage to the school. The indicator of regularity of each school is obtained from the average of the indicator of regularity of its teachers. (INEP, 2015).

2.1.3 Indicator of adaptation of the formation of the teacher

This indicator, according to INEP (2014), refers to the categories of adequacy of teacher formation in relation to the subject taught, according to the groups defined below:

Group 1 - Teachers with higher education degree in the same area of the course they teach, or a bachelor's degree in the same course with a pedagogical supplementing course completed.

Group 2 - Teachers with a bachelor's degree in the corresponding course, but without a degree or pedagogical supplementing.

Group 3 - Teachers with a degree in a different area than the one that teaches, or with a bachelors in the subjects of the common curricular base and pedagogical supplementingconcluded in an area different from the one that teaches.

Group 4 - Teachers with other higher education not considered in the previous categories.

Group 5 - Teachers who do not have a university degree. INEP (2014, p.5).

Thus, for each of the courses analyzed, INEP (2014) identified the teacher formation responsible for its development in the class, based on the data collected in the School Census.

The results of this research sought to analyze the hypotheses of relations between the attributes of educational indicators of teacher effort, teacher regularity, teacher formation adequacy, and the number of students enrolled, with proficiency levels in Portuguese Language and Mathematics in the Brazil Test, of the 5th year of Elementary School, of the State education network of Tocantins, in 2015.

In Figure 1, it is possible to observe a statistical significance, $p < .05$, analysis of variance test (ANOVA), between the number of students enrolled per school and the level of proficiency in the Brazil Test. In this manner, how much bigger it is the number of registered students, greater is the level of proficiency in the test. That is, of the 157 searched schools, 17 had note 5, with an average of 77 students; 64 schools - note 4, average of 55 students; 73 schools - note 3, average of 43 students and 3 schools - note 2, average of 22 students.The higher the number of students enrolled the higher the level and proficiency in the test, Figure 2.

III.   RESULTS

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Nvl_PROVA_BR	3	19546.46327	6515.48776	7.02	0.0002
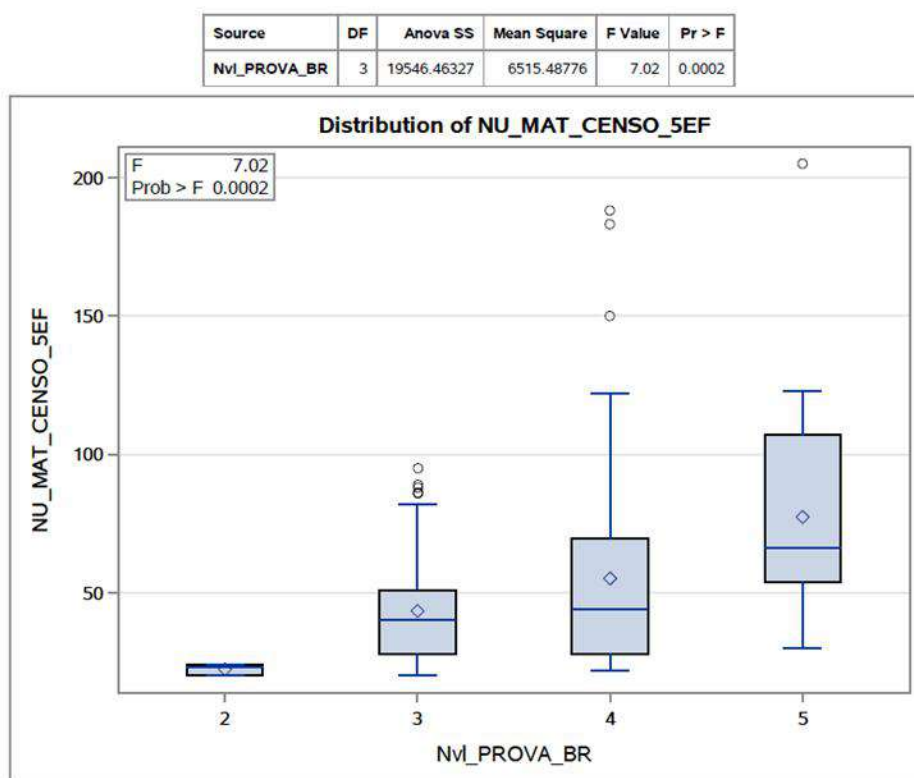
Fig.1. Anova test for the relation between the numbers of students enrolled per school and the proficiency levels of the Brazil Test.
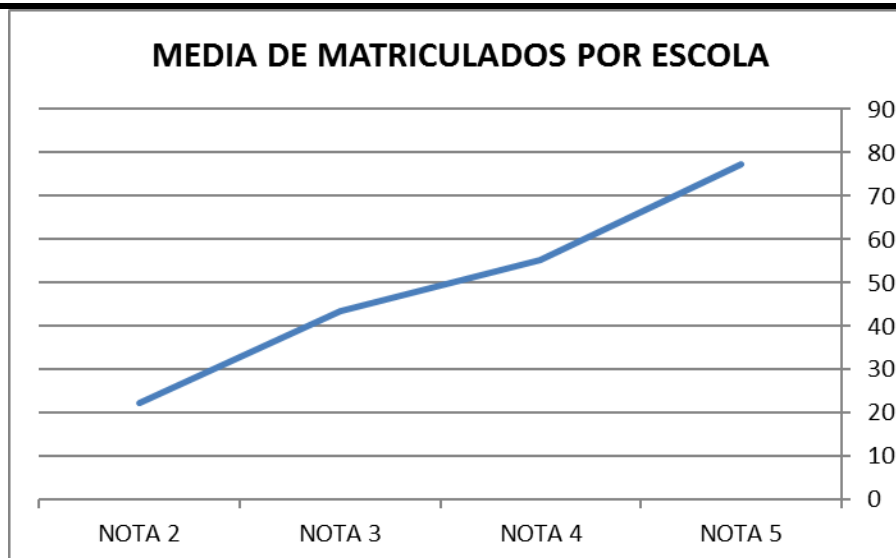
Fig.2. Relationship between the average numbers of students enrolled per school and the proficiency levels of the Brazil test.

The Anova test for the teacher regularity indicator, which evaluates the permanence of the teachers in their schools during the last five years, there was no evidence of a correlation with the levels of proficiency in the Brazil Test, Figure 2, Table 1. The results show that this index of teacher regularity does not influence the student's grade in the tests of Portuguese and mathematics.

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Nvl_PROVA_BR	3	0.79111218	0.26370406	1.11	0.3468
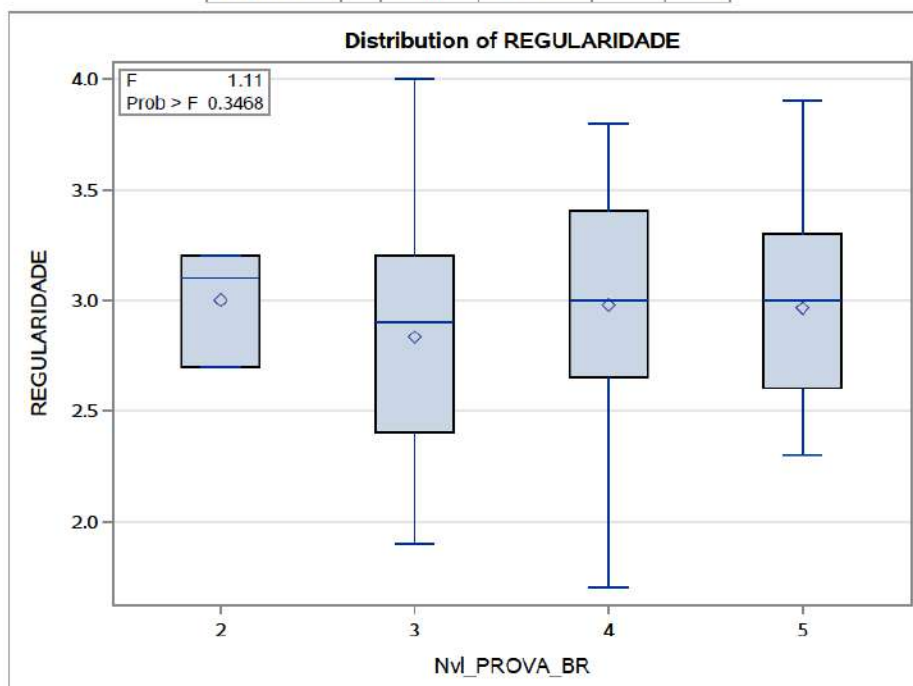
Fig.3. Anova test for the relation between the teacher regularity index and the proficiency levels of the Brazil Test.

Table 1. Average of teacher regularity and proficiency levels of the Brazil Test.

Nvl_PROVA_BR	AVERAGE OF REGULARITY	TOTAL SCHOOLS
NOTE 5	2,96	17
NOTE 4	2,98	64
NOTE 3	2,84	73
NOTE 2	2,99	3

There is also no correlation between the proficiency levels of the Brazil Test and the teacher formation adequacy indicator in relation to the school course (Table 2), both at the highest levels of adequacy, 4 and 5 (Figure 4), and at the lower levels. Recalling that the data analyzed refers to students up to the fifth year of elementary school. The

behavior of this indicator suggest the need to evaluate students of higher grades, in future work. The more advanced the course is in the school grades, the greater the need for more specific and deep knowledge of the subjects to be approached in the course by the teacher.

Table 2. Levels of adequacy of teacher formation to the proficiency levels of the Brazil Test.

Nvl_PROVA_BR	IN PERCENTAGE					TOTAL SCHOOLS
	ADEQUACAO _1	ADEQUACAO _2	ADEQUACAO _3	ADEQUACAO _4	ADEQUACAO _5	
NOTE 5	87,48	0,45	5,81	2,82	3,45	**17**
NOTE 4	85,89	0,00	3,50	5,31	5,31	**64**
NOTE 3	88,57	0,00	2,43	5,75	3,26	**73**
NOTE 2	86,67	0,00	0,00	0,00	13,33	**3**

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Nvl_PROVA_BR	3	318.6372748	106.2124249	0.38	0.7673
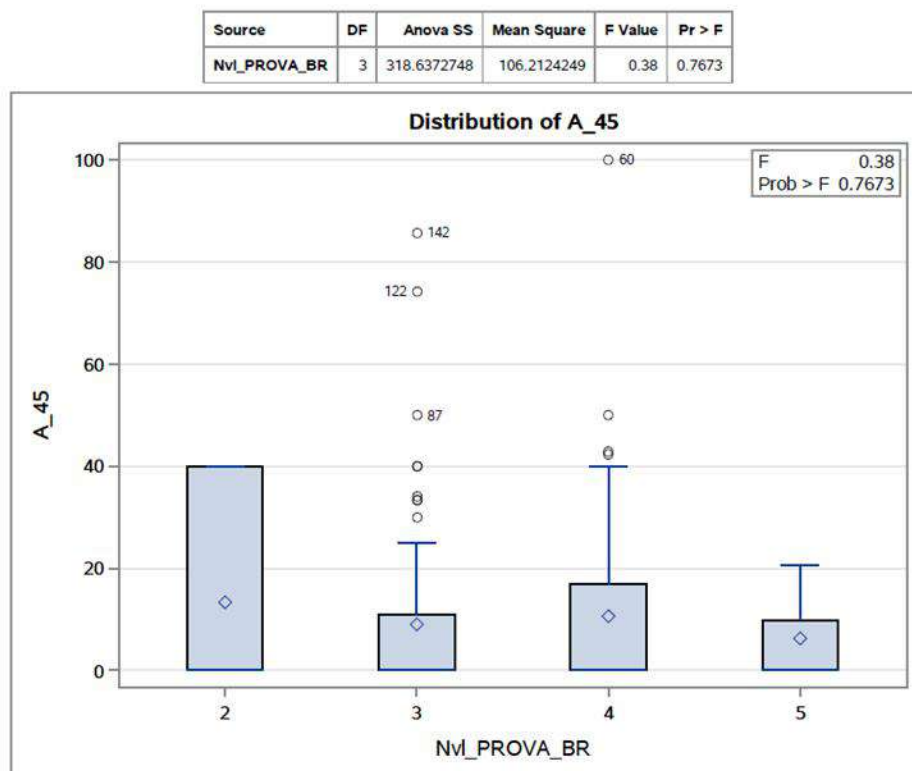
Fig.4. Anova test for levels 4 and 5 of teacher formation adequacy in relation to proficiency levels of Brazil Test.

For the teacher effort indicator, which affects the number of students attended by the teacher in a single working shift at school, statistically significant evidences were obtained for the proficiency levels of students in the Brazil Test. Both at the lower levels of effort, 1 and 2, and at higher levels, 3, 4, 5 and 6, $p < .05(.009)$, Figures 5 and 6. The results show that the lower the teacher effort the

higher the average of Portuguese and Mathematics scores in the Brazil Test. And, the higher the teaching effort, the lower the average of Portuguese and Math scores. The level of proficiency 2 (two) of the Brazil Test was withdrawn from this evaluation, because the sample had only three schools in this category.

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Nvl_PROVA_BR	1	6260.565402	6260.565402	7.00	0.0090
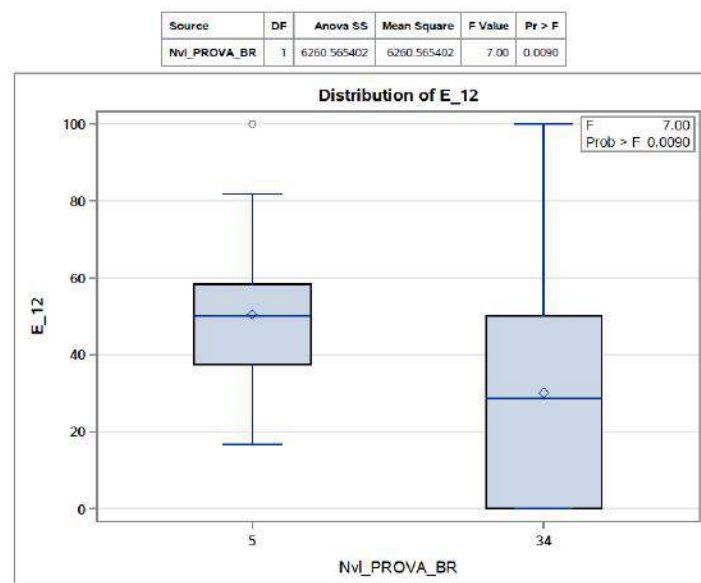
Fig.5. Anova test for levels 1 and 2 of the indicator of teaching effort in relation to the level 5 and levels 3 and 4 of proficiency of the Brazil Test.

Source	DF	Anova SS	Mean Square	F Value	Pr > F
Nvl_PROVA_BR	1	6260.565402	6260.565402	7.00	0.0090
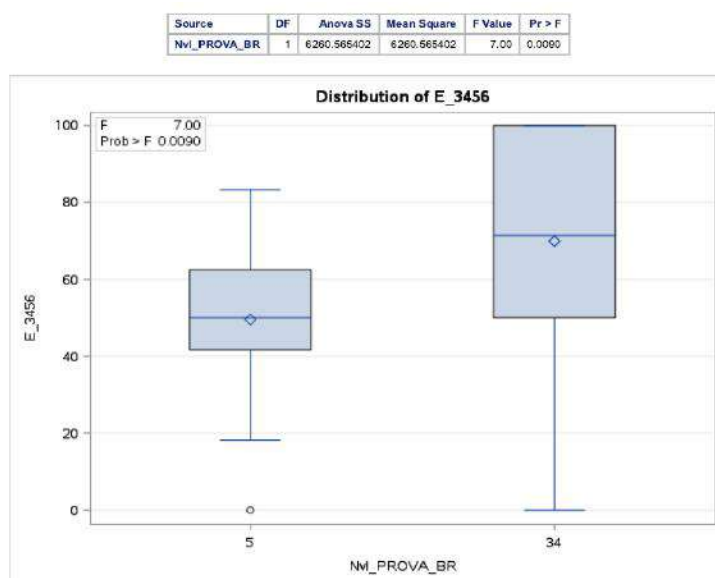
Fig.6. Anova test for levels 3, 4, 5 and 6 of the indicator of teaching effort in relation to the level 5 and levels 3 and 4 of proficiency of the Brazil Test.

IV.   FINAL CONSIDERATIONS

This article analyzed data extracted from the Basic Education Development Index (IDEB) of the schools of the Education Network of the State of Tocantins, in the 5th year of Elementary School, in 2015. In this analysis, the indicator of teacher effort, the indicator of teaching regularity, and the indicator of teacher formation adequacy were correlated with IDEB grade. The work was an attempt to find out what are the factors that are present in schools that allows a higher grade.

By means of the use of tools of statistics with categorization of numerical data, projection of tables, as well as the use of algorithms that use several existing techniques in the computational environment, it was possible to arrive at some conclusions on the raised data:

- The higher the number of students enrolled the higher the level and proficiency in the test;
- The Anova test for the teacher regularity indicator, which evaluates the permanence of the teachers in their schools during the last five years, there was no evidence of a correlation with the levels of proficiency in the Brazil Test;

- There is also no correlation between the proficiency levels of the Brazil Test and the teacher formation adequacy indicator, both at the highest levels of adequacy, 4 and 5, and at the lower levels;
- For the teacher effort indicator, which affects the number of students attended by the teacher in a single working shift at school, statistically significant evidences were obtained for the proficiency levels of students in the Brazil Test. Both at the lower levels of effort, 1 and 2, and at higher levels, 3, 4, 5 and 6, $p < .05 (.009)$,

Finally, it is important to note that the analysis consisted only of 2015 year. The classes analyzed were of the fifth year of the public network of Tocantins State. Maybe, the results here can be different in other States and years, due to political, socioeconomic and cultural changes, among other aspects. For a greater reasoning, it is being developed by the authors of this article a broader analysis, involving other results of the IDEB and other levels of education.

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Lean Accounting: Economic-financial Performance of Companies with Lean Manufacturing

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Abstract— *This article presents a study of multiple cases with four leading publicly traded companies on Bovespa (Brazilian Stock Exchange), before and after the implementation of lean manufacturing, evaluating economic and financial performance through primary and secondary data. Net income was the indicator that showed the greatest positive variation after lean manufacturing, although it increased indebtedness (over 200%) and storage (over 140%), indicating difficulties in conditioning suppliers to the production cycle. Lean manufacturing was not accompanied by accounting practices appropriate to the new productive environment, suggesting a rethinking of the management system, under the lean accounting approach, based on the value stream flow. The results are consistent with the view that lean thinking is a holistic business strategy and demonstrates the weakness in the spread of lean accounting in the corporate environment, which is necessary in order to optimize the overall results of a lean company. It is concluded that there is still a long way for lean Brazilian companies to develop a new organizational model and become lean enterprises focused on the flow of the value chain.*

Keywords — Lean accounting, Lean manufacturing, Bovespa, Value stream.

I. INTRODUCTION

Companies have adopted differentiated procedures in response to changes in an increasingly competitive market, and this new environment has driven changes in organizational structures, manufacturing technologies and accounting practices. From this perspective, in the last decades, many organizations in different industries have transformed their production system and introduced a strategy of lean manufacturing. More recently, organizations are beginning to realize that not only the production processes but also the cost and accounting management system need to be consistent with the lean manufacturing strategy and even lean enterprise [1].

It is worth noting that, according to Womack & Jones [2], a lean company refers to the one that adopted the philosophy of lean manufacturing in its productive sector. In contrast, an organization characterized as lean enterprise requires much more than the implementation of the lean manufacturing approach, and it is necessary to create a new organizational model defined by the understanding of the flow of value in order to consider the expansion of lean philosophy for all the sectors and processes of the organization.

However, making it difficult for the organization to achieve the status of lean enterprise, many managers encourage timely optimization instead of flow, ignoring the importance of lead time whose reduction is one of the principles of lean philosophy. Cost of flow is a powerful way to help bring lead times much closer to value aggregation times when differences between flow and product cost systems almost disappear.

Baines & Langfield-Smith [3] shows how to add operational costs to value-stream maps for all resource-sharing products, highlighting how to translate inventories in time to see the cost based on the flow. The actual value of the cost of the flow serves to help managers prioritize lean improvements by being able to see the financial consequences in terms of increased sales, less money invested in inventories, reduced operating expenses and postponed investments.

In this new environment dominated by lean thinking, the role of the accountant should be modified to encourage behaviors and practices of lean accounting [3]. Jusko [4] understands that lean accounting is not simply

to apply principles of the lean philosophy to the accounting function; it is about using accounting methods and practices that can support lean thinking and show clearly and simply how lean changes affect operational and financial performance and add value to the customer.

According to the literature, the needs of companies based on the lean enterprise precepts are not fully met by the classic model of the controlling area [5]. Exceeding the accounting, financial and legal sphere, controlling in lean organizations presents a broader and more complex role, with participatory bias, linking to the operational aspects of the sectors. In this way, it is based on the management of the flow of value, identifying and eliminating waste; stimulating optimizations based on managerial information of an objective and significant nature for all individuals aligned with the company's processes; and developing a logical and consistent management accounting system [6].

Given the above, it is of great value to study the magnitude of the results coming from the adoption of the lean philosophy by the Brazilian productive sector, allowing also to reflect if the companies researched adjusted their accounting controls to support the implementation and maintenance of the production system organized according to the principles of lean manufacturing.

Therefore, this study aims to evaluate the financial economic results measured in large Brazilian companies that are leaders in their segment, after the effective adoption of procedures for implementing lean manufacturing.

II.   LITERATURE REVIEW
LEAN MANUFACTURING

Lean Manufacturing's approach was pioneered by Toyota through the Toyota Production System (TPS), which was based on Just In Time (JIT) and Jidoka. In 1998, a working group led by James Womack of the Massachusetts Institute of Technology (MIT) presented the five guiding principles of lean thinking, with a view to implementing this thinking in the productive system [7].

As a first guideline, lean thinking is part of the attribution of value for each product, in particular. In this sense, one must identify what the customer wants and, from the understanding of what is value from the perspective of the consumer, then the real cost of the product is defined, so as not to waste time on what the customer does not want [7].

The second principle refers to the identification of the rationalized and simplified flow of value in the production medium. Defining the best purchase, receipt, movement of inputs and transformation process, from the

request to the actual delivery to the customer, becomes essential for the identification of the flow of value. It is possible to identify potential wastes and activities that do not add value to the finished product [7].

The third principle, then, starts from the creation of the flow of value without interruptions, that is, the continuous flow of the processes is effected, so that each item is passed continuously from one process to the next, without stoppage or generation of stock. In this respect, it is necessary to abandon the idea that batch and departmental production is the most efficient [7].

Based on the creation of the continuous flow, there is (i) a reduction in the need to configure machines in the change from one product to another; (ii) a decrease in processing time, through the array of cells; (iii) and the maintenance of the productive operations close to each other, resulting in a reduction in costs and improvement of quality, as well as a reduction in the delivery time of the product [7, 8].

The fourth principle, one of the most emblematic in the field of lean thinking, refers to the production pulled by the customer, avoiding the extra production and, consequently, the generation of unnecessary stocks. Thus, from the continuous flow of the process, it is understood the need to manufacture only when the customer requests (manufacturing pulled by the customer), without pushing undesirable stock and implementing JIT concepts, in order to develop the suppliers for input supplies according to the request for the start of production [2; 7].

Finally, following a logical trigger, the last principle is based on the constant pursuit of perfection. Therefore, once the value is identified from the perspective of the customer as well as the flow of value, it is necessary that the organization seeks to improve processes and activities, reducing costs, improving product quality, eliminating waste, pursuing zero defects, streamlining value flows and increasing the value of products to customers.

This principle also encompasses the measurement and control system that provides information and delegates authority for each employee to act, when necessary, autonomously in activities that add value and eliminate waste in the process, reflecting the involvement of factory floor workers with ideas and initiatives for the continuous improvement of processes [7].

LEAN ACCOUNTING

Lean accounting can be understood as a set of managerial accounting tools adapted and structured with specific decision models to supply the decision-making process of companies that are adopting or adopting the principles and values of lean manufacturing.

Lean accounting is consistent with the principles of lean thinking, as it does not encourage overproduction, as costs are directly attributed to the flow of value according to resource consumption. Also, it does not motivate the formation of unnecessary stocks of raw materials, in-process components and finished products. In addition to the philosophy of lean thinking, it registers and encourages the reduction of lead time and the elimination of waste [9, 10].

Thus, reflecting specifically on the general principles of lean accounting, we can identify a system of measurement and evaluation of economic events captured according to lean thinking, aiming to reach certain performance, quality and productivity standards through conceptual paradigms composed by a series of managerial practices. Thus, we can include costing according to the flow of value, techniques of monitoring inventory levels, modification of financial statements and inclusion of non-financial statements [10].

One of the characteristics of lean results statements is that they separate the costs that are defined by the volume of costs that are only variable in the medium term or fixed. This is extremely important to make decisions about the elasticity of demand and how to deal with it. Standard cost systems, on the other hand, assume that all manufacturing costs are totally variable. As a result of this implicit assumption, by predicting the impact of additional sales, the impact of profits is underestimated and, predicting the impact of lost sales, the reduction in profits is underestimated [11].

In a lean financial statement, the difference between the variable margin and the gross margin is clear. In addition, the specific accounting transactions of the Generally Accepted Accounting Principles (GAAP) for the valuation of inventories are separated from the actual elements of costs, giving a direct clarification to the decision making. It is valid, then, to evaluate how to reach the stages for the implantation and advance of lean accounting. As the stages of development of lean thinking advance, processes begin to get under control, inventories decrease, and efficiency increases. So, traditional controls, geared towards mass production, are progressively being replaced [6].

There are three stages of implementation of lean accounting. Stage 1 is called Pilot Lean and Production Cells, referring to the introduction of the first cells, intensive training of lean principles, identification of the value stream and early customer-driven production initiatives, as well as the beginning of elimination of unnecessary processes.

Lean Manufacturing Widespread, stage 2, refers to the stage at which lean thinking is disseminated strongly; applies visual controls throughout the production; beginning of certification of all suppliers covered by the method; and controlled reduction of inventories, both for inputs and finished products. Cost analysis contributes to the identification of value flows, so costs are allocated according to the characteristics of the production cells and the characteristics of the products, with an integration between the direct operational and the financial costs.

In stage 3, called Lean Thinking Applied or Lean Enterprise, lean thinking expands outside the company, seeking real partners for the process. At this stage the company is fully organized by value stream and there is extensive cooperation between customers, suppliers and partners and continuous improvement becomes part of the routine. Target costing is used to understand the value to the customer and directs the continuous improvement of products and processes. Value stream mapping and costing expand, involving suppliers, customers, and third parties. With purchases and inventories under control, many purchasing and inventory records are eliminated, as well as rationalized or outsourced accounting routines, going backwards or backflushing accounting cost [5, 9].

Thus, the adequacy of managerial accounting for lean transformation requires reporting and decision-making to support production and other processes based on lean thinking.

According to Maskell & Baggaley [5], making use of a cost flow by value, in which costs are allocated directly to the flows, a new information system is needed when the company migrates from mass production to lean manufacturing. These costs include labor and raw material; support for production, operation, maintenance and installations; and all other costs of the flow of value.

III. METHODOLOGY

The present study is descriptive exploratory, starting with a bibliographic review, followed by the collection of primary and secondary data. In order to understand and interpret more profoundly the facts and phenomena related to the adoption of lean manufacturing by the Brazilian productive sector and the adequacy of accounting control to support the implementation and maintenance of the lean manufacturing system, a multiple case study, comprising four large companies governed by the Brazilian Securities and Exchange Commission (CVM) and the Brazilian Stock Exchange (Bovespa), which implemented lean manufacturing, was developed.

Firstly, as a secondary source of research, the Lean Institute Brazil was contacted to have certification of which Brazilian companies adopted lean philosophy with a high degree of development and investment in its structure. Confirmation of 18 companies was obtained;

however, this work was focused on the organizations considered leaders in their segments, with revenues in excess of R$ 1 billion/year, shares opened on the Bovespa and governed by CVM regulations and which implemented lean manufacturing in similar times. In this way, four organizations from different sectors were selected, in order to enrich the analysis:

Company 1 – transport equipment sector.
Company 2 – housewares sector.
Company 3 – processed foods sector.
Company 4 – chemicals sector.

This work considered the period of time between 2005 and 2015, making 11 years of analysis of the indices and accounting variations of the data. The analysis was divided into three time intervals according to the similarity of the time of implantation of lean manufacturing by the companies:

(I)   period prior to the implementation of lean manufacturing – between 2005 and 2008;
(II) lean manufacturing period – between 2009 to 2012;
(III) post-implantation period of lean manufacturing – from 2013 to 2015.

The survey was further developed in CVM and Bovespa data. The data collected were based on the evaluation of profitability, based on net sales; contribution margins (gross profit); net profits; inventory turnover; and level of indebtedness.

Complementarily, in order to obtain primary data, according to the accessibility factor, companies 2 and 4 were chosen to apply a face-to-face questionnaire. The research instrument was answered by professionals directly involved in the implementation of the lean philosophy, such as Product Development Director and Controller.

The questionnaire developed was based on the North American model instituted by the Lean Enterprise Institute, founded by James Womack in 1997. Aiming to characterize how lean concepts were adopted in the production and accounting/financial controls of the two companies, the questionnaire base had the following characteristics:

Part I: socio-demographic issues, aiming at the better characterization of the company, as well as evaluation of the approximate time that the organization remained in the implementation of this methodology.

Part II: closed questions, based on multiple alternatives with scale of evaluation, about the degree of intention that the company had to implement the techniques, practices, reports and actions.

Part III: Closed questions, based on multiple alternatives with scale of evaluation, on how companies have effectively implemented lean manufacturing practices.

Part IV: open questions of textual responses in order to capture some problems that companies have faced, and potentially still face, to reach the central purpose of the lean proposal, specifically within Brazil's tax and social economy and legislation.

The data were analyzed and tabulated using Microsoft Excel, using mean and dispersion measures.

IV.   RESULTS AND DISCUSSION

Table 1 presents a summary of the indices and values obtained from the data collected at the CVM and Bovespa, according to the company surveyed.

It can be seen that in Company 3 and Company 4 there was an increase in the contribution margin and net profits from the implementation of lean manufacturing, and the latter parameter also increased in Company 2, although less significantly.

In all the companies there was a significant increase in the stock levels in the period after lean manufacturing, contrary to the precepts of lean thinking. An analysis by company will be presented below.

Table 1: Results of companies that adopted the Lean manufacturing, considering different indices and the period between 2005 and 2015

Year	COMPANY 1					COMPANY 2					COMPANY 3					COMPANY 4				
	FL	MC	LL	NE	NED	FL	MC	LL	NE	NED	FL	MC	LL	NE	NED	FL	MC	LL	NE	NED
2005	9.1	24%	5%	3.8	2.6	4.9	19%	3%	0.8	0.1	5.1	28%	7%	0.6	1.7	17.0	16%	4%	1.5	4.3
2006	8.2	22%	6%	4.6	1.8	5.0	23%	7%	0.8	0.1	5.2	26%	2%	0.7	1.8	16.5	13%	1%	1.7	4.6
2007	9.9	16%	5%	4.9	3.0	5.5	28%	10%	0.8	0.1	6.6	28%	5%	0.8	2.2	22.4	14%	2%	2.2	7.4
2008	11.7	20%	8%	6.8	4.2	5.9	31%	13%	1.1	0.1	11.4	24%	0%	1.6	5.3	23.0	12%	-11%	2.9	11.2
2009	10.8	19%	6%	4.2	3,5	6.6	20%	7%	0.6	0.1	15.9	23%	1%	3.1	8.8	19.4	13%	5%	1.9	9.0
2010	9.3	19%	8%	3.6	2.3	7.3	25%	10%	0.9	0.1	22.6	25%	4%	2.1	7.1	25.5	16%	7%	3.0	10.2
2011	9.8	22%	5%	4.2	3.1	7.4	24%	5%	0.8	0.1	25.7	26%	5%	2.7	8.0	32.5	11%	-2%	3.6	15.1
2012	12.1	24%	10%	4.4	4.2	8.4	22%	10%	0.9	0.1	28.5	23%	3%	3.0	9.4	35.5	9%	-2%	4.1	17.5
2013	13.6	23%	12%	5.3	5.1	9.3	23%	11%	1.1	0.1	27.7	25%	4%	3.1	10.0	40.9	13%	1%	5.0	18.5
2014	14.9	20%	9%	6.3	6.6	9.6	22%	11%	1.1	0.2	29.0	29%	8%	2.9	11.5	46.0	13%	2%	5.3	20.3
2015	20.3	18%	5%	9.0	13.8	9.3	17%	4%	1.1	0.2	32.2	31%	10%	4.0	15.2	47.2	22%	6%	5.5	27.2

Source: CVM (2016); BM&FBOVESPA (2016)

Indices in order of presentation:

FL - Net Sales - in billions of Brazilian Real

MC - Contribution Margin – in %

LL - Net Profits – in %

NE - Inventory Levels - in billions of Brazilian Real

NED - Levels of Indebtedness - in billions of Brazilian Real

COMPANY 1

With offices and factories in various parts of the world, this leading company in its segment in Brazil is listed on the Dow Jones Sustainability Index (DJSI) and BM&FBovespa Corporate Sustainability Index (ISE) portfolios, composed of organizations that have the highest standards of governance and sustainable management.

The performance of Company 1, before, during and after-deployment lean manufacturing was evaluated. Net revenue remained stable, once between 2005 and 2008 the average was already 22% in relation to net revenues. Between 2009 and 2012, at the peak of lean deployments, gross profit reached an average of 19% of gross revenues. However, in the economic environment, after 2013, gross profit rose to 22% of net revenue, reaching lean indexes similar to those pre lean manufacturing.

After lean manufacturing, the average operating profit on net revenue was 6% and, from the period of 2009-2012, a good average of operating profitability was established, advancing to a level of 10% on the operating profit due to the automation and de-bureaucratization of productive and administrative processes, with restructuring including employees.

In lean manufacturing years, inventories remained at a good level compared to previous periods - average inventory during implementation 2008/2012 was R$ 4,200 million versus an average of R$ 4,900 million previously. In fact, factory supply also changed so that, prior to lean, all inputs to be used in the assembly were disposed alongside the product under construction; currently, the components are delivered and used every shift.

However, the economic situation led, after 2011, to a level of R$ 6,000 million, on average, so that growth in the stock level, from 2005 to 2015, increased by 232%, surpassing the growth in the level of net sales (variation of 122% in the same period). This positive variation in stocks is not in line with the principles of adoption of the lean manufacturing processes initially proposed.

The level of borrowing, in turn, increased considerably; before implementation, was R$ 3,500 million a year, but after 2011, the funding level reached R$ 6,000 million.

It is thus perceived that structural investments require high efforts and financing that improve logistic performance (speed and quality), but also require compatible financial performance for the maintenance of new practices.

COMPANY 2

It is a multinational company and the largest manufacturer of domestic utilities in the world, present in practically all countries. In Brazil, the company has 3 factories, 2 administrative offices, 4 technology centers, 23 laboratories and 3 distribution centers.

Net sales remained stable, once between 2005 and 2008 the average was already 26% in relation to net revenues. Between 2009 and 2012, gross profit went to an average of 23% of gross revenues, however, given the economic situation after 2013, gross profit rose to 21% of net revenue, showing a lower performance than before of lean manufacturing.

Considering the years before the introduction of lean manufacturing, the average operating profit on net revenue was between 8 and 9%; in the post-deployment years, operating profit remained at an average of 9%.

In the production lean years, stocks remained at average levels similar to previous periods, that is, average inventory during the 2009/2012 implementation - R$ 811 million versus an average of R$ 849 million previously. However, after 2011, the stock reached a level of R$ 1,150 million, on average, representing a growth of 144%, between 2005 and 2015, being higher than the index of inflation of the period (approximately 90%). Therefore, a reduction of inventories was not observed as proposed in lean manufacturing.

Finally, with regard to the level of indebtedness, in this case the effects of loans and financing remained at stable levels.

Therefore, there was no substantial influence of lean philosophy on the company's financial results. However, analyzing the practices for the transition to lean manufacturing, there was a preponderant interference in logistics and production control.

COMPANY 3

It is one of the largest food companies on the planet and is a global leader in the export of animal protein to produce food that reaches more than 150 countries on five

continents. It has around 105 thousand employees in 35 industrial units in Brazil; 16 overseas factories and 40 distribution centers.

It was observed that, during the lean manufacturing implementation period, due to the complexity and size of the company, there was a decrease in the average gross margin, reducing from 26 to 24%. The consistency in the use of the organization in cells allowed an optimization in anti-waste practices and the company's margins increased from 24% in the implementation period to 29% in subsequent years, in order to give leverage in return for the organization.

During the implementation of lean manufacturing, Company 3 undertook a vast restructuring in its production sites, as well as remanufactured its administrative structure and controls to a cellular base according to the logistics of its factories, creating subdivisions according to the product. These changes impacted on its EBITDA (earnings before interest, taxes, depreciation and amortization), which jumped from an average of 3% in the pre-implantation and during the implantation periods to an average of 7% in the post-implantation period.

The process of corporate restructuring and factory alignment focused on lean manufacturing began in mid 2008/2009 through the association of two of the largest processed food companies in the world. Thus, after the merger, the company launched a process of restructuring and reorganization of its plants in Latin America, applying lean manufacturing processes and processing readjustment in serial cells with the approach of suppliers.

In reference to inventories, the association of processed food companies between 2008 and 2009 meant that inventory levels obviously migrated from a balance of less than R$ 1 billion to R$ 3 billion after 2009. Differently to economic-accounting results that made a positive leap with the implementation of lean manufacturing, stocks jumped to R$ 4 billion in mid-2015.

Another factor that demonstrates the increase in the level of inventories refers to the comparison with indices inflationary; inflation between 2012 and 2015 was 25%, while the level of inventory increase was 50% for the same period.

A major effort in restructuring the post-merger company was observed through the level of indebtedness, so much was invested in the reorganization of production units around South America, contributing to the high indebtedness ratio that increased from R$ 1,2 billion in 2005 to R$ 12 billion in 2015.

Analyzing the case of Company 3, it can be observed that lean manufacturing, together with the restructuring of

the factories with a focus on high waste control and cell production, gave positive results in the economic performance that reflects positively today. However, too much indebtedness and a need to improve on the basis of decreasing turnover are left as a remnant.

COMPANY 4

Created in the early 2000s, it is the largest producer of thermoplastic resins in America, the world leader in the production of biopolymers and the largest producer of polypropylene in the United States. It has 40 industrial units, 29 in Brazil, 5 in the United States, 2 in Germany and 4 in Mexico.

It was noted that the contribution margin rose from 12% to 16%. The use of lean manufacturing in its factories helped consolidate international demand and leveraged sales with rapid and effective deliveries from the cellular organization the company adopted.

As this industry shares a history of successive acquisitions, from its foundation to mid-2010, its main challenge has become the adequacy of its administrative and commercial structure. Thus, the cellular structuring for adapting to lean manufacturing was reflected in all the fixed structures of the factories, contributing to the improvement in operational profit, which increased from 1 to 3% in the post-implantation period.

Again, it was observed that the main challenge in implementing lean manufacturing is consistent reduction in inventories. Thus, the industry in question had, in 2002, R$ 1,567 billion in inventories; in contrast, in 2015, it presented R$ 5,517, meaning a variation of 252%, which surpassed the sales (variation of 177%) in the same period. Other evidence of a significant effort in the restructuring of the post merger company was the level of indebtedness, contributing to the increase of R$ 3.2 billion in 2005 to R$ 25.3 billion in 2015.

Thus, Company 4 presented a positive influence on its lean manufacturing post-roll results, albeit without significant variation.

LEAN MANUFACTURING: IMPLICATION IN THE ACCOUNTING SYSTEM

According to the data collected, a similarity was observed in the response of the questionnaires by Company 2 and Company 4, pointing out that, although they are of different segments, the path taken to implement lean manufacturing, as well as the difficulties encountered, were very close.

The primary data collected corroborate the information of the CVM and Bovespa and suggest why it has not been generally verified a very significant influence of the lean philosophy on the economic financial results of the companies. Regarding planning for the implementation of lean manufacturing, the

organizations under study presented 80-90% of the conditions necessary for the implantation of lean thinking, including the training of employees according to the new production practices.

Also, the companies adopted internal controls in the pursuit of measures that indicated the positive effects on the customers gain, reduction of wastes and performance of the supplies of the suppliers. The companies still had difficulties in maintaining the low levels of inventories due to the set-up of machines and excessive regulation, demanding high security stocks.

The suppliers had an impact on the performance of lean production, so that the difficulties in conditioning the production cycle were observed. The Company 4, for example, highlighted the balance between customer orders and the supply time, explaining the stock level of 252%, between 2005 and 2015.

Regarding the financial gain, a Company 2 obtained a gain of 15% in profitability, but had a difficult to point out the overall gain of the chain. Company 4, on the other hand, is not a numerical example that allows analysis of some kind, stating that the controls for this election are still under supervision.

Both companies did not demonstrate certainty as to the accounting method that reflected the flow of value. In fact, the answers show the maintenance of the traditional methodology in the internal controls for the calculation of costs in accounting, representing a bottleneck in the accounting controls of a company with lean manufacturing.

The results obtained corroborate the study by Collatto et al. [12], which indicated that industrial firms that have adopted lean manufacturing continue to use traditional costing methods since they understand that the sophistication of accounting methods will not lead to more assertive management information.

Fullerton et al. [13] evaluated 244 industrial goods firms in the United States and found that the extent of lean manufacturing implementation is associated with the appropriate use of accounting practices. The authors concluded that lean accounting positively influences the use of value flow costing, which, in turn, positively influences the use of visual performance measures.

Other works in the literature also claim that traditional cost accounting systems are inadequate when referring to the principles of lean manufacturing, and it is necessary to rethink the management and accounting system under the lean accounting approach based on the flow of value [5, 6].

V.   CONCLUSION

The studied companies can be seen as a milestone in the implementation of lean manufacturing in Brazil and the trajectory covered by each of them, explored in the present study, can serve as a basis for directing better practices for applying lean thinking in the productive and corporate environment.

In companies 3 and 4, there was a slight increase in the contribution margin, in the post-implantation period of the lean philosophy. In addition, the exploration of lean practices has led to a more significant increase in net income in almost all the companies surveyed, although an increase in the level of indebtedness of more than 200% between 2005 and 2015 has also been observed. Implantation of the production cells of the value chain and the training of the employees demand a lot of investments, collaborating to the increase of the indebtedness in the long term.

In all companies, one point worth mentioning is a significant increase in inventories (above 140%) between 2005 and 2015, which is totally against the principles of lean manufacturing. This fact demonstrates the impact that suppliers can have on the performance of lean manufacturing, so that difficulties were observed in conditioning the suppliers to the production cycle, which caused a constant search of partners with certifications and efficiency in the time of supply of the supplies.

An inadequate integration between the control system and the lean manufacturing was verified, generating a costing method and mismatched evaluations in the leading companies studied. Thus, investments in the implementation of lean manufacturing should be not only well planned, but well coordinated and managed through accounting controls appropriate to lean philosophy.

In this sense, a bottleneck observed mainly in companies 2 and 4, since the industries did not demonstrate certainty as to the appropriate accounting method that reflected the flow of value and the effective gains in the productive cycle.

Although the flow of value in the cells allowed production to continue uninterrupted, reducing costs, companies did not reach the objective of systematic reduction of inventories due to supply chain failures and failures to integrate accounting controls in costing, as indicated by the primary data collected.

Therefore, the results obtained confirm that the full adoption of lean thinking, through lean enterprise, is a process that starts on the factory floor and evolves to the administrative areas of organizations, including the entire chain of value. In this way, it can be concluded that the companies studied can be characterized only as lean companies, being far from exercising the precepts of lean management of the business.

It was verified the importance of the spread of practices and actions related to lean accounting in the corporate environment, in order to meet a production system based on lean manufacturing. At this point, it is perceived that an adequate analysis of the financial-managerial statements derived from the adhesion to lean manufactuirng by the company is of paramount importance for the maintenance of investments, route correction and any other type of decision making that effectively optimizes the results of a lean company.

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The Impact of Interactive Physics Animate Media to Concept understanding of High School Students

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Abstract— *The purphose of this research is to know the impact of Interactive physics animate media to concept understanding of high school students. The impact of media can be shown by difference of concept understanding indicator before and after learning physics with Interactive Physics animate media. The design of this research is one group pre-test and post-test. The subject of this research are 75 students class XI senior high school. The technique to get data in this research is test before and after learning physics with Interactive physics animate media. The data analyze in this research is using IBM SPSS 20 with paired sample t-test. The result of this research shows that p-value < 0,05 wich mean that the concept understanding of students is increased after using Interactive Physics animate media.*
Keywords— Physics Animate Media, IBM SPSS 20.

I. INTRODUCTION

Learning in 21th century must develope a vision of education using technology that make impact to concept understanding (Aderson & Krathwohl, 2001). One of contribution to developing a vision in learning is developing physics learning for students (Sanders, 2007), because physics is one of science that studies and analyzes the symptoms or processes of nature and the nature of substances and their application (Giancoli, 2014). Developing physics learning is an important thing in this global era, because by learning physics student can explore their skills to face complexity problem (Dircknick and Holmfeld, 2009). But a lot of students think that physics is more hard then the other lesson. That because physics contains some of abstract concept (Omek, et al., 2008). According to result of begining observation to some high school in Jember, that student use text book to learning physics concept. According to Halim et al (2012), student more hard to study a science concept because a lot of material content should be memorize. Whereas, physic is a lesson that have a lot of abstract concept and it can't be understand if the student only memorize the material content. For that, we need to

develop an innovative physics learning. Innovative learning can make students esier to finishing problem and understanding of physics concept (Hmelo and Ferrari, 2016; Heong, et al., 2011).

Concept understanding is a part of cognitive skill, this skill make some one understand the content on some learning matery (Darvies in Dimyati & Mudjiono, 2009). Students can be said understand a concept if they can explain the concept correctly. Concept understanding devided to be three part namely translation understanding, interpretation understanding, extrapolation understanding (Sudjana, 2012). The student will have all of concept undertanding if they can learning with good media (Wicaksono, 2017). According to the result of interview by the researcher to some high school in Jember, students prefer learning physics with media and animation because difficult content become esier and more interesting. For that, we need to use a kind of animated interactive media.

Interactive media is one of kind media that the user can be free to use the media (Suhandi, et al., 2009). According to (Gunawan, et al., 2015), interactive media can make student more active physics learning. Learning with interactive media more meaningfull, because the student can explore their skills to solve a problem (Saregar, et al., 2013). One of interactive media that can make student more attractive is animated media. So the researcher do this research to know the impact of interactive physics animate media to concept understanding of senior high school.

II. METHODOLOGY

The type of this research is quasi experimental research The purphose of this research is to analyse the impact of interactive phisycs animate media to concept understanding of high school students. It was using one group pre-test and post-test design. The early researh had done with observation about student media and interview with 30 student from 3 of 10 high school in Jember district The interview has given with some qustion about requirement of media in physics learning.

The impact module of interactive phisycs animate media to concept understanding is shown by the existence of significant (statistically) increment scores of all concept understanding categories between the pre-test and the post-test. The test was using one groups of students at science study program in islamic senior high school academic year 2018/2019. There are 32 students in these group. Every students have pre test before learning phisycs concept, after that students learning with interactive phisycs animate media, and than students have post test.

The score of pre test and post test were analyzed with the paired t test or non parametric analyze Wilcoxon test. The testing methode was selecting depend on the fulfilment of the nomality assumtion for pre test and post test scores. Otherwise, the non-parametric analysis will be used. The analysis was performed using the IBM SPSS Statistics 20 software.

III. RESULT

The The result of this research are presented in Figure 1, Table 1, and Table 2. The Figure 1 is result of score pre-test and post-test for all categories concept understanding. The orange bar is representing the pre-test and the shaded bar for the post-test. Table 1 and Table 2 are representing the existence of significant (statistically) increment scores between the pre-test and the post-test of Translation, Interpretation, and Extrapolation understanding.
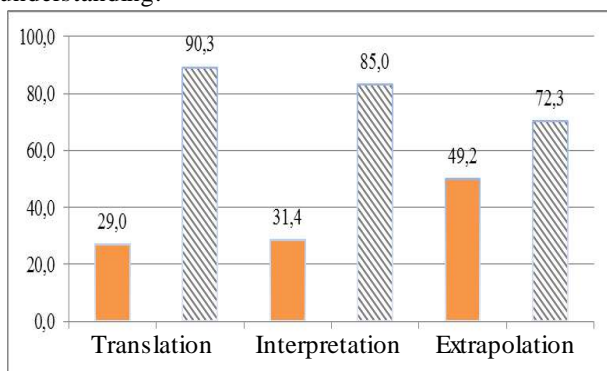
Fig.1: The score of the students' concept understanding before and after learning with interactive phisycs animate media.

Table 1. The result of normality test for concept understanding of students

	Translation	Interpretation	Extrapolation

	Pre-test 1	Post-test 1	Pre-test 2	Post-test 2	Pre-test 3	Post-test 3
N	36	36	36	36	36	36
Paired Sample Test Sig. (2-tailed)	0.00001		0.00001		0.00001	

Table.2. The result of paired t-test for concept understanding of students.

	Translation		Interpretation		Extrapolation	
	Pre-test 1	Post-test 1	Pre-test 2	Post-test 2	Pre-test 3	Post-test 3
Asymp. Sig. (2-tailed)	0.326	0.072	0.061	0.071	0.128	0.231

Figure 1 represents that the score in the pre-test and the post-test in all of categories of student's concept understanding in using of interactive phisycs animate media is increasing. The score of the pre-test and the post-test for the translation understandings category respective are 29.00 and 90,3; The score of the pre-test and the post-test for the interpretation understandings category respective are 31,4 and 85; The score of the pre-test and the post-test for the extrapolation understandings category respective are 49.2 and 72.3. The result show that all student's concept understanding are increasing,. The summary of the paired t-test after the fulfilment of the normality assumptions for all pre-test and post-test is shown in Table 1 and Table 2. For that, we used a paired t-test statistical measurement.

IV. DISCUSSION

Acording to the Figure 1, we can see that before learning with interactive phisycs animate media was done, the mean scores of student's concept understanding are low. The mean scores of student's concept understanding after using interactive phisycs animate media can be categorized as high acording Hake (Jatmiko, 2016). The result of the research were suported by Gunawan., et al (2015) and Saregar ., et al (2013) that student's concept understanding skill was increase after using Interacive multimedia. The most high increament on the Figure 1 is translation understanding and the most low increament is extrapolation understanding. Acording to Bloom it cause translation understanding is only change variables and extrapolation understanding is predict a problem, so extrapolating is more dificult to understand for student (Sudjana, 2012).

Acording to the Table 1, we can see that the score of asym significant > 0.05, it mean that scores pre-test and post-test in all categories of student's concept understanding was normal, so we choose paired sample t-test for the the statistically test. The scores of paired sample test in all categories of student's concept understanding < 0.05. It mean that there is impact of interactive phisycs animate media on physics concept understanding. That happen because student learn with interactive phisycs animate media in physics. This arguement was suported by result of study by Wicaksono, et al., (2011) and Suhandi, et al., (2009) that concept understanding of student become increa after using interactif media in learning. The increament of students concept understanding is because of using animate media in learning, so student have motivation and esier to understand physics concept. This statement suport by Anggraeni (2013), coca, et al., (2013), and Hopson (2014) that using technology and animate media is make learning more active and students achievement increas. Similiarly with Cui, et al., (2017); Harianto, et al., (2017); Sharif, Wills, & Sargent, (2010) that students achievement increas in term using visual media in learning..

V. CONCLUSION

Based on research above, the student's concept understanding after using interactive phisycs animate media had significant increament. So, it can be concluded that there is impact interactive phisycs animate media on student's concept understanding.

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Water Wave Modeling using Wave Constant G

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Abstract— *In this research, analytical method of water wave dynamics was developed using wave constant G at velocity potential of Laplace equation solution result, where at small amplitude theory the wave constant was eliminated with wave amplitude. The assumption of sinusoidal wave is maintained.*
The calculation methods that were formulated include wave number calculation method and shoaling and breaking modeling. Using the wave constant, then equilibrium equation will be met more accurately.
Keywords— Wave constant G, sinusoidal water wave surface, wavelength, shoaling-breaking.

I. INTRODUCTION

Small amplitude wave theory (Dean (1991)) was formulated with an assumption that wave amplitude is very small so that the elevation of water wave surface at the execution of Bernoulli equations at the surface is considered to coincide with the still water level elevation (zero elevation). Using this method, relation equation between wave constant G and wave amplitude A was formulated. Afterwards, wave constant G at velocity potential equation was eliminated with wave amplitude A. Bearing in mind that there is no wave amplitude at the velocity potential equation, then the accuracy of wave analysis by eliminating wave constant G requires accurate relation equation. Particle velocity equation which is a differential of velocity potential equation is a function of wave constant G where the particle velocity is used in various calculations and at equilibrium equation. Hence, eliminating wave constant G with wave amplitude requires an accurate relation.

In this research, relation between wave amplitude A and wave constant G was formulated without working on the assumption of small and long wave and without eliminating wave constant G. As a result, an equation where wave constant G together with wave amplitude A as its variables was formulated. The relation was formulated using KFSBC together with momentum equation.

To simplify the calculation, the equation was developed by maintaining an assumption that the wave is sinusoidal, where wave height H is twice wave amplitude or $H = 2A$. The existing understanding is that sinusoidal wave is only

for small amplitude wave. This research experienced no obstacle as a result of the working on sinusoidal wave assumption and quite accurate calculation result was obtained.

II. VELOCITY POTENTIAL FOR SLOPING BOTTOM

In this research, velocity potential at sloping bottom from Hutahaean (2008) was used with initial form as follows
$$\Phi = Ge^{kh}\beta(z)coskxsin\sigma t$$
G is wave constant, k is wave number, σ is angular frequency, $\sigma = \frac{2\pi}{T}$, T is wave period, z is elevation at vertical axis with $z = 0$ at still water level surface. In this research, a new constant $G = Ge^{kh}$ was formed and bearing in mind the separation between G and e^{kh} did not provide any benefit at all; therefore, to make it more concise, incorporation was done, then the potential velocity equation becomes:
$$\Phi = G\beta(z)coskxsin\sigma t \quad ....(1)$$
$$\beta(z) = \alpha e^{k(h+z)} + e^{-k(h+z)} \quad ....(2)$$
$$\beta_1(z) = \alpha e^{k(h+z)} - e^{-k(h+z)} \quad ....(3)$$
$$\alpha = \frac{1}{2}\left(\frac{1+\frac{dh}{dx}}{1-\frac{dh}{dx}} + \frac{1-\frac{dh}{dx}}{1+\frac{dh}{dx}}\right) \quad ....(4)$$

$\frac{dh}{dx}$ is bottom slope. At sloping bottom there will be $\frac{dG}{dx}$ and $\frac{dk}{dx}$. Related to the changes in the value of the wave constant, there are two conservation laws in the velocity potential equation, i.e. wave number conservation and energy conservation.

a. Wave Number Conservation
At the execution of Laplace equation with variable separation method, as it is with $coshk(h + z)$ at velocity potential for horizontal bottom, it has been determined that $\beta(z)$ is just a function of z, hence:
$$\frac{d\beta(z)}{dx} = 0 \quad ....(5)$$
$$\frac{dk(h+z)}{dx} = 0 \quad ....(6)$$
At $z = 0$, applies
$$\frac{dkh}{dx} = 0 \quad ....(7)$$
or
$$\frac{dk}{dx} = -\frac{k}{h}\frac{dh}{dx} \quad ....(8)$$
For $z = \eta$ where η is the elevation of water wave surface against still water level,

$$\frac{dk(h+\eta)}{dx} = 0$$

At the characteristic point where $coskx = sinkx = cos\sigma t = sin\sigma t$, hence $\eta = \frac{A}{2}$, where A is wave amplitude. This will be explained in other part. Wave number conservation equation becomes

$$\frac{dk\left(h+\frac{A}{2}\right)}{dx} = 0 \qquad ......(9)$$

or

$$\left(h+\frac{A}{2}\right)\frac{dk}{dx} + \frac{k}{2}\frac{dA}{dx} + k\frac{dh}{dx} = 0 \quad ......(10)$$

Equation (10) can be called continuity equation or mass conservation equation at waves experiencing changes in water depth, wave number k and wave amplitude A. This equation cannot stand by itself, it has to meet certain limitation conditions, in this case Kinematic Free Surface Boundary Condition (KFSBC).

b.   Energy conservation

Other characteristic contained in (1) is energy conservation that will be formulated as follows.

The velocity of water particle in horizontal u direction at the direction of axis-x is,

$$u = -\frac{d\Phi}{dx} = Gk\beta(z)sinkxsin\sigma t - \frac{dG}{dx}\beta(z)coskxsin\sigma t .....(11)$$

Differential of this particle velocity equation in horizontal direction against axis-x, where there are changes in G and k is

$$\frac{du}{dx} = Gk^2\beta(z)coskxsin\sigma t$$
$$+ \frac{dGk}{dx}\beta(z)sinkxsin\sigma t$$
$$+ \frac{dG}{dx}k\beta(z)sinkxsin\sigma t - \frac{d^2G}{dx^2}\beta(z)coskxsin\sigma t$$

Particle velocity in vertical direction is,

$$w = -\frac{d\Phi}{dz} = -Gk\beta_1(z)coskxsin\sigma t$$
$$.......(12)$$

The differential of this equation against vertical-z axis is

$$\frac{dw}{dz} = -Gk^2\beta(z)coskxsin\sigma t$$

Mass conservation law or continuity equation is $\frac{du}{dx} + \frac{dw}{dz} = 0$. Substitute equations $\frac{du}{dx}$ and $\frac{dw}{dz}$, and work on the characteristic point, i.e. a point where $coskx = sinkx = cos\sigma t = sin\sigma t$,

$$G\frac{dk}{dx} + 2\frac{dG}{dx}k - \frac{d^2G}{dx^2} = 0 \qquad ....(13)$$

The equation can be written as,

$$\frac{d^2G}{dx^2} = G\frac{dk}{dx} + 2\frac{dG}{dx}k \qquad ....(14)$$

Either (13) or (14) can be called mass conservation equation, but considering that at G there is energy

dimension, then it can be called energy conservation equation. At either long wave or small amplitude an assumption of $\frac{d^2G}{dx^2} = 0$ can be done, so the following relation was obtained,

$$\frac{dG}{dx} = -\frac{\frac{dk}{dx}}{2k}G \qquad ....(15)$$

or

$$\frac{dG}{dx} = -\mu Gk \qquad ....(16)$$

$$\mu = \frac{\frac{dk}{dx}}{2k^2} \qquad ....(17)$$

$\frac{dk}{dx}$ at (15), (16) and (17) can be approached with (8) i.e. $\frac{dk}{dx} = -\frac{k}{h}\frac{dh}{dx}$. Therefore, in this case energy conservation equation is connecting changes in G with changes in water depth h and wave number k. In this research energy conservation equation with higher degree of accuracy was used, i.e. $\frac{d^3G}{dx^3} = 0$. Equation for $\frac{d^3G}{dx^3}$ was obtained by differentiating (14) against horizontal-x axis and at the element $\frac{d^2G}{dx^2}$ substitute with (14), and $\frac{d^2k}{dx^2}$ is ignored since it is very small, a form of energy conservation like (16) was obtained, i.e. $\frac{dG}{dx} = -\mu kG$ with different coefficient of changeμ.

$$\mu = \frac{2\frac{dk}{dx}}{\left(3\frac{dk}{dx} + 4k^2\right)} \qquad ....(18)$$

With relation (16), hence particle velocity at the direction of horizontal-x axis becomes

$$u = Gk(sinkx + \mu coskx)\beta(z)sin\sigma t ....(19)$$

III.   THE METHOD OF WAVELENGTH CALCULATION

The first equation connecting G and k is KFSBC:

$$\gamma\frac{d\eta}{dt} = w_\eta - u_\eta\frac{d\eta}{dx} \qquad ....(20)$$

γ is weighting coefficient at weighted total acceleration equation with a value of 2.784-3.160 (Hutahaean (2019a)) and 2.483 for $H_{1/3}$ and 2.202 for $H_{1/10}$ in Hutahaean (2019b). This research used the value of$\gamma = 2.483$. Substitute (12) and (19) that was done at $z = \eta$ to (20), where the right side is multiplied with $\frac{\sigma}{\sigma}$,

$$\frac{d\eta}{dt} = -\frac{Gk}{\gamma\sigma}\sigma\Big(\beta_1(\eta)coskxsin\sigma t$$
$$+ (sinkx + \mu coskx)\beta(\eta)sin\sigma t\frac{d\eta}{dx}\Big)$$

At the characteristic point, this equation can be written as

$$\frac{d\eta}{dt} = -\frac{Gk}{\gamma\sigma}\Big(\beta_1(\eta) + (1+\mu)\beta(\eta)\frac{d\eta}{dx}\Big)\sigma coskxsin\sigma t$$

Wave amplitude A is defined as,

$$A = \frac{Gk}{\gamma\sigma}\Big(\beta_1(\eta) + (1+\mu)\beta(\eta)\frac{d\eta}{dx}\Big)....(21)$$

$$\frac{d\eta}{dt} = -A\sigma coskxsin\sigma t ....(22)$$

$\eta = A cos kx cos \sigma t$ ....(23)

$\frac{d\eta}{dx} = -kA sin kx cos \sigma t$ ....(24)

By working on the assumption at (22), (23) and (24), there is an assumption that water wave surface equation is sinusoidal, where wave height $H = 2A$. From (23), at the characteristic point $\eta = \frac{A}{2}$, then (21) becomes

$A = \frac{Gk}{\gamma\sigma}\left(\beta_1\left(\frac{A}{2}\right) - (1+\mu)\beta\left(\frac{A}{2}\right)\frac{kA}{2}\right)$ .....(25)

This equation is the first equation for G and k calculation with wave amplitude A as input,

$f_1(G,k) = -A + \frac{Gk}{\gamma\sigma}\left(\beta_1\left(\frac{A}{2}\right) - (1+\mu)\beta\left(\frac{A}{2}\right)\frac{kA}{2}\right)$

...(26)

As the second equation is surface momentum equation where convective velocity is ignored.

$\gamma\frac{du_\eta}{dt} = -g\frac{d\eta}{dx}$ ....(27)

From (19)

$u_\eta = Gk(sin kx + \mu cos kx)\beta(\eta)sin\sigma t$

$\gamma\frac{du_\eta}{dt} = Gk\sigma(sin kx + \mu cos kx)\beta(\eta)cos\sigma t$

At the characteristic point the second equation was obtained, i.e.

$f_2(G,k) = \gamma\sigma G(1+\mu)\beta\left(\frac{A}{2}\right) - gA$

......(27)

(27) can be formed into equation for G and it is substituted to (26), so an equation is formed just for wave number k. In this research, the two equations are done simultaneously, so the values of G and k are obtained which meet KFSBC and momentum equation, with input σ, h and wave amplitude A. The calculation was done using Newton-Rhapson method, where this iteration method needs initial price of iteration. As the initial price, for wave number k equation from Hutahaean (2019a) was used, i.e.

$\gamma^2\sigma^2 = gk\left(1 - \left(\frac{kA}{2}\right)\right)$ ....(28)

This equation is a quadratic equation of wave number k that can be completed using simple method to find the root of a quadratic equation. After the value of wave number was obtained, the initial estimation value of G can be calculated using (25) where wave amplitude as input,

$G = \frac{\gamma\sigma A}{k\left(\beta_1\left(\frac{A}{2}\right) - (1+\mu)\beta\left(\frac{A}{2}\right)\frac{kA}{2}\right)}$ .....(29)

3.1. The result of wavelength L calculation

Wave number k can be changed into wavelength with a simple relation, i.e. $L = \frac{2\pi}{k}$. The result of wave length calculation for various wave periods in a number of water depths is shown on Fig.1, where the calculation was done at bottom slope $\frac{dh}{dx} = -0.005$, weighting coefficient $\gamma = 2.483$, and wave amplitude $A = 0.6$. m.
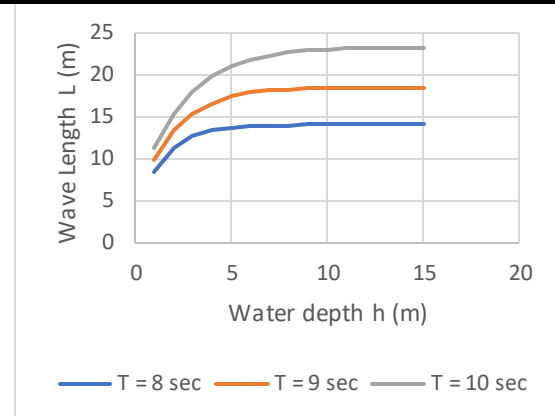
Fig.1: Graph of wave length against water depth

Fig.1 shows that wave with wave period of 8 sec, wavelength constant starts at water depth 9.0 m or deep water $h_0 = 8$ m with $L_0 = 14.0$ m, whereas at wave period 9 sec., $h_0 = 10.0$ m with $L_0 = 18.4$ m, at wave period 10 sec. $h_0 = 12$ m, with $L_0 = 23.2$ m. The wave length is quite realistic, quite in line with what exists in the nature.

At the equations for calculating wave number, there are wave amplitude as the variables, hence the wave length that was produced will be determined by the size of the wave amplitude A. Fig.2 shows graph of wavelength against water depth using wave with wave period of 8 sec., wave amplitude A, 0.60 m, 0.80 m and 1.0 m. It is shown that the bigger the wave amplitude, the shorter the wave length. The calculation was done using $\frac{dh}{dx} = -0.005$, weighting coefficient $\gamma = 2.483$.
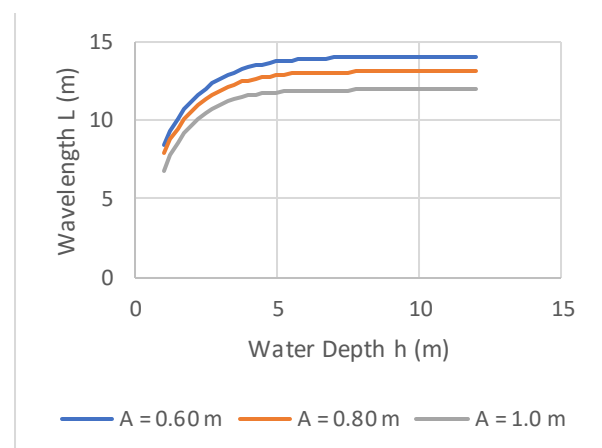
Fig.2: The influence of wave amplitude on wave length

With the presence of the influence of wave amplitude on wave length, the calculation of wave length change from a water depth to a shallower water depth should have been calculated along with shoaling analysis. There is also the influence of bottom slope on wave length which will be discussed on the next research due to space limitation.
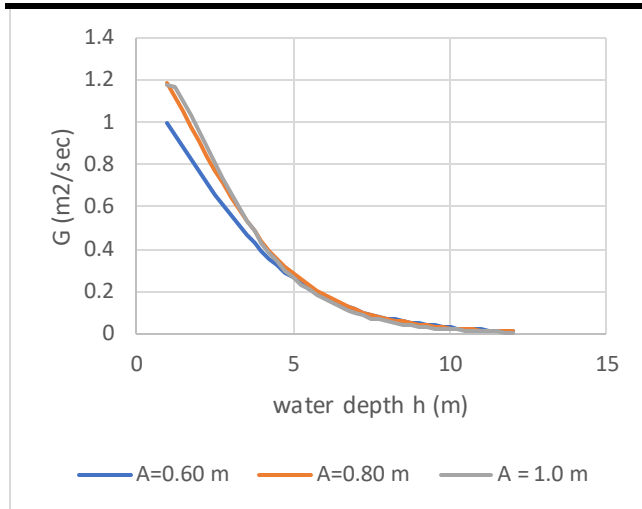
Fig.3: The value of wave constant G

Fig.3 shows the value of wave constant G for wave with wave period of 8 sec., where the influences of wave amplitude and water depth are visible. At the deep water, the influence of wave amplitude is not that big where the value of G at the three wave amplitude values is almost the same. The difference is visible at shallow water, where the bigger the wave amplitude, the bigger the value of G but at big wave amplitude, i.e. 0.80 m and 1.0 m where the difference is very small. Considering that basically particle velocity is a function of wave constant G, then if wave constant G is eliminated with wave amplitude, then a very accurate relation between wave constant G and wave amplitude is needed in order to obtain an accurate particle velocity.

IV. SHOALING AND BREAKING MODEL

In the journey to shallower water, there are 3 (three) wave parameters with changing values, i.e. wave number k, wave constant G and wave amplitude A, where in this case wave amplitude A has been absorbed as variable of a wave. Therefore, at shoaling and breaking analysis there are 3 (three) unknowns, i.e. $\frac{dk}{dx}$, $\frac{dG}{dx}$ dan $\frac{dA}{dx}$ where the changes occurred as a result of changes in water depth h. There is an unchanged wave characteristic, i.e.

$$\beta(\eta_0) = \beta\left(\frac{A_0}{2}\right) = \alpha_0 e^{k_0\left(h_0+\frac{A_0}{2}\right)} + e^{-k_0\left(h_0+\frac{A_0}{2}\right)}$$

and

$$\beta_1(\eta_0) = \beta_1\left(\frac{A_0}{2}\right) = \alpha_0 e^{k_0\left(h_0+\frac{A_0}{2}\right)} - e^{-k_0\left(h_0+\frac{A_0}{2}\right)}$$

Index 0 shows the value at deep water. The conservation of the two characteristics is the consequence of wave number conservation law, where $\frac{d\beta(\eta_0)}{dx} = 0$ and $\frac{d\beta_1(\eta_0)}{dx} = 0$.

As a governing equation of changing equation $\frac{dk}{dx}$, $\frac{dG}{dx}$ and $\frac{dA}{dx}$ are wave number conservation equation, i.e. (10)

$$\left(h + \frac{A}{2}\right)\frac{dk}{dx} + \frac{k}{2}\frac{dA}{dx} + k\frac{dh}{dx} = 0 \quad ......(10)$$

The next equation is KFSBC equation in the form of an equation for wave amplitude A (25),

$$A = \frac{Gk}{\gamma\sigma}\left(\beta_1\left(\frac{A}{2}\right) - (1+\mu)\beta\left(\frac{A}{2}\right)\frac{kA}{2}\right) \quad ......(25)$$

Defined,

$$f = \left(\beta_1\left(\frac{A_0}{2}\right) - (1+\mu)\beta\left(\frac{A_0}{2}\right)\frac{kA}{2}\right) \quad ....(30)$$

$$A = \frac{Gk}{\gamma\sigma}f \quad ......(31)$$

Wave amplitude equation (31) was differentiated against horizontal-x axis

$$\gamma\sigma\frac{dA}{dx} = \left(\frac{dG}{dx}k + G\frac{dk}{dx}\right)f \quad ....(32)$$

Then $\frac{dA}{dx}$ is substituted to (10)

$$\left(h + \frac{A}{2}\right)\frac{dk}{dx} + k\frac{dh}{dx} + \frac{k}{2\gamma\sigma}\left(\frac{dG}{dx}k + G\frac{dk}{dx}\right)f = 0$$

.....(33)

Hence (33) meet KFSBC. For (27) to meet energy conservation equation, then $\frac{dG}{dx}$ is substituted to (16), $\frac{dG}{dx} = -\mu kG$, to obtain changing equation of wave number $\frac{dk}{dx}$ that meets wave number conservation equations, , KFSBC and energy conservation.

$$\left(\left(h + \frac{A}{2}\right) + \frac{Gkf}{2\gamma\sigma}\right)\frac{dk}{dx} = -k\frac{dh}{dx} + \frac{\mu Gk^3 f}{2\gamma\sigma} \quad ......(34)$$

At (34), there is variable μ which is a function of $\frac{dk}{dx}$. Therefore, the calculation of $\frac{dk}{dx}$ with (34) was done using iteration, i.e. the first step, $\frac{dk}{dx}$ was calculated with (8), $\frac{dk}{dx} = -\frac{k}{h}\frac{dh}{dx}$, the value of μ was calculated with (18). Then, $\frac{dk}{dx}$ was calculated with (34) and μ was recalculated with (18). This step is repeated over and over again until a stable value of $\frac{dk}{dx}$ where generally 5-6 iterations have obtained stable value of $\frac{dk}{dx}$. After a stable value of $\frac{dk}{dx}$ was obtained, $\frac{dG}{dx}$ was calculated with (16) and $\frac{dA}{dx}$ with (10). Then, the value of variable at the point $x = x + \delta x$ was calculated at the depth of $h_{x+\delta x} = h_x + \delta x\frac{dh}{dx}$ where $\frac{dh}{dx}$ is negative, using Taylor series.

$$k_{x+\delta x} = k_x + \delta x\frac{dk}{dx}$$

$$G_{x+\delta x} = G_x + \delta x\frac{dG}{dx}$$

$$A_{x+\delta x} = A_x + \delta x\frac{dA}{dx}$$

The calculation was done from the deep water until coastal water, until breaker point and afterward

4.1. Breaking Characteristics

At the equation for the wave amplitude, i.e. (30) and (31), there is breaking condition when $f = 0$,

$$\left(\beta_1\left(\frac{A_0}{2}\right) - (1+\mu)\beta\left(\frac{A_0}{2}\right)\frac{kA}{2}\right) = 0 ....(35)$$

$\beta_1\left(\frac{A_0}{2}\right)$ and $\beta\left(\frac{A_0}{2}\right)$ are values at deep water, where $\beta_1\left(\frac{A_0}{2}\right) = \beta\left(\frac{A_0}{2}\right)$, so that if (35) is divided by $\beta\left(\frac{A_0}{2}\right)$ the result is

$$\left(1 - (1+\mu)\frac{kA}{2}\right) = 0$$

$$\frac{k_b A_b}{2} = \frac{1}{(1+\mu)} ....(36)$$

In (36), there is the influence of bottom slope on the breaking parameter that was absorbed at the value of μ. The formulation process has stated that wave is sinusoidal, i.e. in (22). (23) and (24), then relation $A_b = \frac{H_b}{2}$ applies, therefore breaker length index is obtained.

$$\frac{H_b}{L_b} = \frac{2}{(1+\mu)\pi} ....(37)$$

In (37), there is the influence of bottom slope on breaker height, whereas the previous section has shown that there is the influence of bottom slope on wavelength. So, in general, bottom slope will have an influence on the breaking wave. However, more detail discussion will be done in the next research.

4.2. The result of Shoaling-Breaking Model

As an example, a model was executed for wave with wave period $T = 8$ sec., deep water wave height is $H_0 = 2.32$ m., bottom slope $\frac{\partial h}{\partial x} = -0.005$, weighting coefficient $\gamma = 2.483$. As seen in Fig.4, breaking occurs at breaker depth $h_b = 3.66$ m, with breaker height $H_b = 2.95$ m.
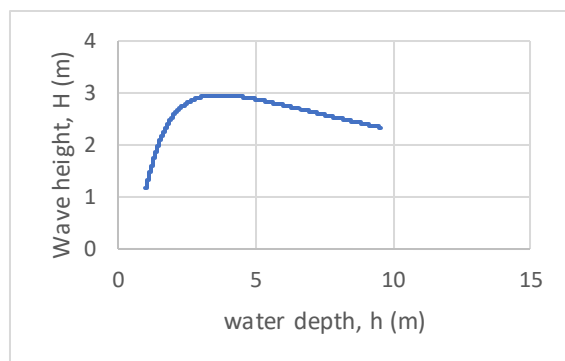
Fig. 4: Shoaling-breaking, wave period $T = 8$ sec., $H_0 = 2.30$ m.

The comparison with breaker height index equations is presented on Table (1). As comparator, the average values of 5 empirical breaker index equations that were obtained from laboratories experiments were used, i.e. Komarand Gaughan (1972), Larson, M. and Kraus, N.C. (1989), Smith and Kraus (1990), Gourlay (1992) andRattana

Pitikonand Shibayama (2000). Whereas comparator for breaker depth, equation from SPM (1984) was used.

Table.1: Comparison of the result of the model with empirical equation

T (sec)	H_0 (m)	H_b (m)		h_b (m)	
		Model	BHI	Model	SPM
8	2,32	2,95	2,71	3,66	3,38
9	2,94	3,73	3,43	4,63	4,28
10	3,63	4,6	4,23	5,71	5,28
11	4,39	5,57	5,12	6,91	6,39
12	5,22	6,63	6,09	8,22	7,61
13	6,13	7,78	7,15	9,65	8,93
14	7,11	9,02	8,29	11,19	10,36
15	8,16	10,36	9,52	12,85	11,89
16	9,29	11,79	10,83	14,62	13,53

Note: BHI: average from 5 (five) Breaker Height Index equation

The comparison between the result of the model with empirical breaker height equation is shown on Table (1). As deep water wave height H_0, 0.9 x H_{0-max} was used in every wave period, where $H_{0-max} = \frac{g}{\gamma^2 \sigma^2}$ m (Hutahaean (2019b)), whereas deep water depth $h_0 = \frac{1.8\pi}{k_0}$, bottom slope $\frac{\partial h}{\partial x} = -0.005$, weighting coefficient $\gamma = 2.483$.. Breaker height H_b from the model is bigger than breaker height from BHI, with an increasing pattern of differences with the increase in wave period.Similar differences pattern occur at breaker depth h_b, but with not so big differences. For more clear information see Fig .5 for breaker height comparison and Fig.6. for breaker depth comparison.
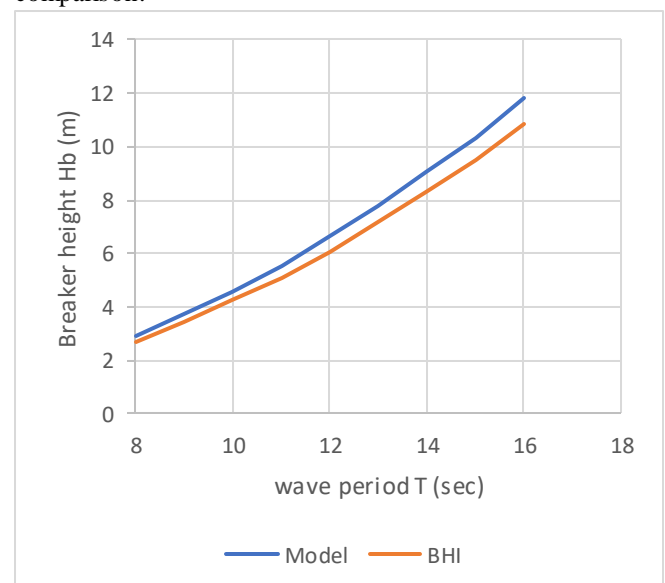
Fig.5: Comparison of breaker height
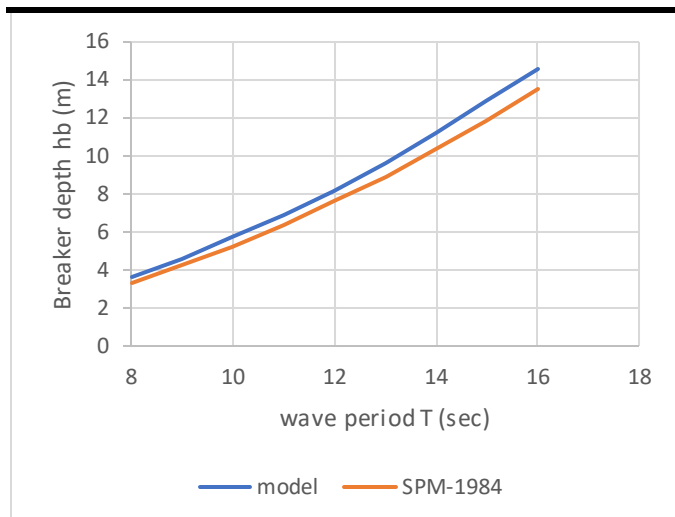
Fig.6: Comparison of breaker depth

Table.2: Comparison of breaker height index $\frac{H_b}{h_b}$

T (sec)	$\frac{H_b}{h_b}$		Model	
	Model	BHI	L_b (m)	$\frac{H_b}{L_b}$
8	0,81	0,8	4,6	0,64
9	0,81	0,8	5,82	0,64
10	0,81	0,8	7,19	0,64
11	0,81	0,8	8,7	0,64
12	0,81	0,8	10,35	0,64
13	0,81	0,8	12,15	0,64
14	0,81	0,8	14,09	0,64
15	0,81	0,8	16,17	0,64
16	0,81	0,8	18,4	0,64

$\frac{H_b}{h_b}$ comparison is shown in Table (2), which shows that the result of the model is quite close with the result of empirical equation. Breaker steepness cannot be compared since there were wave-length differences, where breaker length model L_b is quite short, quite in accordance with what exist in the nature. Breaker steepness $\frac{H_b}{L_b}$ is quite in accordance with analytical equation (37), i.e. $\frac{H_b}{L_b} \approx \frac{2}{\pi}$.

V. CONCLUSION

Wave dynamic calculation using wave constant G can be done easily and provide a quite good calculation result. The wave constant execution enables energy conservation equation execution which is a relation between wave constant changes with wave number changes.

The execution of sinusoidal wave assumption, simplify the correlation of calculation result in the form of wave amplitude with wave height, where generally the information needed is wave height. In addition, the execution of sinusoidal wave assumption in this research found no difficulty in the use of even big wave amplitude.

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Model of Social and Environmental Scientific Research: A Theoretical test Applied to the Analysis of Environmental Public Policies and the Economic and Socio-Environmental Performance of Firms

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Abstract— *This theoretical essay aims to bring up an empirical investigative scientific model based on the approaches of systemic and Cartesian thinking to explain the construct system of government policies and actions related to socio-environmental issues and the economic and social-environmental performance of firms. In this context, it is necessary to highlight the relevance of proposing the construction of a scientific research model to evaluate how socio-environmental issues and public environmental policies influence the economic and social-environmental performance of firms, from the epistemological and theoretical perspectives based on systemic thinking to shape the abstract mental model (conceptual model) of the observed reality and through the Cartesian thought to determine the prescriptive elements of the logical (operational) model of the investigative process. The construction of an empirical research model is an efficient tool to establish connections of distinct realities and their practices associated to search for borderline knowledge, through the appropriation of the epistemological knowledge, theories and the underlying techniques applied to theories. The investigation tool built for research is based on the variables of the conceptual model and the set of problematic situations in the business point of view, covering questions about environmental legislation, institutional instruments for direct regulation in the market; responsibility for environmental damage; international and regional socio-environmental agreements; environmental marketing, economic, environmental and social performance.*

I. INTRODUCTION

In terms of the relationship between society, government and the market, with the business segment as reference, it is necessary to understand if environmental issues impact business decisions, whether due to the need to conform to government policy guidelines dictated by the government, or because of actions of organized society that impose certain standards or rules in defense of the environment to be adopted in segments of economic activity, because there is evidence of a gap in this interlocution between government agents and the business segment in search of a common denominator, with regard to environmental issues. According to Marcovitch (2006), there are significant differences between the time of political logic and business logic. In this scenario, there are still companies that advocate economic growth as a necessary evilness for development, relegating the socio-environmental issues to second place. However, there are companies of the size of General Electric and Wal-Mart with strategies for green product portfolio, as well as companies such as Super-Bac, specializing in biotechnology for waste treatment or Floresta, a manufacturer of organic cosmetics that adopt and develop management practices related to their business activities with respect to the principles of sustainable development. So we came to a standstill? No, there is no deadlock, although there is still a strong dichotomy between the economic and environmental

currents. Reason why, it is necessary to seek answers to some questions: 1) Do public environmental policies affect the economic and social-environmental performance of companies? 2) Does environmental legislation influence the economic and social-environmental performance of companies? 3) Do actions of the public power related to environmental issues influence the economic and social-environmental performance of companies? The answers to these questions will be of great value to know the extent to which environmental public policies can influence the economic and socio-environmental performance of companies. In this context, the relevance of proposing the construction of a scientific research model to assess how environmental issues and policies influence the economic and social-environmental performance of firms, under the epistemological and theoretical perspective structured in systemic thinking must be highlighted, to format the abstract mental model (conceptual model) of the observed reality and through the Cartesian thought for determination of the prescriptive elements of definition of the logical (operational) model of the investigation process. Have et. al (2003, XVI) advocate that a model will always be a powerful tool, if combined with experience, knowledge and employed at the right time, for solutions to certain phenomena or facts.

Systemic thought establishes the mental instruments for abstract description of the reality observed in relation to its constituent parts. Therefore, through the systemic approach, the construction of the conceptual model allows the researcher to expand its dimensions to better understand how socio-environmental issues and their degree of relationships, interactions and interdependence among the various organizational, technological and cultural elements can be associated to the economic and social-environmental performance of companies. On the other hand, the deterministic precepts of the Cartesian view lead to the understanding of the phenomenon or fact by means of the logical description, through the application of statistical procedures, the study variables that attest to their validation and reliability. According to Martins (2005), a research model seeks to specify the nature and importance of relationships between variables, constructs and factors that can offer, based on scientific theories, explainings and explanations of a given System.

Therefore, based on the following question: do public policies and governmental actions related to socio-environmental issues have any association with the economic and social-environmental performance of firms?, this theoretical essay aims to present a proposal of a scientific model of empirical research based on the approaches of systemic and Cartesian thinking to explain the construct system of government policies and actions related to socio-environmental issues and the economic and socio-environmental performance of companies. On the other hand, the contributions of this study will be relevant to open new borders of knowledge in relation to the understanding of environmental issues, especially if environmental public policies and public power actions, based on the regulatory and normative framework of the State, influence the economic and social-environmental performance of companies.

II. THE THEORETICAL CONTRIBUTION APPLIED TO THE INVESTIGATION MODEL

2.1 Economic and socio-environmental enterprise performance under the systematic approach

The sustainability phenomenon, the balance of natural ecosystems in harmony with living beings, has its archetypes studied in various branches of applied natural and social sciences and their respective areas of specialization. These are frontier topics of scientific knowledge coupled with theories of the exact, biological and human sciences which comes from pioneering and contemporary studies on man's anthropic action in nature. Among the numerous preselected sustainability studies related to sustainability, the following stand out: the demographic growth issues of Thomas Malthus's theory (Nobre and Amazonas, 2002); the concern with the environmental degradation and of irreversible character provoked by the action of the man portrayed by George Perkins Marsh, in 1864, in the book Man and Nature, the pioneerism of Svante Arrhenius in 1896, in supporting the hypothesis of correlation between CO_2 emission and Earth's temperature (Marcovitch, 2007). There are also issues related to the technological progress from the industrial revolution and its improvements during the twentieth century, when man improves steam engine and expands his capacities in industry and transport. (Goldemberg and Lucon, 2007).

Yet, it is from the 1970s that concern for the environment and its sustainability-related factors gain momentum when Maurice Strong and Ignacy Sachs coined the concept of eco-development. Also in this decade, the First United Nations Conference on Environment and Development (Stockholm, 1972) was performed, which originated the United Nations Environment Program (UNEP). The Brazilian government, in a pioneering way, in 1981, institutes the Politics and the National System of Environment and creates the National Council of the Environment - CONAMA with the participation of the civil society. Also worthy of note was the fact that, in 1985, as a mark of

Brazilian society, it began the discussion of socio-environmental issues in the first national meeting with the proposal of the creation of extractive reserves, under the command of the seringalist Chico Mendes (Silva, 2006). In 1987 the World Commission on Environment and Development (CMMAD) of the United Nations, chaired by the Prime Minister of Norway, Gro Harlem Brundtland, adopted the concept of Sustainable Development in his report Our Common Future, also known as the Brundtland Report (Aliegri, Almeida and Kruglianskas, 2007, Bellen, 2004; Lago, 2007). However, it was in Eco-92, in Rio de Janeiro, during the United Nations Conference on Environment and Development, at the 1992 UN Earth Summit, that the concept was incorporated as a principle, which served as the basis for formulation of the Agenda 21, with more than 170 countries participating in the Conference as signatories.

However, the consolidation of the concept of Sustainable Development at the World Summit on Sustainable Development, held in Johannesburg, South Africa, through the 2002 Policy Statement, should be highlighted, describing it as a set structured in three interdependent dimensions and interactors - economic development, social development and environmental protection. The United Nations Conference on Sustainable Development (UNCSD) - Rio + 20, which assesses the renewed political commitment of nations to sustainable development and new emerging challenges to meet global challenges, is also associated with this scenario. These dimensions include society, government and companies that are committed to meeting the needs of the current generation, without, in the meantime, compromising the ability to meet the needs of future generations. (Almeida, 2010, Gaetani et al. 2012.).

Therefore, under a new perspective of world vision, whose perspective on the phenomena related to the individual and the new way of thinking the present and the future as interdependent elements and also in relation to the complex interactions between dimensions: society, government and companies, we seek to understand Economic and Socio-environmental Business Development under the systemic approach. Systems theory came to revolutionize the way we know and understand phenomena. It is at first seen as the counterpoint of logical thinking, which was based on the

Cartesian principles of evidence, analysis, synthesis and enumeration, in the representation of its parts as the sum that forms the whole. However, systems theory with its principles based on concepts that the whole does not consist of the simple sum of the parts, revolutionizes the way of thinking the phenomena (Guimarães et al. 2009). According to Woodworth (1976, p. ix) the systemic reality differs from the Cartesian reality:

> The systems approach is a way of thinking about the elements that make up an organism or phenomenon, moving beyond the component parts to the whole, for the consideration of how the subdivisions work, and for an examination of the purposes for which the organism works.

Thus, systemic thinking is formed from the analytical understanding of the set of interrelated parts that constitute a dynamic process of interaction between the various divisions that have a certain phenomenon. In systemic thinking we seek to understand a phenomenon from the whole that it represents and not by the behavior of its parts, therefore, an antithesis to Cartesian thought, where the laws that govern the behavior of the whole are considered fundamental (Rapoport, 1976). In addition, the understanding of systemic thinking becomes significant when we use the concepts and foundations of holism. Holism has the central idea that the universe is a self-organizing reality and matter, life and mind are inseparable (Smuts, 1999). The dimensions of economic, environmental, and social development that make up the archetype of sustainable development are inseparable and self-organizing forming a set comprised of nature, man and the universe.

The systemic vision of sustainable development is based on the organicity, purpose, overallity and aggregability of socio-environmental ecosystems and their economic, environmental and social, interdependent and integrated dimensions, in a dynamic interactive process with the environment, both (ecosystem and environment) in a constant pace of change (Figure 1). Therefore, from the viewpoint of sustainable development, socio-environmental ecosystems and society are living in a continuous process of social, technological and cultural values changes that impose transformations on a sustainable society, through an evolutionary process (Bellen, 2005).
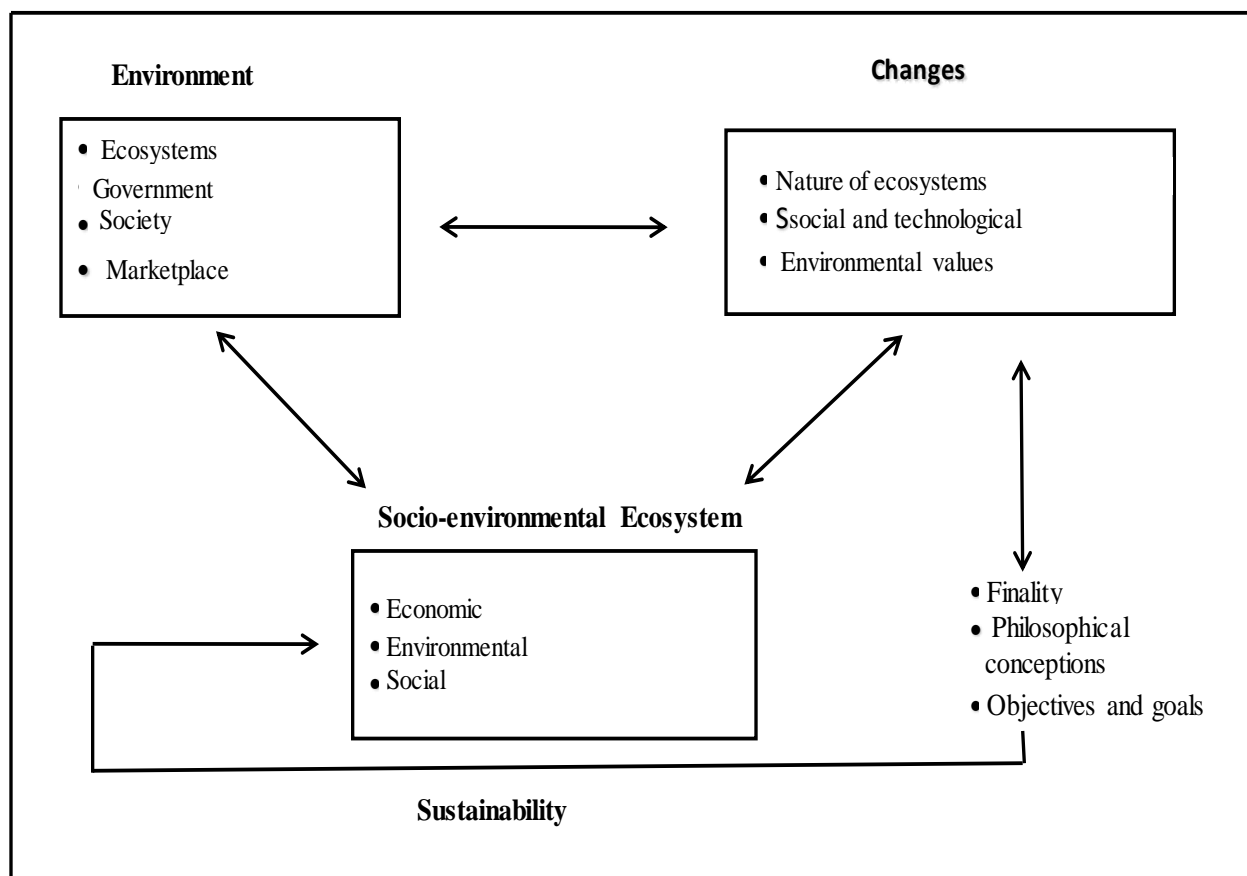
Fig.1: Sustainable development: a systemic view

Source: Almeida (2010)

The sustainability of the business ecosystem is based on the firm's business strategies, based on the premise of making use of natural resources, in order to preserve the conditions for future generation use. Thus, the environmental inputs, the public environmental policies and the actions of the public power are processed by the business ecosystem, in which the firm's business is dimensioned considering the factors related to ecology and the environment, law and the environment, economy and the environment and administration and the environment. The results, business policy and economic, environmental and social performance are new elements inserted into the environment, which will be evaluated to feedback the business ecosystem.

Therefore, the business vision of sustainable development is based on the entrepreneur's expertise in establishing a strategic alignment to insert environmental issues into the core business of the company. On the other hand, the environmental ecosystem presents a series of constraints caused by the set of actions and interests dictated by environmental stakeholders - the society, government and market to be processed by the business

ecosystem and that are dimensioned from the strategic business point of view as threats or opportunities. Hence, it is important to be alert to the scenario of changes signaled by the environment, especially those arising from the action of the State as an economic agent, making political decisions associated with the production, circulation and consumption of wealth under interventionist or non-interventionist ideas whose environmental public policies based on different development styles produce differentiated impacts on business performance.

2.2 The deterministic epistemological basis applied to the investigation model

The dimensions of a phenomenon or fact studied can be described and explained by the construction of a conceptual and operational model of investigation, since its variables and indicators allow an analysis of its constituent elements in an orderly and structured way. In this context, the conceptual (abstract) model describes the mental organization for understanding the phenomenon studied in its various dimensions, as well as their respective interactions among

its various constituent elements. On the other hand, conceptual models become deterministic (operational) insofar as their constituent elements are dissected from their dimensions into variables and indicators that allow them to be measured by statistical tools. According to Martins and Theofilo (2009) the definition of operability leads to a series of procedures to which a measurable meaning is attributed to a concept applicable to a specific set of circumstances. Therefore, based on the concepts and fundamentals of the systemic approach, one can construct the conceptual model of investigation and fulcrum in Cartesian thought, making use of statistical tools, searching for explainings and logical explanations by applying a statistical method of descriptive and inferential analysis.

The (deterministic) operative model, based on the set of variables and data indicators, allows the analysis of research data through the application of the descriptive analysis method, using percentage relative frequency, position, dispersion and association measures

and by the inferential method for hypothesis validation. The authors and specialists in applied statistics to social sciences (Malhotra, 2008; Monteiro Filho, 2003; Mattar, 1996; Levin, 1987) point out that position measures are characterized as instruments for finding what is typical in a group of data and falls within the so-called central tendency measures (mean, fashion and median) and separations (Quartis, Decis and Centis). Now, the dispersion measures (total amplitude, mean deviation and standard deviation) are classified as instruments that allows evaluating the degree of concentration and also the variation that the data has around the mean. In the case of association measures (linear regression, correlation) these are used to verify if there is a relation and / or association between two or more data set searched. They also report that inference methods are useful for testing hypotheses. Table 1 presents an overview of the typologies of Scales and the statistical methods that can be used for data analysis.

Table 1: Measurement Scales for Data Analysis

Scale	Features	Statistical method	
		Descriptive	Inferential
Nominal	Numbers identify and classify objects	Percentage and mode	QI- Square; Binomial Testing
Ordinal	Allows the ordering of numbers in relation to the object	Percentile and Median	Correlation of Posts; Friedman's ANOVA
Interval	Allows the comparison of differences between ranges in relation to an object	Interval, Mean, Standard Deviation	Product-moment Correlation, t-Test, ANOVA, Linear Regression, Factor Analysis
Reason	Comparison of absolute measures and proportion	Geometric Mean and Harmonic Mean	Coefficient of variation

Source: Adapted from Malhotra (2008) Mattar (1996)

Therefore, there are several scales that allow the methodological analysis and interpretation of data of a given empirical research. However, considering data collection through the application of a questionnaire structured on a Likert scale, a set of integrated statistical tools should be sought to allow the validation of the

research instrument, test of significance of hypothesis, as well as analysis of the degree of association between explanatory and explained variables studied. We will now describe some of these statistical methods for analyzing and interpreting empirical research data.

In order to analyze the validation and reliability of the research instrument, it is possible to use the Cronbach Alpha that measures the internal consistency of the data based on the average correlation between the items (Rodrigues and Paulo, 2007) and the Pearson correlation coefficient to measure the degree of association between the grouped components of each question.

According to Selltiz et al. (1967) the scientific process increases the probability that the data obtained are significant, accurate and unbiased to the research question proposed. In this context, the validation of an analogical construct is conditioned to a meticulous scientific process of verification of hypotheses constructed from theoretical and epistemological approaches and, above all, submission of these hypotheses to tests of significance, by applying parametric or non-parametric statistics. For Stevenson (1981) the purpose of the tests of significance is to evaluate the statements about the values of population parameters. In this way, one can, based on a certain statement about a population parameter, by applying a test of significance, make a decision to accept or reject a certain hypothesis. According to Gujarati (2000) the test of significance is a statistical procedure in which the results of the sample are used to verify the validity or falsity of a null hypothesis. The process to determine the test of significance of hypotheses should observe the following requirements (Doria Filho, 1999; Matar, 1996 and Stevenson, 1981), namely:

a) Define the hypothesis H0 (null) and the hypothesis H1 (experimental)

b) Select the appropriate statistical test for the problem

c) Choose a level of significance critical value (s)

d) Calculate the value of the statistical test and compare it with the critical value (s)

e) To decide whether to accept or reject the null hypothesis (H0)

Thus, according to the specificities of the sample data, a parametric or non-parametric statistical tool is applied to test the hypothesis significance.

The linear correlation is a measure that determines the association between a dependent (explained) variable in relation to an independent (explanatory) variable, measuring the degree or the force of that relationship between the variables (Black, 1997; Larson & Faber, 2007; Bruni, 2009). For sample data, Pearson's correlation coefficient (r) was used to determine the strength and direction of the relationship between the dependent (Y) and independent variables (Pearson's correlation coefficient), which were obtained from a given population and that were measured in interval data. X).

The Pearson correlation coefficient expresses, numerically, the degree or the force as the direction of the correlation that presents a variation between -1.00 and + 1.00. The association terms closest to 1, in both directions, describe the greatest correlation force.

III. THE MODEL OF SOCIO-ENVIRONMENTAL SCIENTIFIC RESEARCH

The construction of an empirical research model is an efficient tool to establish the connections of the different realities observed and its practices associated with the search for knowledge of borders, through the appropriation of the knowledge of epistemology, theories and the underlying techniques applied to theories. It is in this context that it is idealized the theoretical and operative constructs to explore, understand and explain the dimensions and structuring elements of a certain scientific phenomenon. Therefore, the socio-environmental phenomenon can be understood and explained from the epistemological appropriation related to the Environmental Public Policies and actions of the public power.

Public environmental policies and public power actions are instruments of the government to meet the demands of society and are operationalized through the application of normative and regulatory acts which impose certain constraints on the business ecosystem. Thus, these regulations are agents that interfere in the dynamics of the business ecosystem, being able to influence, directly or indirectly, the results of the business subsystems that make up certain segments of the economic activity, by virtue of their spatial or geographical boundaries. Nevertheless, it may influence the results of business performance, therefore, explicitly or implicitly, environmental public policies and actions of the public power, as well as, through regulation of the organs of the environmental system, interfere in the economic and social-environmental performance of companies.

3.1 The theoretical model

The conceptual model of socio-environmental scientific research proposed here presents the independent variables of the environmental - political ecosystem and socio - environmental governmental actions, as inputs to be processed by the business ecosystem. The results of this processing can be dimensioned in terms of the dependent variables of economic and socio-environmental business performance. Therefore, it will be sought, through the appliance of this model, to know if

the independent variables of social and environmental governmental policies and actions influence the economic and socio-environmental corporate performance of the

firms, dimensioned by the variables dependent on environmental marketing and economic, environmental and social performance (figure 2).

Independent variables

Social and Environmental Government Policy and Actions

• Social and environmental legislation
• Institutional instruments of direct regulation in the market
• Responsibilities for environmental damage
• Economic instruments of credit and financial incentives
• International and regional socio-environmental agreements

Dependent Variables

Economic and Socio-environmental Performance

• Environmental Marketing

• Economic Performance

• Environmental Performance

• Social Performance

Business Portfolio

Control Variable

Source: Authors

Fig.2: Social and environmental government policy and actions and the economic and socio-environmental performance of the Firms

The construction of social and environmental governmental policies and actions focuses on obtaining data and information on public environmental policies referenced in social and environmental legislation and by public authority actions related to the inherent aspects of

environmental issues. It is also focused on knowing thematic frontiers of knowledge and the epistemological bases of theoretical approaches contextualized with environmental issues viewing to identify contributions to the foundation and understanding of the concept of

economic and social-environmental business performance, whose assumptions are:

● Identify in the socio-environmental legislation and its conditions of normalization and regulation of economic activities, with regard to environmental licensing, the direct institutional instruments of market regulation and the aspects related to liability for environmental damages.

● Identify the actions of public power in environmental matters and its determinants related to the economic instruments of social and environmental credit and financial incentives of economic activities and to the International and Regional Socio-environmental Agreements.

● Identify business actions related to sustainable business performance, as well as evidence on business practices associated with the economic, environmental and social performance of companies.

3.2 The operational model of research

From the taxonomy of the theoretical model, the arrays of the logical structure of the political variables and socio-environmental governmental actions (independent variable) were elaborated; economic, environmental and social performance (dependent variable) and business size (control variable). Tables 2, 3 and 4 present the analysis structure of the variables and the set of indicators.

Table 2: Dimension, independent variables, variables indicators and Issue of approach

Dimension	Independent variables	Variable Indicators	Issue of approach
Social and environmental government policy and actions	Social and environmental legislation	Difficulty in meeting the technical criteria for releasing the environmental license	Technical criteria for licensing
		Response time for analysis and dispatch of the environmental permit	Environmental Leave Release Time
		Intensity of the Company's expenditures to comply with Environmental Legislation	Intensity of expenditure
	Institutional instruments of direct regulation in the market	Influence of regulatory instruments in the Company's production system	Environmental regulation instruments
	Liability for environmental damages	Sanctions for environmental damages	Tax and / or administrative penalties
	Economic instruments of credit and financial incentives	Application of economic instruments related to environmental issues	Environmental economic instruments
	International and regional socio-environmental agreements	Environmental technical standards related to international and regional socio-environmental agreements	Environmental technical standards

Source: Authors

Table 3: Dimension, dependent variables, variable indicators and Issue of approach

Dimension	Independent variables	Variable Indicators	Issue of approach
Economic and socio-environmental performance	Environmental Marketing	Marketing of products with the eco-label	Environmental Marketing
	Economic Performance	Business performance under the economic and financial prism	Economic Performance
	Environmental Performance	Use of natural resources and emissions of waste, effluents and greenhouse gases	Environmental Performance
	Social Performance	Corporate social responsibility actions	Social Performance

Source: Authors

Table 4: Dimension, control variable, variables indicators and Issue of approach

Dimension	Independent variables	Variable Indicators	Issue of approach
Business Portfolio	Demographic Profile	Classification of company size	Number of Employees
		Annual gross revenue of the company	Annual Gross Revenue
		Export percentage	Percentage of exports and, relation to gross revenue
		Socio-environmental organic structure	Organic way of dealing with socio-environmental issues

Source: Authors

3.3 The basis of the research instrument

The logical structure of the data collection instrument is conceived from the dimensions of socio-environmental governmental policies and actions and of economic and socio-environmental performance. Each dimension is associated with a set of indicators of the variables, which are expressed by a question of the questionnaire. The questionnaire is modeled as an opinion poll in three blocks, namely:

I) Company Profile - Ranks the companies surveyed in relation to size, gross sales, export volume and the form of the company's socio-environmental organic structure.

II) Environmental Public Policies - This block is divided into two sections. The first one seeks to get to know the positioning of the companies surveyed on the issues related to socio-environmental legislation, the institutional instruments of direct regulation in the market and the aspects circumscribed to the responsibility for environmental damages. The second section deals with issues related to the economic instruments of credit and financial incentives and to international and regional socio-environmental agreements.

III) Economic and Socio-environmental Business Performance - we seek to identify the degree of economic and socio-environmental results of the firms surveyed. The business actions are evaluated: environmental marketing, economic, environmental and social performance.

The instrument of data collection should be elaborated in a scale of the Likert type, with value of score of 1 to 5. The Likert scale is of characteristic sum and it allows the ordering of attitude of favorability or unfavorability in relation to a certain object, but does not measure how much this attitude is more or less favorable (Selltiz et al., 1967). According to Gill (1999), the results obtained by manifestation of attitude and / or opinion about a problem studied, through the application of data collection instrument built on the Likert-type scale, can be analyzed using the tests of correlation. However, it should be noted that there is a discussion among researchers on the use of parametric and non-parametric statistics in the analysis of the data obtained through the Likert scale. Carifio & Perla (2007) emphasizes that non-parametric statistics should be applied to ordinal data. However, Allen and Seaman (2007) stress that ordinal (Likert-scale) data analysis as the data range is based on the assertion that parametric statistical tests are more powerful than non-parametric alternatives. Carefio and Perla (2007) point to the use of Pearson's correlation, multiple regression, variance analysis and F-test as possible parametric statistical instruments for the Likert scale data analysis. But according to Kislenko and Grevholm (2008), there is no consensus among researchers on which methods are suitable for using the Likert scale.

IV. CONCLUSION

The central focus of the socio-environmental scientific research model emerges from the question: do public policies and governmental actions related to social and environmental issues have any association with the economic and socio-environmental performance of firms? Coming from this question problem, the conceptual model (figure 2) was designed as a social and environmental policy and the economic and social-environmental performance of the firms, organized and operationalized through the set of variables related to public social and environmental governmental policies and actions (table 2). economic and socio-environmental performance (table 3) and business profile (Table 4). The research instrument built for research is based on the variables of the conceptual model and in the set of problem situations in view of the business segment covering questions about environmental legislation, institutional instruments for direct regulation in the market; responsibility for environmental damage; international and regional socio-environmental agreements; environmental marketing, economic, environmental and social performance. After applying the research in a certain segment of companies, the data collected must be submitted to statistical procedures which attest to their validation and reliability.

Lastly, it is recommended that data from empirical research go through an analysis of descriptive and inferential statistics. The descriptive analysis is done through the interpretation of the percentage relative frequency and Pearson coefficient of variation analysis. The inductive or inferential analysis is based on the application of Pearson's correlation technique to determine the degree of association between the studied variables. For the experimental hypothesis of the research, we suggest the application of the significance test as measured by the F statistic. Pearson's correlation and the Cronbach's alpha are also applied to validate the applied research instrument, as well as to measure the degree of internal reliability of the data collected.

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Qualitative Evaluation of the Basic Sanitation System with Fuzzy Logic in the Colonia Antônio Aleixo and Puraquequara Neighborhood in Manaus-AM, Brazil

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Abstract— *The present work is justified by the problems that exist in the municipality of Manaus in relation to basic sanitation, where it is one of the worst in Brazil, considering the neighborhoods of Colonia Antônio Aleixo and Puraquequara, which have rarely had popular participation in their planning , has unleashed over the years a continuous process of invasions that lasts until the present day, which ends up degrading the environment and calls on the government to intervene in order to provide these places with urban infrastructure. In this disregard for the population of the city of Manaus at a certain time ago, in relation to basic sanitation, it was interesting to evaluate the situation of some districts of Manaus by means of some data to verify through the technique of artificial intelligence called logic fuzzy, how good is the quality of basic sanitation in the days in two specific neighborhoods. The definition of the modeling was done and the results obtained with an artificial intelligence technique made it possible, through some data, to generate another very important data, which is the quality of basic sanitation in the neighborhoods analyzed in the course of all the work presented.*
Keywords— *Basic sanitation, Free Zone of Manaus, Fuzzy Logic, public policy on basic sanitation.*

I. INTRODUCTION

The Free Zone of Manaus was conceived in the year of 1957, in an original idea of the Federal Deputy, by the state of Amazonas Francisco Pereira da Silva and implanted in the year of 1967, in the military government. It aimed to implant an industrial district, a commercial center and an agricultural district in the center of the Western Amazon, exactly to foster activities of the three (3) sectors of the economy: Primary Sector (agricultural district); Secondary Sector (Industrial District); and, Tertiary Sector (Shopping Center). But besides these economic goals, it also had social objectives, such as deploying high-quality services in the center of Western Amazonia in all areas of State activity [1].

Among these services, there was the basic sanitation plan, developed in the administration of the municipal mayor of Manaus Paulo Nery, since the city was expanding and there was no basic sanitation, other than that left by the British during the rubber period [2].

Manaus at that time had few neighborhoods, still, and practically ended up in the neighborhood of Flores. But its expansion began with the construction of four (4) residential complexes, the famous COABS: one (1) in Flores; one (1) in Park 10; one (1) in the Root; and one (1) in Japan. All with the purpose of receiving the population that was growing, in function of the Free Zone of Manaus. Within these proposals for the construction of housing projects, there was clearly the inclusion of basic sanitation. It was done, but in a timid way [1].

In the period of the implantation of the Franca area of Manaus, the neighborhood Colônia Antônio Aleixo, already existed in the infrastructure of the city of Manaus. But it was a place with no connection, land route to the city, since there lived those affected by leprosy, disease, which since biblical times proves awe in the population and their sufferers, are removed from the city. It was only in 1972 that the first access road was built, by land, being

paved during the management of Jorge Teixeira, in the city of Manaus [3].

Beginning in the early 1980s, people without the disease's prevalence began to fix housing on the site. This place is very close to the meeting of the waters and, as they were a place to treat a disease, never suffered intervention of the public power in the structural part of basic sanitation. With the increase of residences and the settlement of areas near the Amazon River, it would be necessary to intervene to prevent human debris from being dumped directly into the river. But initiatives so far are flimsy [3].

In this disregard for the population of the city of Manaus at a certain time ago, in relation to basic sanitation, it was interesting to evaluate the situation of some districts of Manaus by means of some data to verify through the technique of artificial intelligence called logic fuzzy, how good is the quality of basic sanitation in the days in two specific neighborhoods.

The objective of this article is to qualitatively define the situation of the Basic Sanitation System with the Fuzzy Logic in the neighborhoods of Colonia Antônio Aleixo and Puraquequara in Manaus-AM.

II. JUSTIFICATION

This work is then justified by the problems that exist in the municipality of Manaus in relation to basic sanitation, where it is one of the worst in Brazil, considering the neighborhoods of Colonia Antônio Aleixo and Puraquequara, which in general have never had popular participation in their planning , has unleashed over the years a continuous process of invasions that lasts until the present day, which ends up degrading the environment and calls on the government to intervene in order to provide these places with urban infrastructure.

III. LITERATURE REVIEW

3.1 . BASIC SANITATION

Concerns about a centralized water distribution system were born from growing health concerns. In the ancient world, there was already this concern about the existence of water distribution systems in Egypt, Palestine, Persia, Phenicia, etc., as [4] point out: "Egypt, India, Sumeria, Mesopotamia and Greece are pioneers in the construction of wells, fountains, dams and aqueducts. In Mesopotamia irrigation systems were already used (4,000 BC). The first sewer galleries (3,200 BCE) date from India. The Sumerians (5,000-4,000 BC) constructed irrigation canals, galleries, settlements, cisterns, reservoirs, wells, tunnels and aqueducts".

As can be observed, every people had its peculiarities in relation to water. While some associated their importance with deities, others were concerned with the better use of water resources. In Egypt, for example, the use of a product for the treatment of water (aluminum sulphate in water clarification) was considered to be inappropriate for consumption [5].

In ancient Greece, this thought arose out of concern for health, since Tales of Miletus claimed that water was the origin of the whole universe and, since origin was the most important thing for human beings, as [4]: "In classical Greece, the cradle of philosophy, it had an intrinsic relationship with medicine. And as water was the source of life, according to philosophy, medicine used this precept to defend the preservation of this good, since the disease originates from external causes such as water quality".

Thus, from a concern with health, it began to establish the need for a water distribution system for the population based on the polis (public city), that is, this would be attribution of the State. [4]: "In order to achieve this, it is important to note that, in Rome, this process consecrated as a function of engineering knowledge, which was fundamental to Rome, due to its large engineering constructions that needed underlying elements".

As can be seen, with extreme clarity, in the words of the authors mentioned above. The Roman State became responsible for activities of a purely public nature, such as health, which included water distribution and sanitation and urban hygiene [6].

In the Middle Ages, this system changed profoundly, mainly by the loss of power of the Roman Empire. The cities were practically abandoned and refuges were created around the rivers, which caused a profound change in the water distribution system, which was then collected directly from the rivers. [4]: In England, the first legislation to protect water resources was introduced, as was pointed out by [4]. "In 1388, in England was formatted the first environmental legislation of the world, the so-called "English Act", which dealt with pollution of water and air. This law described prohibitions as the dropping of excrement, litter and debris into cesspits, rivers and other waters".

With this, the presence of the State was instituted as the controller of the conditions of the water, at the same time that the capitalism appeared. The process of capitalist development, intensified by the Trade Revolution of the sixteenth and seventeenth centuries, was, until then, the circulation of commodities [4].

From the second half of the eighteenth century, however, industrial mechanization began in England, diverting the accumulation of capital from commercial activity to the production sector [7].

This fact brought about great changes, both economic and social, that allowed the disappearance of the remnants of still existing feudal relations and practices and the definitive implantation of the capitalist mode of production [7].

At the same time, as mentioned above, campesinos who moved to the cities formed a large contingent of available labor - the so-called reserve industrial army (the first consequence of the Industrial Revolution - the intense rural exodus), which is essential for occurrence of the Industrial Revolution. Because of the scarcity of jobs, this massive, very low-cost labor force met industrial needs, since the cost of the labor force was very small, they could apply large sums of capital to new facilities [8].

It was of great importance for this advance, that is, organization in associations, leading to a vote in 1924 by the English parliament, where the right which was hitherto restricted to the ruling classes, the free association, was won. The trade-unions negotiated with the capitalists to create a scale of wages, forcing their acceptance, and set off strikes whenever these wages were rejected. Thus, these associations were strengthened [9].

From the middle ages, feudalism, to the industrial era, the changes were so profound that they eventually had a definite influence on the migratory process due to the new opportunities that arose from the improvement of life that affected the nomadic nature of man [9].

This intensification of population for the city undoubtedly provoked a complete change in the system of cities, especially in relation to the provision of public services, among them the distribution and treatment of water, which forced the capitalist countries to promote changes in the sanitary areas [10].

This change took place around the so-called 'contagion theory', which was nothing more than the intensification of diseases due to water quality, such as a cholera epidemic that occurred in the mid-nineteenth century [11].

As a result, the European states have stepped up six investments in sanitary aspects with the creation of water distribution and treatment systems for the population and also the establishment of sanitary sewage systems, as well as a major shift in urban waste. These systems demonstrated to the rest of the world the need for treatment and distribution of water by a public system and that had as a consequence an immediate improvement in the public health system of the population as a whole. In Brazil, this concern only began to exist upon arrival of the royal family to Brazil in 1808, since the conditions of sanitation in Brazil were very improper. But with the arrival of Dom Joao VI, this concern began, as it was necessary to have minimum hygiene conditions for the royal family [12].

But as public policy, these issues began to be concentrated in the field of municipal management, since the central power did not give attributions like this. The Republic, proclaimed in 1889 did not change that vision, which only occurred from 1930 with the arrival of Getúlio Vargas to the power [13].

3.2 FUZZY LOGIC

"The theory of fuzzy sets emerged as a tool to respond to problems related to vague information, Inaccurate or ambiguous, usually described in language natural - qualitative terms - to be transcribed into numerical language" [14].

According to Fonseca Júnior:

"Fuzzy logic is an intelligent technique that provides a mechanism for manipulating imprecise information - concepts of small, high, good, very hot, cold. - Allows to infer an approximate answer to a question based on inexact, incomplete or not totally reliable knowledge" [15].

According to [16] fuzzy logic theory, also known as nebulous logic or even fuzzy logic, has been increasingly used in systems that use information that is provided by people to automate any processes, such as decision aid. This theory has been used in applications ranging from the control of household appliances to resources used in medicine and the financial market.

The fuzzy logic can also be used for simulations and treat imprecise concepts such as bad, regular and good, which is the case of the present work.

According to [17]:

"The Fuzzy Logic (Nebula) is the logic that supports the modes of reasoning that are approximate rather than exact. Modeling and fuzzy control of systems are techniques for the treatment of qualitative information in a rigorous way. Based on the concept of fuzzy sets, fuzzy logic is the basis for the development of process modeling and control algorithms and methods, allowing the reduction of design and implementation complexity, making it the solution to control problems that were previously intractable by classical techniques ".

According to [17], "fuzzy modeling and control theory deals with the relationship between inputs and outputs, adding several process and control parameters". This allows complex process considerations to be handled in such a way that the resulting result of the fuzzy logic is stable and robust.

IV. METHODS

4.1 DATA OF THE NEIGHBORHOOD COLONY ANTÔNIO ALEIXO

In the year 2013, PMM surveyed the area on the situation of basic sanitation in the Colonia Antônio Aleixo neighborhood, where data are contained in tables 1, 2 and 3 below.

Table.1 - Water supply system in the neighborhood Colonia Antônio Aleixo – Manaus

Water supply system	Rating of the service provided	Main complaint of the service	Distribution network pressure	Does water analysis in the residence	The depth of the well	Water-borne diseases
Public network 70.23%	Bad 45.14%	Quality 45.10%	Strong 47%	Yes 0%	15 m 16.66%	Yes 53,85%
Alternative source 23.12%	Regular 43.10%	Lack of water 41.18%	Poor 53%	No 100%	20 m 50%	No 46.15%
Public and Well Network 6.65%	Good 11.76%	Quality and lack of water 13.72%	-	-	Others 33.34%	-

Source: PMM (2013).

Table.2 - Sanitary sewage system in the Colonia Antônio Aleixo neighborhood – Manaus

Type of Exhaustion System	Individual system, Treatment type	Problems with the pit
Collective 0%	Septic tank 35%	There is not 44,88%
Single 100%	Sink 65%	Bad smell 55.12%
-	Others 0%	Others 0%

Source: PMM (2013).

Table.3 - Solid Waste System in the Colonia Antônio Aleixo - Manaus neighborhood, according to the diagnosis of the area carried out by PMM

There is solid waste collection	Frequency of collection	Transportation that carries out the collection	Collection Classification	Quality of Public Cleaning
Yes 97%	Frequency of collection Daily 100%	Truck compactor 90%	Bad 30%	Bad 50%
No 3%	Weekly 0%	Dump Truck 1%	Regular 60%	Regular 49%
-	Others*	Carrots of the garis 9%	Good 10%	Good 1%

*Refers to collection two (2) to three times per week

Source: PMM (2013).

4.2 DATA OF THE PURAQUEQUARA DISTRICT

In the year 2013, PMM also surveyed the area of the Puraquequara neighborhood on the situation of basic sanitation, the information is found in Tables 4, 5 and 6 below.

Table 4 - Water supply system in the Puraquequara neighborhood – Manaus

Water supply system	Rating of the service provided	Main complaint of the service	Distribution network pressure	Does water analysis in the residence	The depth of the well	Water-borne diseases
Public	Bad	Quality	Strong	Yes	15 m	Yes

network 72.13%	46.44%	50.45%	54.00%	0%	20.00%	61,56%
Alternative source 21.03%	Regular 34.56%	Lack of water 43.57%	Poor 46.00%	No 100%	20 m 45.00%	No 38.44%
Public and Well Network 7.65%	Good 19.00%	Quality and lack of water 5.98%	-	-	Others 35.00%	-

Source: PMM (2013).

Table 5 - Sewage system in the Puraquequara neighborhood – Manaus

Type of Exhaustion System	Individual system, Treatment type	Problems with the pit
Collective 0%	Septic tank 45.00%	There is not 48,89%
Single 100%	Sink 55.00%	Bad smell 51.11%
-	Others 0%	Others 0%

Source: PMM (2013).

Table 6 - Solid Waste System in the Puraquequara neighborhood - Manaus, according to the diagnosis of the area carried out by PMM

There is solid waste collection	Frequency of collection	Transportation that carries out the collection	Collection Classification	Quality of Public Cleaning
Yes 95%	Frequency of collection Daily 100%	Truck compactor 85%	Bad 40%	Bad 60%
No 5%	Weekly 0%	Dump Truck 10%	Regular 45%	Regular 35%
-	Others*	Carrots of the garis 5%	Good 15%	Good 5%

*Refers to collection two (2) to three times per week
Source: PMM (2013).

V. MODELING FUZZY LOGIC

For the fuzzy logic modeling, InFuzzy software was used, where it allowed all modeling, rule definition and simulation to occur to obtain the basic sanitation quality of the neighborhoods Colônia Antônio Aleixo and Puraquequara, both in the city of Manaus.

Following is the initial screen of the software used to make the whole process using the artificial intelligence technique called fuzzy logic.
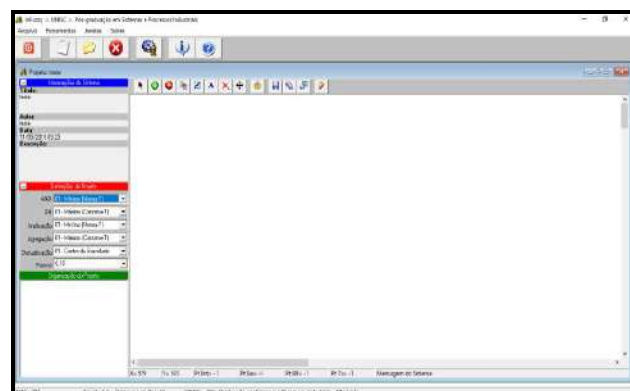
Fig.1 - InFuzzy software environment
Source: Authors (2019).

5.1 STRUCTURAL MODELING

Following is the initial modeling with its entire structure, such as the four input variables indicated by a

green background color, the rule engine that is responsible for the conditions of comparisons to generate the result in the output variable, such rule engine is indicated by the yellow background color, and put an end to the output variable indicated by the red background color.
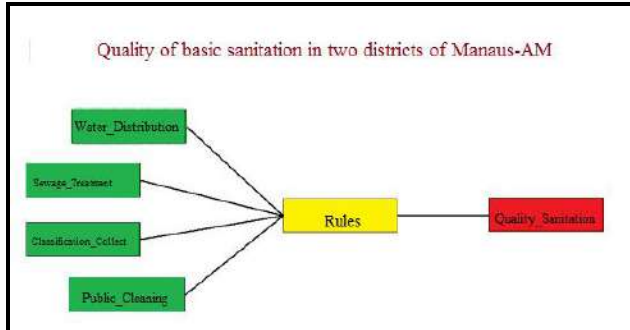
Fig.2 - Structural modeling
Source: Authors (2019).

V.II. VARIABLES OF ENTRY

Based on the data from the tables presented previously, four fields were used to serve as input variables:

- Classification of the service provided (Table 1 and 2).

- Individual system, type of treatment (Table 3 and 4).

- Classification of the collection (Table 5 and 6).

- Quality of public cleaning (Table 5 and 6).

The following are the graphs of all input variables used, where the blue color symbolizes the poor condition, red the bad condition, green represents regular and purple means good.
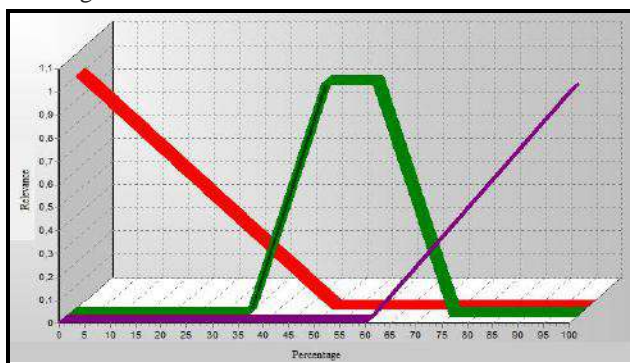
Fig.3 - Variable classification of the service provided
Source: Authors (2019).
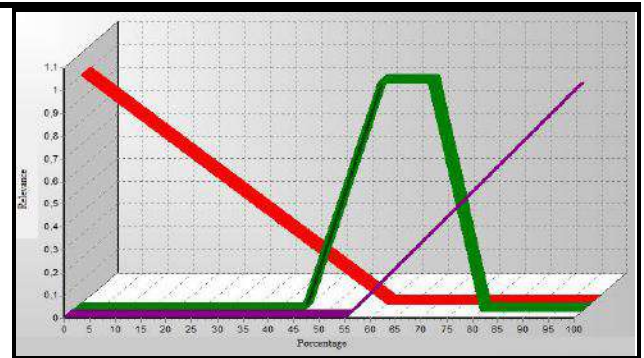
Fig.4 - Individual system variable, type of treatment
Source: Authors (2019).
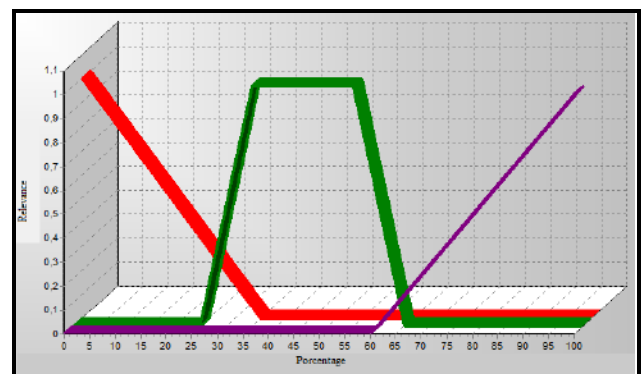
Fig.5 - Collect classification variable
Source: Authors (2019).
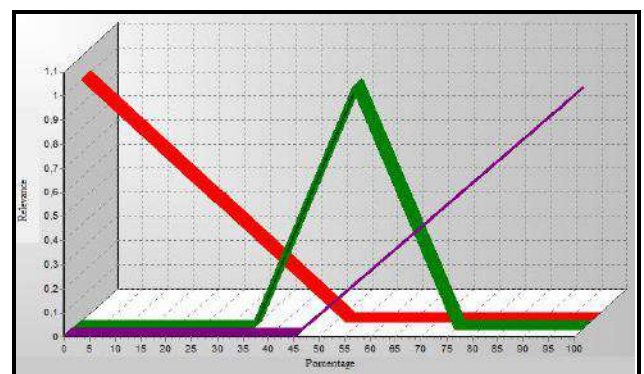
Fig.6 - Variable quality of public cleaning
Source: Authors (2019).

5.3 OUTPUT VARIABLE

The output variable represents the satisfaction of the quality of basic sanitation in the neighborhood, where the inserted rules and the input variables have a direct impact on the final result, as well as the pertinence functions used in the modeling of the variables.
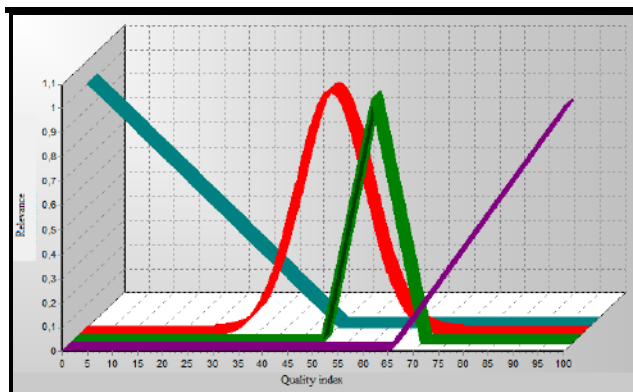
Fig.7 - Output variable (quality of basic sanitation)
Source: Authors (2019).

VI.   RESULTS OF DEFUZZIFICATION

In the simulation process the data used for the Colonia Antônio Aleixo neighborhood were indicated in the table below. An important observation to be made is that the data used are the ones with the highest percentage, except the one corresponding to the "Individual system, type of treatment", since the septic tank is more pleasant than the sink, percentage in this case, both for the table below, as for the Puraquequara neighborhood table.

Table.7 - Data used in the Fuzzy Logic (Colônia Antônio Aleixo)

Classification of service provided (Water supply)	45.14
Individual system, type of treatment (Sewage treatment)	35.00
Classification of collection (Waste collection)	60.00
Quality of public cleaning (Garbage collection)	50.00

Source: PMM (2013) adapted by the authors.

The defuzzification is nothing more than the result of all logic, where the graph shown below is the simulation made of the quality of basic sanitation in the neighborhood Colonia Antônio Aleixo.

By analyzing the graph below, observing the quality index obtained, it is noticed that the degree of satisfaction regarding the quality of basic sanitation is poor.
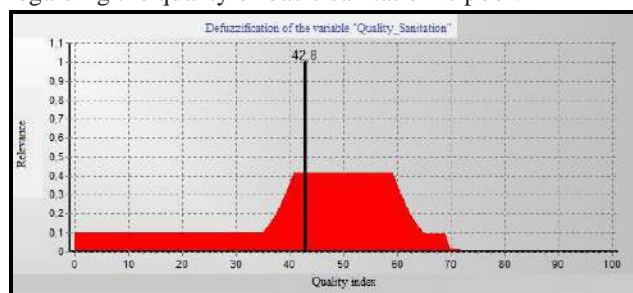
Fig 8 - Defuzzification of the neighborhood Colônia Antônio Aleixo
Source: Authors (2019).

In the Puraquequara neighborhood, the data used for the simulation were the following in the table below.

Table.8 - Data used in the Fuzzy Logic (Puraquequara)

Classification of service provided (Water supply)	46.44
Individual system, type of treatment (Sewage treatment)	45.00
Classification of collection (Waste collection)	45.00
Quality of public cleaning (Garbage collection)	40.00

Source: PMM (2013) adapted by the authors.

Below is a graph of the defuzzification of the Puraquequara neighborhood, where it can be observed that the satisfaction of the quality index of basic sanitation in this neighborhood of Manaus, which is classified as very bad.
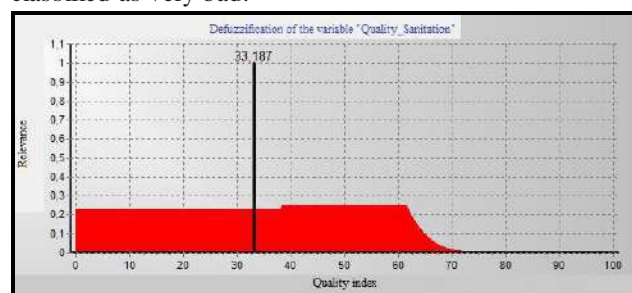
Fig.9 - Defuzzification of the Puraquequara neighborhood
Source: Authors (2019).

VII.   CONCLUSION

The monographic essay had the specific objectives achieved and evidently the general objective as well.

The first stage of data collection was done through the PMM survey in the districts of Manaus, where the data were extremely important for the development of this course completion work.

The definition of the fuzzy logic modeling was done in an exquisite way, using reliable input variables and establishing agreement with the data taken from the tables.

The definition of the modeling was done and the results obtained with an artificial intelligence technique enabled, through some data, to generate another very important data, which is the quality of basic sanitation in the neighborhoods analyzed during all the work presented, with a final response to poor quality in the neighborhood Puraquequara and bad index in the neighborhood Colonia Antônio Aleixo.

Thus, it was evidenced that in the chaos of the advances the existence of the PMM of a specific diagnosis of the neighborhood in question can foment specific actions in the area of sanitation for the

neighborhood. Regarding the challenges, it is up to the PMM to verify the conditionalities and specificities of the neighborhood so that it has different treatment in the application of the plan. Vulnerabilities are many, mainly in the distribution of water that only reaches 67% of the population. In the sewer network the drama is bigger. With this, the Antônio Aleixo Colony neighborhood has been the same as in many other neighborhoods located on the river banks; the discharge of sanitary sewage into the river caused mainly by invasions of areas on the slopes of the river which constitute one of the main environmental problems of the locality and, consequently, a great challenge for the environmental organs of the public power, because a deep intervention with significant costs to public budgets and the degradation of the exuberant landscape that could become a huge tourist attraction.

The importance of the action of environmental agencies could start from the diagnosis of the problem, propose an alternative solution from the discussion with those involved (the residents) and apply the solution discussed closing the sanitation cycle of the region.

For the permanent process in which individuals and communities become aware of their environment and acquire new knowledge, values, skills and experience are crucial to their ability to act and solve environmental problems, present and future.

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Monitoring of Nitrogenized Coverage Fertilization in Wheat Crops by Remotely Piloted Aircraft (RPA)

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Abstract— One of the factors that makes possible the variable condition within the same culture is known as agricultural georeferencing for the creation of maps and, more recently, the use of remotely piloted aircraft to acquire images of higher quality and more dynamically and cheaper, because it is a new technology, lacks regional technical-scientific information. The uses of remotely piloted aircraft help in the discovery of variables using images in a faster way, thus enabling the identification of factors that may interfere with production and take measures to correct them. The objective of this study was to monitor nitrogen fertilization coverage in wheat crops by remotely piloted aircraft (RPA). Nitrogen fertilization in wheat crops was managed of the two ways: conventional management and RPA management. The variables analyzed were yield (kg / ha) and economic analysis. The analysis of variance revealed a significant effect of nitrogen and non-significant between crops in relation to the variables response yield, revenue, expense and profit, evidencing the superiority of the RPA management in relation to the conventional one.

Keywords— Economic analysis, RPA, management of nitrogen fertilization.

I. INTRODUCTION

Precision Agriculture is the management of production variability and the factors involved in it, using recent technologies adapted to the agricultural system, with the objective of optimizing the use of inputs and reduce the impact on the environment. Because of this, commercial agriculture has suffered profound changes in recent years, triggered off mainly by the use of technology in the field, directed to the mechanization of processes, use of chemical inputs, direct sowing system and biotechnology (CIRANI and MORAES, 2010)

The use of remote sensors has many applications such as biomass identification, leaf index, diseases, pests, water stress, yield prediction, monitoring of soil properties and mapping. Chemical analysis in leaves, pest control and management and weeds, soil surface properties, biological conditions, chlorophyll parameters, nitrogen concentration in the leaf, vegetative cover, among other factors can be also monitored (ZHANG and KOVACS, 2012).

The application of these techniques consists of applying variable amounts of nutrients to heterogeneous crops, depending on the peculiar properties of each part of the crop (GÓMEZ-CANDÓN et al., 2014).

One of the factors that enables this variable condition within a single culture is known as agricultural geo-referencing for map creation and, more recently, the use of remotely piloted aircraft (RPA) for higher quality, more dynamic and cheaper image acquisition, because it is a new technology, it lacks regional technical-scientific information.

For Primicerio (2015) remotely piloted aircraft helps in the discovery of variables with the use of images in a faster way, thus allowing the identification of factors that may interfere in production and take measures to correct them.

The current work aims to monitor the nitrogen fertilization of cover in wheat crops by remotely piloted aircraft. Its development seeks to compare the use of remotely piloted aircraft with the conventional management carried out by the farmers of the region, analyzing and presenting proposals that can optimize the use of nutrients in the crops.

II. MATERIALS AND METHODS

2.1 Climate and soil

The monitoring was carried out in two wheat crops (1 and 2) located in the western region of Santa Catarina, located in Araçá line, in the municipality of Maravilha / SC, 2017. According to the classification system of Köppen, the climate is of the type Cfa (MENDONÇA; DANNI-OLIVEIRA, 2007).

The main meteorological systems responsible for rainfall in the state are cold fronts, tropical convection, SACZ (South Atlantic Convergence Zone) and maritime circulation. In the regions closest to the mountain slopes, rainfall is more abundant, since the elevation of hot and humid air favors the formation of cumuliform clouds, resulting in increased local precipitation volume (MONTEIRO, 2001).

The meteorological conditions (temperature and precipitation) were obtained in INMET (2018) and can be seen in figure 1.
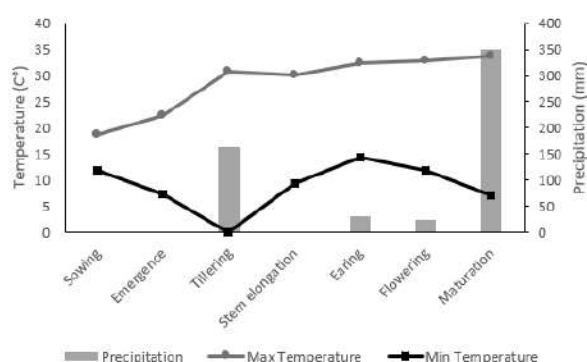
Fig 1 - Weather conditions during the experiment.

The soil is classified as CAMBISSOLO háplico (EMBRAPA, 2013).

2.2 Equipment

The wheat crops were conducted with localized management (georeferencing) and the area mapping was carried out with the help of a RPA JunoTM Series Trimble® navigation, which demarcated the area vertices for map generation and sampling mesh.

A square mesh was adopted totalizing sampling points, in order to configure a better spatial distribution of the points in the area.

The sampling mesh used was characterized by one point (sample) per hectare, which was determined and georeferenced through Farm Work Office® software.

The images were obtained at wheat grading stage through the use of a RIP DJI® Phatom 2 vision, through an embedded camera, its payload, which does not allow calibration of the light input, since it has fixed aperture of focal ratio 2.8G , with a focal length of 5mm. In this way, we chose to capture images in a video format, with a 140º Field Of View (FOV) lens (HARRIS, 2015) and a

resolution of 1280x720 pixels with a 1 / 2.3 CCD sensor ', that is, 6,16mm x 4,62mm, in a flight approximately 2 meters above the ground with GSD of 1.92mm.

In the 2016 harvest, with the research entitled "Monitoring of nitrogen fertilization in coverage in dual-purpose wheat crop via REMONTELY-PYLOTED AIRCRAFT (RPA)" - Edital: nº28 / UNOESC-R / 2016, CNPq Normative Resolution nº17 / CNPq / 2016 and resolution nº203 / CONSUN / 2011 ", the computational analysis algorithm was created, which was validated in the 2017 crop in the respective wheat crops.

The wheat crops in relation to nitrogen fertilization were managed of the two ways: conventional management (CQFS-RS / SC, 2016) and management by RPA.

2.3 Management

In the conventional management nitrogen fertilization was 15 kg / hectare in the sowing of the crop, with single application of 67.5 kg of nitrogen in the tillering stage. 30 kg of P_2O_5 and 30 kg of K_2O per hectare were distributed in the sowing line, the N, P, K formulation used at sowing was 10:20:20.

The sowing of the cultivar was performed on July 1st, 2017 with a line spacing of 17cm and 51 seeds per linear meter. The germination index and seed purity were respectively: 92% and 98%, totaling a stand of 270 germinated plants per square meter.

Control of weeds, pests and diseases were carried out during the development of the crop.

The harvest was made when the wheat was fully ripened and at a moisture content of 13%. A square of 25cm x 25cm totaling 0.0625m² per sample used. In each one of the crops, 10 samples were collected, which were later threshed manually, weighed in analytical balance at UNOESC, and subjected to moisture and pH analyzes, with the appropriate discounts.

In the RPA management, 15 kg of nitrogen per hectare was applied to the sowing line, two aerial applications in the tillering stages (34.5 kg N per hectare) and stem elongation (5.17 kg N per hectare). 30 kg of P_2O_5 and 30 kg of K_2O per hectare were distributed in the sowing line, the N, P, K formulation used at sowing was 10:20:20.

The sowing of the cultivar was performed on July 1st, 2017 with a spacing between lines of 17cm and 51 seeds per linear meter. The germination index and seed purity were 92% and 98% respectively, totaling a booth of 270 germinated plants per square meter.

The other cultural treatments (phytosanitary treatments, harvesting, analysis of PH and moisture) of these crops were the same of the crops cultivated in conventional system.

The cultural practices were carried out according to the technical indications of the wheat crop (EMBRAPA, 2014).

The cultivar sown on wheat crops was TBIO TORUK®, with interesting characteristics for this producing region, it has medium cycle, with short stature of the plants, good tolerance to diseases, besides good tillering and uniform earing, its requirement for soil fertility is medium / high (BIOTRIGO, 2014) .

The variables analyzed were yield (kg / ha), by the method proposed by MAPA (2009) and economic analysis, using the unlimited capital methodology based on the kg of nitrogen fertilizer (urea) and the kg of grain of wheat (MATUELLA and SIMIONI, 2015). The Test of F submitted the collected data to Analysis of Variance and the Tukey Test (P≤0.05), with the aid of Sisvar 5.0 Software (FERREIRA, 2010), compared the differences among the averages.

III. RESULTS AND DISCUSSION

The analysis of variance revealed a significant effect (P≤0.05) of the nitrogen fertilizer management and non-significant for the crops in relation to the yield response variable (Tables 1 and 2).

Table 1 - Yield of the experiment in relation to nitrogen fertilization management (Maravilha / SC - Harvest 2017)

Management of nitrogen fertilization	Yield (sc/ha)
Conventional management	33,64 b
RPA management	48,06 a
CV (%)	18,04

Results followed by the same letter do not differ by Tukey's test (P≤0.05).

Table 2 - Yield of the experiment in relation to crops (Maravilha / SC - Harvest 2017)

Wheat crop	Yield (sc/ha)
Crop 1	41,02 a
Crop 2	40,68 a
CV (%)	18,04

Results followed by the same letter do not differ by Tukey's test (P≤0.05).

The analysis of variance revealed a significant effect (P≤0.05) of the nitrogen fertilizer management and non-significant for the crops in relation to the variables revenue, expense and profit responses (Tables 3 and 4).

Table 3 - Revenue, expense and profit of the experiment in relation to nitrogen fertilization management (Maravilha / SC - Harvest 2017)

Management of nitrogen fertilization	Revenue (R$/ha)	Expense (R$/ha)	Profit (R$/ha)
Conventional management	1110,20 b	186,00 b	924,20 b
RPA management	1609,78 a	139,50 a	1470,28 a
CV (%)	17,94	5,00	20,38

Results followed by the same letter do not differ by Tukey's test (P≤0.05).

Table 4 - Revenue, expense and profit of the experiment in relation to crops (Maravilha / SC - Harvest 2017)

Wheat crop	Revenue (R$/ha)	Expense (R$/ha)	Profit (R$/ha)
Crop 1	1377,50 a	162,75 a	1214,75 a
Crop 2	1342,49 a	162,75 a	1179,73 a
CV (%)	17,94	5,00	20,38

Results followed by the same letter do not differ by Tukey's test (P≤0.05).

As observed in Table 1, the yield of wheat cultivated by RPA was significantly higher due to the splitting of the nitrogen applications, because when the N doses in tillering and stem elongation were fractionated, the definition of the yield components occurs.

The georeferenced management by RPA involves the obtaining and processing of detailed information on a particular area of wheat crop, allowing the definition of more efficient management strategies, especially in the rational use of inputs (nitrogen fertilization) according to its ecophysiology (EMBRAPA 2014).

The yield did not show differences among the crops (Table 2), because they were located within the same soil and climatic conditions (FIGURE 1).

In relation to the nitrogen dose, the recommendation has to relate with the previous crop, soil organic matter, climatic conditions, cultivar, among others (FLOSS, 2011).

As observed in Table 3, for the revenue variable, RPA management (R $ 1609.78 per hectare) differed significantly from the conventional one (R $ 1110.20 per hectare). Yields on crops of wheat and other crops are dependent on management and soil-climatic conditions (FLOSS, 2011).

In relation to expenses (TABLE 3), it is possible to notice that the RPA management presents significantly the lowest values (R$) when compared to the conventional one.

The reading of the chlorophyll content by RPA (SPAD reading) is a technological tool that provides the farmer with a subsidy to verify the performance of wheat (and others), with nitrogen fertilization correlated with its ontogenic stages.

The use of the SPAD allows quick and easy results, allowing the farmer to apply only what is required by said culture, articulating technical, ecological, social and environmental aspects, thus providing the sustainability of the respective plant production system (HURTADO et al. 2008).

As shown in Table 3, the significantly higher profit, it was obtained in the RPA management when compared to the conventional one, because in this management, the revenue was higher and the expense was lower in relation to the conventional management, obtaining a difference of R$ 546.08 more.

This explanation is due to the management by RPA (SPAD index) providing a better optimization of the nitrogenous fertilizer (HURTADO et al., 2008).

Based on the technical and economic results of the respective research, it can be noticed in a particular environment, the phenotypic manifestation is the result of the action of the genotype under influence of the environment. However, considering a series of environments, it is detected that, besides the effects of genotypes and environments, an additional effect, provided by their interaction. This interaction quantifies the differentiated behavior of the genotypes in the face of environmental variations and it is called interaction genotypes x environments (GxE) (CRUZ and REGAZZI, 1997; CRUZ and CARNEIRO, 2003).

IV. CONCLUSION

With this study can conclude that the georeferenced management with RPA is more efficient in relation to the conventional management, considering some technologies that allow applying the necessary amount of nitrogen, avoiding wastes, thus obtaining more efficiency of the plants in the absorption of this nutrient along of the cycle. It can also concluded that the management with RPA obtained greater profitability compared to conventional management, because it obtained lower expenses with nitrogen fertilization.

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The contribution of the public policy "Rede Certific" to the industrial fishing sector in the coast of Santa Catarina, Brazil

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Abstract— *This article brings a look at the professionalization of fishermen in the state of Santa Catarina (SC), the national leader in the capture of marine fish. It houses the largest fishing industrial park in the country, among the difficulties in professionalizing the sector, there is a migration of qualified fishermen to pre-salt oil exploration. To meet this need for qualified fishermen on the coast of Santa Catarina, the professional qualification course was implemented in the modality of recognition of knowledge through the public policy of the National Network for Professional Certification and Initial and Continued Training (Network Certific). The purpose of this work was to demonstrate the Certific Network in the training of fishermen to perform at different levels of experiences to be acquired on land and at sea. With a qualitative approach, the exploratory and descriptive research medium was used, with interviews to 30 actors during the period between May and July 2017, with an instrument containing closed, open and semi-structured questions. Data were expressed as means and discourse analysis, focusing on induction and deduction. It was noticed that the Certific Network contributed with the sector for the offer of certification through courses that the Marine of Brazil did not supply in sufficient quantity added to the fact that, in its systematics, it allows the recognition of practical knowledge, providing an empowerment of Lasse worker who felt marginalized by acting illegally. This experience can serve as an example for meeting the UN's ODS objective 8 and 14, by promoting full and productive employment, integrated with society.*
Keywords— *professional certification; industrial fishing; public policy.*

I. INTRODUCION

The shortage of qualified and skilled labor in the fishing industry with the reduction in the supply of training networks in Brazil has been extensively recognized and criticized in the regulatory economic policy scenario for the sustainable development of the sector (COSTA, 2003). Among the United Nations (ONU, 2017) Sustainable Development Goals, number 8, aims to "promote sustained, inclusive and sustainable economic growth, full and productive employment, decent work for all" and number 14 aims to "conserve and sustainably use oceans, seas and marine resources for sustainable development."

The most recent research deals with rural productive inclusion for fishermen in fishing tourism (GONÇALVES, 2018), the public policy of granting rural credit to finance fishing and aquaculture (FARIAS, 2018), the fishing chain (MEANTE & DÓRIA, 2017), the territorial development of fisheries and aquaculture (Food and Agricultural Organization - FAO, 2018), artisanal fisheries (GOMES, 2018). The theoretical framework reveals that the marine and estuarine fishing activity in Brazil involves the work of a large contingent of fishermen (HAIMOVICI, ANDRIGUETTO FILHO & SUNYE, 2014), besides providing jobs and economic benefits (CÉLIO-JÚNIOR, 2014, AGUIRRE MUNIZAGA, DÍAZ ARAYA & MONDACA ROJAS, 2014).

Despite the efforts and great knowledge required of fishermen throughout their labor practices, the fisheries sector seeks to integrate society fully with the development of jobs and benchmarking of fishers' incomes in formal and legal work (FAO, 2016, 2018).

Public regulatory fisheries policies establish access rights and quotas to alleviate the problem (NÓBREGA, MORAIS NETO & LIRA, 2013; SONVISEN, 2014), seeking sustainable development. However, legislation does not guarantee the sustainability of resources (CALLEJA, 2015), if there is no efficient management based on transparency and stakeholder participation (MORA ET AL., 2009, KNOX & TRIGUEIRO, 2015).

In addition, we also recognize the professionalization of the fisherman by the industrial workforce that needs to exchange knowledge, have a network of relationships for the exchange of information and the expansion of the visibility of economic activities (FAO, 2018).

Thus, in Brazil, through the Ministry of Labor and Employment, together with the Ministry of Education, the National Network for Professional Certification and Initial and Continuing Training (Network Certification) aims to recognize and certify the knowledge acquired by workers in processes formal and non-formal education and initial and continuing training at different levels of vocational education, regimented by Interministerial Ordinance n. 1,802 of 2009 and which was subsequently regulated by Administrative Rule no. 5 in 2014, with the objective of developing professional certification processes (COSTA & COSTA, 2013, COSTA, 2015).

In this context, this article aims to highlight the National Network of Professional Certification and Initial and Continued Training (Network Certific) in the training of fishermen to work at different levels of experience to be acquired on land and at sea. The focus of the study is the analysis of the profile of enrolled students and managers of Fisheries, Marine and the Santa Catarina Federal Institute of Santa Catarina (IFSC), located in the city of Itajaí, state of Santa Catarina (SC). Responsible for the training courses in the training of the waterway career in the category of professional fisherman (POP) and Professional Fisherman Specialized (PEP) qualification for professional fishermen.

Thus, the research is justified by the importance of formal regularization of activities through the qualification that are performed by the competent bodies in obtaining legal and necessary (CARVALHO, 2009) and profession that is considered dangerous by the International Labor Organization (OIT, 2007). It is an original applied research in the training of fishermen for the qualification, habilitation and training of people skills for the safe exercise of the profession in the professional activities of fisherman in fishing vessels of any type and size.

This paper presents in the second section a theoretical review that addresses the legalization of activity in Brazilian industrial fisheries and the Network Certification as an instrument of public policy for professional and technological education. The third section describes the methodological procedures presented in the paper and in the fourth the results of the applied research are analyzed and discussed. Finally, the final considerations of the study and the suggestions for future research are presented.

II. THEORETICAL REVIEW LEGALIZATION OF INDUSTRIAL FISHING ACTIVITY IN BRAZIL

Industrial fishing is practiced from the coastal to oceanic regions by the fishing fleet composed of vessels of more than 20 gross tonnage, with autonomy of navigation and specific technology. The state of Santa Catarina is a leader in this sector and houses the largest industrial fishing park in the country, capturing about 20% of Brazilian marine fish in 2012 according to the Statistical Bulletin (UNIVALI, 2013). In addition, the municipalities of Itajaí and Navegantes contributed 83% of the total landed by weight in the State (CÉLIO JUNIOR, 2014).

This production is managed by fish companies or shipowners, natural or legal persons responsible for the vessel who register and obtain the fishing license (DIEGUES, 2004). The hiring of the crew and the employment relationship are regulated by labor laws, and the income can be measured by quotas (CARVALHO, 2009). The professional fisherman to carry out the activity must have the General Register of the Fishing Activity - RGP, managed by the fishing license of the Brazilian Institute of Environment and Natural Resources (IBAMA), in addition to the Registration and Registration Register (CIR) provided by Marinha do Brasil (2003), which has the supremacy in the holding of the fisherman's career since 1952 (BRAZIL, 1952; CARDOSO, 2009) as well as in the training of workers.

These fishermen (waterways) are divided into deck section and machines. Fishermen 1 (POP N1), Professional Fisherman 2 (POP N2), Specialized Professional Fisherman (PEP), among others, according to norms of the maritime authority (NORMAM-13 / Directorate of Ports and Coasts - DPC) (MARINHA DO BRASIL, 2003). The category ascension occurs due to specific professional requirements, such as embarkation time or approval in qualification courses with certification and qualification to the position and function registered in the CIR (BRAZIL, 2003).

It is known that the educational level of the fishing workers contributes directly to the professionalization, the

legalization of the activity and consequently the sustainable development of industrial fishing (FAERJ & SEBRAE, 2009). However, many fishermen abandoned early formal studies (SOUZA & CAETANO, 2012), beginning their work activities with young and more experienced relatives (DIEGUES, 2004, KNOX & TRIGUEIRO, 2015), empirically learning the trade (CARDOSO & HAIMOVICI, 2014), without formal qualification (MEIRELES, 2015).

The problem worsened with the migration of more qualified fishermen to activities linked to the pre-salt production chain (FURTADO, 2013, ROSA, 2014, PIQUET; TAVARES & PESSOA, 2017) during the decade of 2000, providing opportunities for fishermen without vessels (SCHWARTZMAN & CASTRO, 2013).

Brazil, a signatory to international agreements, respects the guidelines of the International Maritime Organization in its public policies and delegates to the Brazilian Marine, through its Ports and Coasts Board, since 1952 (BRAZIL, 1952) the training of its fishing professionals, 2009), among them maritime professional education for waterways, with a recent update (BRAZIL, 2015).

THE NETWORK CERTIFICATION AS AN INSTRUMENT OF PUBLIC POLICY OF PROFESSIONAL AND TECHNOLOGICAL EDUCATION

Faced with budgetary constraints facing the country, there was a reduction in the supply of training in the area. As a result of a coalition of institutional political forces, the Brazilian Marine, believed and accredited 2012, the Federal Institutes (IF) to qualify the career of water boaters in the fishermen category. Among these, the unit based in Itajaí in Santa Catarina (SC) has the profile for this training with physical, administrative structure, laboratories, including boat-school and qualified teachers to the formations.

With the accreditation, this unit became a trainer using the public policy of professional education of the

National Network of Professional Certification (Rede Certification) (LIMA & CUNHA, 2017), with the purpose of filling the deficit and promoting training through Professional Certification. The qualification courses of the fishermen meet the requirements of the Maritime Professional Teaching of the Marine, with a workload of 770 hours for the PEP training and 200 hours for the POP, and the fisherman can optimize the time in the course with the proof of his previous experiences and experiences as professional (HICKENBICK, RAMOS & ROSA, 2017).

With this, the Certification Network qualification recognizes the knowledge's of the workers acquired in the trajectory of the profession, but without the qualification required by the competent organs. However, with the methodology of the Certificate, the end of the course varies according to the acknowledgments that each student obtains, and can be from one to three months (IFSC, 2017).

The Specialized Professional Fisherman (PEP) is the one that presents technical and behavioral skills required for the ascension to the capacity of Master in Fishing vessels of Gross Tonnage of up to 100t, used in coastal and inland navigation (Brazil, 2003). PEPs are popularly known as "boat masters" who are responsible for commanding the boat and crew in the work done for the capture and conservation of fish. The Professional Fisherman (POP) understands the professional performance as a crew member in the preparation, execution of the catches and conservation of the fish on board the vessel.

III.   METHODOLOGICAL PROCEDURES

Interviews were carried out with actors involved in industrial fishing in the fishing area of Itajaí, SC, using as a unit of analysis the managers of the fishing sector, the Brazilian Marine and Network Certific, between May and July 2017, totaling 30 people. The interviews were carried out in the workplaces, offices, warehouses, during the repair of nets and vessels, as well as in the period of closed fishing, according to Table 01:

Table.1 - Managers linked to the Fisheries sector and the Certific Network interviewed.

Initials	Respondents	Number of interviews	description
FM	Fishing Managers	20	15 shipowners from the Porto de Itajaí region 02 union representatives from the region 02 servers of the Municipal Fisheries Department 01 community leader
MM	Marine Managers	2	02 officers linked to the Maritime Professional Education System
CM	Certification / IFSC Managers	8	06 teachers servers 01 boat-school commander

			01 Rector's Office		
Total		30			

Source: survey data.

Through a descriptive exploratory research (SEVERINO, 2007) with a qualitative approach and an inductive-deductive method, data collection instruments composed of open and semi-structured questions were structured, with a choice of scale responses *Likert*, with concordance levels of 1 to 5, with NA (not applicable) when the respondent did not find a response to their agreement.

The data were expressed in averages (semi-structured questions) and analyzed the discourse (open questions) (ORLANDI, 2006) according to Table 02:

Table.2 - Interview questions, structure, respondent and analysis.

Question	Structure of Questions	Respondent			Analyze
		GP	GMB	GC	
1. The "know-how" of the fisherman	Quasi structured	x	x	x	Mean
2. Legalization instrument	Quasi structured	x	x	x	Mean
3. Adequate Travel Time	Quasi structured	x	x	x	Mean
4. Contribution with qualified labor	Quasi structured	x	x	x	Mean
5. Certification Satisfaction	Quasi structured	x	x	x	Mean
6 Impact on student life	Quasi structured			x	Mean
7. Inspection of the Marine	Quasi structured	x			Mean
8. Professional Certification Preference / IFSC	Quasi structured	x	x		Mean
9. Professional performance	Quasi structured	x	x		Mean
10. Population in management	Quasi structured	x			Mean
11. Legal documentation	Quasi structured	x	x		Mean
12. Causes of illegality	Quasi structured	x	x		Mean
13. Surveillance procedure	Quasi structured		x		Mean
14. Professional Certification	Quasi structured		x		Mean
15. Working time in the fishing industry	Open	x	x		Discourse
16. Implementation of the IFSC / Itajaí Certification	Open			x	Discourse
17. Contribution of the IFSC	Open	x			Discourse
18. Improvement suggestion	Open	x	x	x	Discourse
19. Evaluation after accreditation	Open		x	x	Discourse

Source: survey data.

The open questions were raised during the data collection, with the annotation of observations and through five specific questions. These responses served to cross the quantitative data and the perceptions of the subjects surveyed, who were identified by number after the acronym GP (Fishery Manager), GMB (Manager of the Brazilian Marine) and GC (Gestor Certification).

The answers of the open questions were selected according to the categories of analysis: course during closing, available time, incentive to the courses, control constraint, political questions, fisherman service, internal process, course systematics, theory and practice integration, reduction accidents and environmental awareness.

SEARCH RESULTS

Table 01 shows the descriptive data of the variables:

Table.1. Data in average and % in the questions with levels of agreement of 1 to 5; - = Not applicable-NA.

Questions / Managers	Fishing N = 20		Marine N = 2		Certific N = 8		Managers Together	
	Mean	%	Mean	%	Mean	%	Mean	%
The "know-how" of the fisherman	5,0	100	5,0	100	4,8	98	4.9	99
Legalization instrument	5,0	100	4,0	80	4,8	98	4.6	92
Adequate time for training	4,8	97	5,0	100	3,6	73	4.5	90

Contribution with skilled labor	4,9	99	4,0	80	5,0	100	4.6	93
Certification Satisfaction	5,0	100	NA	NA	4,6	92	4.8	96
Impact on fisherman's life	-	-	-	-	5,0	100	5,0	100
Inspection of the Marine	4,3	86	-	-	-	-	-	86
Professional Certification Preference / IFSC	4,6	92	-	-	-	-	-	92
Professional performance	4,4	88	-	-	-	-	-	88
Average Total	4,7	95	4,5	90	4,6	92	4,8	93

Source: survey data.

Altogether, the three groups of managers - Fisheries, Marine and Certificates - believe in the "know-how" of the fisherman (99%), which was valued in the certification of professional qualification, as interviewed GP5: *"The métier of it is to look at the stars, to the sky and say I'm going to leave that time will help I'll make a good fishery "[...]," old crew, people who are of the sea, have salt in the skin. "*

Regarding the instrument of professional legalization, 92% recognize the Network Certific, GP19: *"was a key moment among these institutions ";* GP5: *"He is a master indeed, but without the wallet, so he deserves a chance to regularize life and actually be the commander of the boat."*

For 90% of the interviewees, the adequate time for course formation was adequate to that available to the fishermen, but 10% were in doubt about their duration, GP5: *"a course for those who are master, but not in fact, with the professional portfolio, should be smaller and without examination ";* GP11: *"Too long, there's no way to stay with the boat stopped ",* or does not know the subject, as interviewed GP19: *"because I do not know to answer that thoroughly".*

In the opinion of 93% of the managers, the IFSC / Itajaí manages to supply the sector's demand and contribute to the qualification of the regional fishing workforce, as interviewed GP18: *"is the ease that a fisherman has to work legally, since how many illegal fishermen were on the boats, and today qualified to work legally with knowledge and better performance".*

Thus, 96% ratified satisfaction in the training of fishing professionals (Table 1), according to the GP19: *"if there was no certification from the Federal Institute, until today we would have difficulty in qualifying the workforce, I have no doubt in affirming, it was perfect as manager ",* GP16:" *I encouraged and even the boat stopped for them to take the course ".*

The managers unanimously agreed that there was an impact on the professional life of the fisherman with the Certific. These workers were included in the scope of technical and technological education, giving and re-meaning the learning with success and pleasure.

The fear of the professionals for the inspection of the Marine, according to the interviewed GP4: "*The fisherman when he sees the inspection outside, he runs away, [...] is treated as a bandit, is doing his profession, but he looks like a bad guy because he it needs documentation, license and none of that we have today. "* According to the interviewees, the Brazilian Marine exercises inspection in the documentation of professionals by the Waterway Traffic Safety Division, which guides maritime procedures on surveys and irregular workers. These managers realize that there is a reduction in the assessments after the offer of the courses for category of Specialized Professional Fisherman, better known like "masters of boats".

Teachers also said that this pioneering process of professional certification helped the IFSC / Itajaí to become a reference in the country in the professional qualification of waterways, as they are being asked for other intuitions to report on the implementation.

Most of the fishery managers interviewed (70%) work in the sector between the ages of 20 and 40, with the general average of respondents being 32 years of age. GP13: *"I am 72 years old, but I was born in the fishing, since I was little with my father in the canoe, I took the fishing license in 1963 in Florianópolis and in 1972, I made the first whaling.*

The function of these managers involves a contingent of 11,783 workers, of whom approximately 590 professionals are fishermen. Of these, about 60% were qualified for the legal profession, GP18: *"sometimes we do not want to accept fishermen without documentation, but to not leave the boat stopped, it is better to risk",* GP11: "We work more quietly when they have the portfolio and they are all legalized."

According to the fishermen interviewed, the main causes of fishermen carrying out the activity without qualification are factors such as lack of time (50%), lack of interest in qualification (27%), offer of courses (14%) and low schooling %). Another reported fact was the transfer of the most qualified fishermen to vessels operating in the Brazilian pre-salt as of 2010, GP19: *"the migration of the most qualified fishermen to merchant marine from 2010,*

when the government invests in pre-salt exploitation left fishing with the less qualified ".

Among the managers interviewed, 92% have preference for professionals with certification from the IFSC / Itajaí, but for some, what matters is the quality of the course. Of the managers, 86% claim that there is

supervision to the undocumented professionals and 88% believe that the qualification improves the performance of the fishermen (Table 1), although to 14% it is not evident.

Table 02 shows the open questions answered by the Fisheries (GP), Marine (GMB) and Certification (GC) managers:

Table.2. Categorization of open questions answered by Fisheries (GP), Marine (GMB) and Certific (GC).

Category	GP	GMB	GC
	N	N	N
Course during closed	5	-	-
Time available to attend course	5	-	1
Incentive to courses	6	-	-
Supervision coercion	4	-	-
Political issues	1	-	-
Customer Service	3	-	-
Internal process	-	1	-
Course Systematics	-	-	12
Integration theory and practice	-	-	6
Reduction of accidents	-	-	1
Environmental awareness	-	-	2

Source: survey data.

For the managers, the best time for the IFSC / Itajaí to qualify their fishermen in the Certific, would be during the period of closure of that fishing modality that the vessels act.

Shipowners believe that the duration of the course by the certification methodology was adequate to the available time of the fishermen, although it required efforts to adapt the school temporalities in the qualification and legalization of the sector (RIBEIRO, AGUSTINI & MARTINS, 2017). This problem seems to be recurrent, fishermen from Portugal in the 1990s, remained 75% of the year engaged in fishing (AMORIM, 2001). The profession requires full-time work, always depending on the environmental conditions for locating, catching and storing the fish.

The PEP course was the most sought after, taking into account the higher number of enrollments and less drop out. The 13% of the quitting fishermen attributed the unavailable time as an obstacle to attend the course. 87% of the fishermen registered were qualified, of these, 69% requested certification and all obtained their certified knowledge. Thus, for 98% of the interviewees the course was completed in a shorter time and adequate to the available time of the fisherman. With this, 92% declare that it is impossible to attend a traditional course with full time, although 8% would interrupt work to qualify. Note that in the PEP course, there were a greater number (90%) of students who requested certification against 20% of the POP students.

According to managers of the Brazilian Marine there was a reduction in the assessments after the courses offered to specialized fishermen (boat masters). By means of the speeches, the recognition of the Certific Network as Instrument of legalization and contribution with labor (Tables 1 and 2) can be seen, although they demonstrate the insecurity of the new methodology in the area.

The fear of the professionals by the inspection, according to the interviewee GP4: "The fisherman when he sees the inspection outside, he runs away, [...] is treated as a bad guy, he is doing his profession, but he looks like a bad guy because he needs documentation, license and none of this we have today." The lack of administrative political indecision at the federal level to the sector, according to manager GP4: "I had a lot to go forward yet, but it was working, had a strong team, a path, an address and when we thought it was right, ".

The period of "closure" of the courses, as GP4: ""*The sustainable awareness developed and practiced by some managers, GP2:" if we can change the Brazilian market, with boats focused on the quality, bring less fish, make more money, the consumer would have a good quality fish, this is the future of fishing in the country "*.

The interviewees evaluated the courses offered after the Marine's accreditation, as an added value in the training of fishermen, when the Itajaí Ports Office decreased the offer by Federal budget restriction. Confirming this idea GMB 2 says: "*We are experiencing a federal government budget recession and the courses have*

greatly reduced the amount of supply to the communities they need, due to budget constraints". Thus, the IFSC was the pioneer institution in offering this training. The GMB1 states that it "has been a pioneer, ... *the IFSC here for several reasons, was what went off in the front applying courses "*. However, the training of the fisherman does not consist only of a legal and bureaucratic process, but involves his professional qualification, GMB1: *"...legalization is not only to have a role, but presupposes that they are qualified, only when to take the certification is the result of the qualification. "*

On the other hand, the actors that participate in the management of the Certification at the IFSC / Itajaí have declared satisfaction (92%) with the implementation of the qualification, considered positive - innovative, unprecedented for being inaugural on campus, leading to learning through practice, despite the challenges of reconciling the fisherman's time.

The teachers realized the need to improve the Internal Process, requiring some documents to the students with less bureaucracy, workload of those involved, the certification process, specific methodology to the target public, pedagogical training. According to these, the improvements for the improvement of the Network Certific in new editions, motivating other areas for the professional certification.

The role of the IFSC in the view of Certific's managers is to foster the education of people excluded from the formal learning process by modifying the structuring of society. In addition to obtaining a portfolio, transform the fisherman's relationship with the school, valuing knowledge. The managers unanimously agreed that there was an impact on the professional life of the student with the Certificate. These workers were included in the scope of technical and technological education, opportuning and reifying the learning with success and pleasure.

In matters such as the delay in legalization after the end of the courses, GP15: "the fisherman has to wait two years to dispatch"; as well as, fear of the professionals by the coercion of the inspection, interviewed GP4: *"The fisherman when he sees the surveillance outside, he runs away, he is treated like a thug, he is doing his profession, but he looks like a thug because he needs documentation, license and none of that we have today. " The lack of administrative political indecision at the federal level to the sector, GP4: "I had a lot to go forward yet, but it was working, had a strong team, a path, an address and when we thought it was right, they pulled the folder."*

IV. DISCUSSION OF RESULTS

The development of cognitive forms and practices is rarely believed by fish managers (DIEGUES, 2004) because of lack of dialogue and little appreciation of fishermen's knowledge (ALLUT, 2000). However, managers believe in know-how, as ship-owners kept their employees (masters) without documentation for years on the vessels. Probably due to the trustful contracting of relatives and acquaintances (HAIMOVICI, ANDRIGUETTO FILHO & SUNYE, 2014), demonstrated by the reliability and knowledge of the crew in carrying out traditional fishing activities.

The affective commitment, loyalty and loyalty generated in teamwork is a result of shared management of people (LEITE *et al*., 2015), which determine the feeling of being "part" (STECCA, ALBUQUERQUE & ENDE, 2016). This climate of sharing and commitment also occurs in the fisheries sector, due to the complicity of the ship owners and fishermen, assumed in the burden of irregularities, such as the lack of qualification, the "dispatchers" on board.

The managers deposited credit in the qualification of their workers and recognize the Rede Certification as an instrument of professional legalization, expressing satisfaction with the safety in production protected by legalized professionals and licensed boats. The licensing system in Brazil regulates fishing, although it is a bureaucratic record of statistical control, it represents the equal right, generating biological and socioeconomic sustainability, demanding a qualified worker in the industrial fleets.

In general, there is a high difficulty in the productive sectors to get qualified professionals on the market (SCHWARTZMAN & CASTRO, 2013), especially in the fishing sector, when the precariousness of labor leads to illegality to the detriment of the still vessel. The ship owners interviewed report the need to hire legalized fishermen. However, in practice due to the scarcity of this skilled labor, still today part is kept in the underground to not interrupt the activities of the vessels.

The illegal professional practice of workers relegates to invisibility (PEREIRA & BOTELHO, 2017), generated in the absence of public policies that recognize the abilities of the subjects to exercise their rights. The fishermen use subterfuge to avoid surveillance and notice, time fleeing, or leaving at uncertain times of the port and other times becoming invisible in this process, assuming a third party legalized and contracted on the vessel for this purpose.

The craft of the fisherman is based on work and knowledge passed down through generations. The Certified Network, when consolidating public policies of professional education in various sectors, brings to the

fishermen's specific needs and capacities, such as time and knowledge of daily practice, to restore human dignity in the profession (HICKENBICK, RAMOS & ROSA, 2017).

Fisheries and Marine managers estimate that approximately 60% of industrial fishermen work in hiding, a fact that may lead vessels to stop fishing. In addition, skilled workers tend to migrate to the oil sector (Rosa, 2014) in search of better wages as they do in other European fishing fleets (SONVISEN, 2014).

The ship owners considered that the duration of the course by the certification methodology was adequate to the available time of the fishermen, although it required efforts to adapt the school temporalities in the qualification and legalization of the sector (RIBEIRO, AGUSTINI & MARTINS, 2017). This problem seems to be recurrent, fishermen from Portugal in the 1990s, remained 75% of the year engaged in fishing (AMORIM, 2001). The profession of fisherman requires full working time, but always depends on the environmental conditions for locating, catching and storing the fish.

Thus, the best time for qualification of the fishermen, it would be difficult to reconcile in a single course, professionals from nine types of fleet, during the closed period, indicated by 30% of the managers of the fishing, and different fishing modalities on the coast of Santa Catarina. The managers' trust in public policies fluctuates with the administrative representativeness of fisheries at the federal level, from ministerial status to department in another ministry, where the political instability of the last few years has left us unsuccessful in claiming.

The origin of managers determines the systems of beliefs and consensuses aimed at maintaining the sustainability of fishery resources (DIAS NETO, 2010), since the experiences and learning of the fishermen, today managers, occurred in a time of abundance, free from the pressure that the fish stocks (CÉLIO JÚNIOR, 2014).

In the last decades, public policies focused on the living conditions and integration of fishermen into society (HAIMOVICI, ANDRIGUETTO FILHO & SUNYE, 2014), offering professional technical training courses supported by the current educational legislation, although insufficient to the great demand (MANFREDI, 2010, CLARO & PEREIRA, 2013, RAMOS & STAMPA, 2016).

Systems aimed at the recognition of knowledge and experiences have become prerequisites for professional certification of learning in the various educational contexts of European countries (OLIVEIRA, MARESCOTTI & FORMICUZZI, 2014), and currently in Brazil (LIMA & CUNHA, 2017). The adhesion of this public policy concretizes interests shared by the social

actors, placing the country in the condition of high development (LAFONT & PARIAT, 2015), in which the Network Certificates in 2014 the Federal Institutes as accreditors and certifiers of knowledge built in the experience of life / work the Professional certification (LIMA & CUNHA, 2017).

The factor of low schooling, despite the efforts remains unsolved and some fishermen still do not have the documentation, even after completing the course, GP5: *"the fisherman has to wait two years to dispatch"*. This fact demands new studies to the sector that needs urgent solutions. However, most managers recognize that the Certified Network contributed to the skilled workforce, requiring cooperation between educational institutions, government agencies, managers and workers, in the development of a collaborative network (URBANO, 2013). Optimizing vacancies in vocational education institutions, allowing the access of this policy in the various productive sectors that demand the qualification of active professionals in the margin of this process.

V. FINAL CONSIDERATIONS

The public policy National Network of Professional Certification (Network Certification) has contributed to the fishing industry, demonstrated in the political coalitions, boosting economic development and promoting social inclusion, removing workers from illegality, recognizing their knowledge and qualifying them, translating in a professional empowerment.

Training is fundamental in the sustainable development of fisheries, but legalization is not only a role, it presupposes the necessary knowledge to carry out activities, safeguard lives and vessels and ensure sustainable awareness. The fisherman, like any other profession, requires qualification in a process of continuous learning for environmental transformation, subsidized in a cross-curricular sense of the courses that the institution proposes to minister.

The characteristics of the contribution of the course, according to the three-dimensional view of actors, reside for the opportunity to offer this certification of professional qualification of fishermen, through courses that the Marine of Brazil did not supply in sufficient quantity and for the use of the Network Certified that, in their systematics, allow the recognition of practical fishermen's knowledge with the Professional Certification for this sector, allowing the legalization to the time of the worker-student.

It is perceived that this practice facilitates the promotion of initiatives that may contribute to the achievement of the UN's sustainable development goals 8 and 14 through decent work for all, in a productive and

integrated way to society and, by sustaining and using oceans and seas as well as maritime resources.

Our research makes three contributions. The first one to characterize the Specialized Professional Fisherman course (PEP), by means of the survey of the perceptions of the actors, involving managers of the fishing sector in the region of Itajaí (SC), the Brazilian Marine and Professional Maritime Teaching and Certification directly linked to training. The second is to highlight the fishing sector in the quest for full integration into society with the development of jobs and benchmarking of fishers' incomes in formal and legal jobs through qualification and specialization courses, and the third to highlight what public policies need be formed for the valorization of the fisherman and the chain of the Brazilian fishing sector (REDE NACIONAL DE RÁDIO, 2019, 2019a, 2019b).

We suggest that research related to safe-fishing of artisanal fishermen; to the colonies of fishermen; the artisanal fishing (COSTA & ASMUS, 2018; ACAUAN *et al*., 2018) and industrial fishing; the catch of the mullet; the Safra financing line; control of fishing fleets; the Brazilian fishery statistics; outsourcing of public fishing terminals; species of fauna that are in extinction; the technical committees of discussion on the fishing resources in the Brazilian states where the community is impacted; aquaculture tanks and their legislation; the consumption of fish in Brazil and in the world; Brazilian fish exports and their markets; and the fishery and aquaculture financing lines of the Safra Plan must be evidenced, researched and investigated in the academic literature, since they deal with the goals of the Aquaculture and Fisheries Secretariat (SAP) linked to the Ministry of Agriculture, Livestock and Supply (MAPA).

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The Confrontation of Environmental Problems through Compliance

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Abstract— This article intends to treat the Compliance Program as a way to combat environmental problems. Thus, the central issue is the following question: is it possible to address environmental problems through the implementation of the Compliance program? To solve this issue, the main objective of the article is to analyze the role of Compliance in addressing environmental problems. And specific objectives are to study environmental law in globalization and the concept of compliance. Therefore, the article was divided into three topics, the first dealing with Environmental Law in the Globalization era, the second on Compliance and the third on Compliance as an instrument to prevent environmental problems, where Environmental Compliance was analyzed in more detail. which are used by companies and public bodies to comply with environmental standards. As for the Methodology, the report of the results will be composed on the Inductive Logical basis. In the various phases of the Research, the Referent Techniques, Category, Operational Concept and Bibliographic Research will be used.

Keywords— Compliance. Environmental Law. Sustainability.

I. INTRODUCTION

The Environmental Law presupposes a systemic and holistic vision to maintain and recover the environmental balance, through the rational use of natural resources and the restraint of abusive practices that lead to the degradation and the exhaustion of the health of the planet. Principle 4 of the Rio Declaration on Environment and Development of 1992 states that "in order to achieve sustainable development, environmental protection should be an integral part of the development process and can not be considered in isolation ".

In order to achieve sustainable development, it is necessary to impose and take effective measures, since it is not an easy task to achieve, in view of the great natural disasters that have occurred due to the mismanagement of natural resources and the care for the environment.

This article seeks to analyze the emergence of the preoccupation with the environmental issue, inserted in the world context, from the work of Rachel Carson and the role of the Compliance Program in the new world order.

Thus, this article has a central problem, the following question: is it possible to address environmental problems through the application of the Compliance program?

In solving this question, the main objective of the article is to analyze the role of Compliance in addressing environmental problems. And specific objectives are to study environmental law in globalization and the concept of compliance.

As for the Methodology, the report of the results will be composed on the Inductive Logical basis. In the various phases of the Research, the Referent Techniques, Category, Operational Concept and Bibliographic Research will be used (PASOLD, .2008).

II. OF ENVIRONMENTAL LAW IN GLOBALIZATION

The development of the history of scientific and technological advances have always been accompanied by the necessary restructuring of ethical and legal paradigms, as a guide for action and human interference with the environment.

The perception of the negative effects of human action on the environment began in the United States in 1962 when Rachel Carson told "a fable for tomorrow" in her work Silent Spring, the debate on progress linked to a predatory economic model and the relationship of the human being with nature (CARSON, 2010).

Today, the reverberating theme refers to the unbridled emission of greenhouse gases, such as carbon dioxide and methane, which are released by burning fossil fuels and deforestation, which prevents heat from dissipating into the atmosphere.

Contrary to isolated negationist positions, the international community has invested in efforts to control climate change. Recently, at the Climate Conference (COP24) held in Katowice, Poland, after the withdrawal of Brazil's candidacy to host the event, representatives of some 200 nations agreed to maintain the commitments of the Paris Agreement, adopting new measures to implement models based on reducing the emission of gases (UN, 2018).

The concern is part of the Special Report of the Intergovernmental Panel on Climate Change (IPCC) which concluded that global warming is a consequence of the aggressive posture of the use and transformation of natural resources of the earth by man, especially since the Industrial Revolution. This represents the direct reference between global warming and the economic model of development adopted by most countries.

The current socioeconomic model that remains throughout the historical context is based on an aggressive posture of use and transformation of the environment. For a new structural project in the approach to environmental protection the predatory model that perpetuates needs to be reviewed and overcome. The motto focuses on a new model that considers the risks and sustainability levels of exploitation and use of natural resources. Development finds its limit in the protection of all forms of life, preserving the rights of current and future generations.

According to Klauss Bosselmann, with globalization the concept of sovereignty undergoes a reconstruction, especially in the environmental sphere, recognizing the global environment by nature, and the greatest unifier of humanity - at least in the sense of a shared concern.

It is urgent to replace historical misguided public policies and governments that are indifferent to the environmental cause. The challenge of transforming the hegemonic economic model also presupposes a great change in society in its relationship with the environment, re-evaluating the current consumer pattern, which is incompatible with the limited natural resources (BOSSELMANN, 2015).

The planet is the common home of all life forms and the right to a balanced healthy environment is recognized as a fundamental right of the third dimension. From the 1960s and 1970s, environmental protection, understood as a collective right that also protects man's life and quality of life in his individuality, "is now recognized in juridical and constitutional terms as one of the values that make up the list of fundamental (human) rights" (FENSTERSEIFER, 2008).

It is understood that the Fundamental Rights of the third dimension are trans-individual because they are collective, insofar as the number of holders and / or

persons affected by the violated right can be identified; and, because they are at the same time diffuse, since countless their holders or persons affected.

Examples of this are the largest socio-environmental disaster that occurred in Brazil in November 2015 in the city of Mariana, with the rupture of the Fundão dam, built and operated by the mining company Samarco S / A, which resulted in the release of tailings of ore for almost 700 km of Rio Doce; and only three years later, on January 25 of this year, in the city of Brumadinho, metropolitan area of Belo Horizonte, the rupture of the Córrego do Feijão dam, which hit the administrative center of VALE and houses of the rural area, devastating part of the community of Vila Ferteco and leaving a trail of destruction and deaths.

Environmental Law presupposes a systemic and holistic view. For a deeper reflection on the path that has been taken so far, an interdisciplinary analysis is indispensable in order to understand the connection and interdependence between Fundamental Rights and the environment.

In the chronological perspective of Gabriel Real Ferrer, the process of construction of Environmental Law is translated into three great moments, which he calls the three "olas". The author points out the importance of understanding the path taken up to the present situation, as a way to see new evolutions in the environmental field (REAL FERRER, 2013).

Gabriel Real Ferrer (2013) points out the influence of the Club of Rome for the convening and development of the United Nations Conference on the Environment in June 1972, in Stockholm, which provoked the first "ola" that spread over much of the planet. It was the first meeting of developed and developing countries to address the impacts of the environment caused by human action.

In the evaluation of the first "ola", Gabriel Real Ferrer highlights what he suggests as the most transcendent result of that moment: the constitutionalisation of environmental law in a significant number of countries, through the Principles that, embryonic, recognized the need to impose limits growth.

Due to the acute environmental crisis, civil society began to articulate through Non-Governmental Organizations (NGOs), which assumed the important role of new social agents engaged in the environmental cause, marking the beginning of the second "ola".

In 1992, the United Nations held the second Conference on Environment and Development (UNCED), RIO / 92, or Earth Summit. All participating countries incorporated abundant and modern environmental legislation, becoming known as the "photocopy generation" because

they reproduced the laws disregarding the local social, economic, legal and environmental reality.

The second wave is recognized for its importance in guiding global environmental standards through non-binding official documents in Rio / 92.

The third wave presupposes the moment of a collective reaction from the international community to address environmental challenges. There is an improvement in the level of commitment, but the same does not happen with the speed and intensity that environmental problems require. Also, alert Gabriel Ferrer Garcia:

> is well known the lucid phrase with which the V Program of Action on Environment of the European Community (1992/2000) was closed "we can not wait and we can not be wrong", well, I am afraid we have waited and we are wrong too. (REAL FERRER, 2013).

For a new global Socio-environmental State, cooperation and solidarity between States is the new paradigm to be pursued. Gabriel Real Ferrer advocates transforming solidarity as an ethical principle into a legal principle, and stresses the need to think of politically organized groups or societies.

Environmental governance requires new policies for the construction of Environmental Law, transposing the classic power of the States. The planet will have to live a fourth wave to build a Planetary Environmental Law.

The compliance program begins to be used by large companies as support for the construction of this new environmental governance in a global Socio-environmental State. Thus, in the next topic what is this program will be studied.

III. OF COMPLIANCE

The fourth "ola", which Ferrer discusses, in which the world needs to live to build a Planetary Environmental Law, refers to the idea of Globalization and its drastic effects, among them corruption, which affects the private and public spheres of society, compromising sustainable growth and endangering the legitimacy of the government and the security of the global financial and economic system.

In this sense, the 10th Principle of the United Nations Global Compact forced global corporations to implement integrity programs (Compliance Program) to combat corruption in compliance with legal and ethical rules (UN, 2017).

Marco Cruz (2017) considers that the origin of the Compliance Program is remote, since it was born with the first ethical conflict, the expression found for the first time in the text of the Fabrianese Letter in 1186.

It was with the scandal in the electric power industries in the United States of America in 1960 that Compliance emerged as a program, as electric equipment manufacturers raised prices, leading to convictions for individuals and corporations for antitrust violations, encouraging the development of codes of conduct.

Following this scandal, the Foreign Corrupt Practices Act (FCPA) was enacted in 1977, known as the Transnational Anti-Corruption Act, which established accounting, tax and labor obligations to companies (TOMAZ, 2018).

The term Compliance comes from the verb to comply in English, which means to act according to a command or rule.

However, in a corporate form, the term Compliance characterizes the actions and attitudes taken by companies, carried out in compliance with the ethical, legal and procedural rules that regulate an activity, "thus becoming synonymous with correct posture in the conduct of its business".

The Compliance program is an integrity program aimed at establishing a set of institutional, management, control and regulatory acts, promoting transparency and reducing the level of risk of attitudes that violate the principles of integrity, adopting tools that prevent the occurrence of corruption cases (RIBEIRO, 2015).

Candeloro (2012) defines Compliance as an instrument of risk control:

> It is a set of rules, standards, ethical and legal procedures, which, once defined and implemented, will be the main line that will guide the institution's behavior in the market in which it operates, as well as the attitude of its employees (CADELORO, 2012).

In addition, it is also an instrument to combat corruption, "so it is called here the preventive measures of commitment to combat corruption such as the economic compliance programs (RESENDE, 2018).

The Compliance program in the Brazilian legal system is provided for in Law no. 12,846, known as the Anti-Corruption Law, which establishes the program for the application of codes of ethics and conduct with the objective of detecting and remedying irregularities and illegal acts committed against the public administration, national or foreign:

> It should be emphasized that all this systematic compliance programs are not mandatory for Brazilian companies, but serve to reduce the risks in the responsibility of commercial organizations of the acts practiced by their employees or managers with the Public Administration, whether direct or indirect (RESENDE, 2018).

Decree n. 8,420 that regulated the Anti-Corruption Law, establishes that the said program must have its structure

and application according to the reality of the company, improving it and adapting it according to the needs, thus guaranteeing its effectiveness. About this Roberto Epifânio Tomaz:

> The compliance program should be adopted by corporations voluntarily, but it will be applied in all its areas of activity and in all its relations with the private sector, as well as with the public administration - in Brazil of extreme relevance, since the State still constitutes the largest borrower of goods and services (TOMAZ, 2018)

With this, it is realized that Compliance can be applied in any type of business organization, be it individual micro entrepreneur, limited company, anonymous, among others.

It is important to emphasize, therefore, that there is not only a kind of Compliance Program, since each company will adapt the program according to its economic reality and its needs (LIEBL, 2017).

The implementation of the Compliance Program recommends measures such as the elaboration of a Code of Conduct, implementation of Permanent Communication Policies, creation of the Ethics Committee, the Ethics Centered Recruitment system and the institution of the Internal Control and Audit System (CGU, 2009).

Therefore, the Compliance involves the strategy of risk prevention and social and economic gains, as it seeks legal and ethical conduct, starting with the focus of "economic and socio-environmental development in the direction of business, as well as the search for sustainable profitability.

Also, sustainability in the company also arises from the idea of sustainable development in the area of environmental law, and the intention of the company to perpetuate itself over time (LIEBL, 2017).

Thus, with a set of actions adopted will ensure economic, fiscal, labor, environmental and market outcomes. Thus, "Compliance fits into this environment as a program that serves more purpose than to annihilate the "virus" of unsustainability in the company (LIEBL, 2017).

Thus, the results with the adoption of the Compliance Program, guaranteeing the continuity of the company and its values, with financial, economic and social gains are perceptible and necessary for the World Social-Environmental State.

IV. OF COMPLIANCE AS AN INSTRUMENT FOR THE PREVENTION OF ENVIRONMENTAL PROBLEMS

With the alarming levels of environmental degradation and the abusive exploitation of natural resources, from the 60s and 70s, environmental protection, understood as a trans-individual right that also reaches the protection of human life and quality of life in the his individuality, "is now recognized in juridical-constitutional terms as one of the values that make up the list of fundamental (human) rights" (FENSTERSEIFER, 2008).

In Zygmunt Bauman's (2013) reflection, the planet is constantly changing and the behavior of individuals, in today's net modernity, of free traffic and volatile barriers, where local conduct translates into a global reflection, forms an immense network of interdependence that can no longer be undone. Liquid society is experiencing a time crisis. Everything must be quick and thus it becomes superficial. The irreversible phenomenon of globalization has greatly altered the values of the society of producers, outlining the transformation of behavior that was genuinely aimed at a better life for all.

For Anthony Giddens (2000), the world we live in today is out of control, and it does not resemble that projected by Karl Marx, in which the greater the development of science and technology, the more stable and orderly the Planet.

In the modern era, the "precautionary principle" emerged in Germany in the 1980s to limit liability in the face of increased risk of manufacturing, which proposes that action should be taken in the case of environmental issues, even though there is scientific uncertainty regarding to them.

The precautionary principle is included in the Rio Declaration on Environment and Development, which defined it as "the guarantee against potential risks that, according to the current state of knowledge, can not be identified yet" (Raffensperger, 1999, Myhr, 2003; Varella, 2004; BRAZIL, 2019).

However, commitment to future generations is a duty of citizenship, not only of those who feel guilty for the damages caused to the environment, but of all, impelling collective practices and solutions of preservation to nature.

Given this, when it comes to the management of companies and public bodies a viable solution for achieving sustainable development and sustainability is the application of Environmental Compliance.

Disrespect for environmental laws has harmful effects on everyone, and it is through this field that Environmental Compliance has established itself, becoming a significant instrument for environmental management.

Corporate governance is inevitable, adopting eco-efficient placements and effective management that can deliver results with the least possible environmental impact.

Moreover, companies generate an absurdity of bureaucratic processes that lead to the formation of illegal means and fraudulent environmental standards. So

Environmental Compliance comes against these frauds, leaving companies committed to social ethics.

In addition to compliance, companies also seek certification, such as ISO 14000, which deals with environmental guidelines, thus, compliance with ISO complies with the concern of companies with their environmental responsibilities and in compliance with environmental standards.

It is known that there are several forms of Compliance, each of them focused on the reality and objective of the company, thus, Environmental Compliance is focused mainly to meet the environmental standards in which the organization is inserted.

Thus, for Tiago Rezende, environmental compliance "which aims to prevent and adapt companies to the new ethical perspective of the contemporary world must be based on the theory of the dynamic process of Human Rights." (REZENDE, 2018).

This is because the right to the ecologically balanced environment is seen as a fundamental right, in which everyone must preserve for present and future generations.

Therefore, Environmental Compliance also aims at structuring solid business models in the face of the socio-environmental crisis and the expansion of the market, and this model of the current economic market is based on sustainability:

> The changes described are intended to strike a balance between business activities and sustainable development. This means that companies must implement programs based on sustainability in order to provide quality-of-life resources for present and future generations. One of the constructive channels to achieve this goal is the implementation of corporate sustainability compliance programs in organizations (REZENDE, 2018).

Thus, preservation and conservation of the environment, rather than being fundamental for organizations to operate legally, "is also considered strategic for organizations that want a competitive potential (REIS, 2018).

Therefore, in addition to dealing with environmental problems more easily, environmental compliance programs contribute to companies maintaining the achievement of their activities, always guided by ethical and socio-environmental values, in the view that society is part of the environment and requires it to continue developing.

V. CONCLUSION

Historical and theoretical elements have been examined that are able to re-emphasize the importance of preservation and restoration of the balanced environment

for the perpetuation of life in all its forms, in order to reverse the alarming scenario of excessive and unlimited exploitation of natural resources. The global era means confronting the diversity of risk situations and the new transnational demands of modernity, in the configuration of transnational public spaces that are justified as guarantors of Fundamental Rights, and especially of the right to the Environment balanced and healthy, vital to the perpetuation of human species on the planet.

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Cardiac Activity Assessed *in vivo* and *in Vitro* in Rats Treated with Propiltiouracil (PTU)

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Abstract— Thyroid hormones interfere with cardiovascular functions causing morphofunctional changes in cardiomyocytes, evidenced by electrophysiological activities and hemodynamics. This study examined the implications of hypothyroidism on cardiac electrical activity in Wistar rats under experimental conditions in vivo and in vitro. It was approved by the animal ethics committee (CEUA-University of Gurupi-TO, Brazil), using 20 rats (male and / or female), randomly subdivided into 10 control rats (treated with water + aspartame) and 10 experimental rats (treated with water + aspartame + PTU) for 4 weeks. On the 31st day, in thestudies in vivo, the electrocardiographic tracings (ECG DL 660 Delta Life) were obtained with the anesthetized animals and, in the Langendorff preparation, the hearts were isolated and perfused in a chamber with electrodes (Ag / AgCl) connected to the ECG and recorded cardiac electrophysiological activity. In both protocols the analyzed variables were: heart rate (BPM), amplitudes (mV) of P, QRS and T deflections and intervals (ms) PR, QRS and QT. The results obtained were bradycardia, prolongation of the PR interval, QRS and QT interval in bothprotocols in vivoin and in vitro rats treated with Propylthiouracil (PTU). In theexperiment in vitro there was a reduction of P wave amplitude and no significant change in ventricular contractility compared to the control group. It is concluded that the deficit of thyroid hormones alters the functions of cardiac chronotropism and dromotropism evidenced by bradycardia and stretching of PR, QT and QRS intervals.

Keywords— Hypothyroidism. Cardiac Evaluation. Langendorff. Propylthiouracil. Epidemiology.

I. INTRODUCTION

Cardiovascular physiology, as well as cardiology, has advanced in the treatment of cardiovascular dysfunction as a result of basic experimental and clinical research with animals in the last five decades of what has occurred over two centuries.

The electrocardiogram (ECG) identifies the structural and hydroelectrolytic changes of cardiomyocytes associated with changes in the amplitudes and duration of cardiac action potential (PAC) demonstrated by the behavior of the electrophysiological waves of the heart, being of use in both animal and human experiments, consisting of a non-invasive examination and capable of ensuring good quality research with reliable results [1]. (CHRISTOFOLETTI et al., 2013).

Cardiovascular dysfunctions, associated with shorter life expectancy, are a growing public health problem becoming the target of research in experimental animal models and replications in humans [2]. (Graes and Swers, 2014). Is a challenge for epidemiology in health,

seen growing prevalence such disorders in the world's population.

The thyroid glands produce the hormones T_4 and T_3 and basically perform functions on the metabolism of the human body in order to increase it [3]. (GONÇALVES et al., 2006). Thyroid dysfunction affects thousands of people worldwide, and it is relevant to understand how this dysfunction interferes with cardiac electrical activity [4]. (1998). Changes in the number of hormones produced by the thyroid gland, particularly thyroxine modifies cardiac activity by different means: 1) T_4 acts directly on myocyte through nuclear receptors which in turn will act on genes, 2) T_4 mediates a non-nuclear mechanism, 3) through the change in vulnerability and nervous system tone in the sympathetic system, and finally 4) the T_4 causes an increase in energy consumption, resulting in a greater capacity of muscular contraction [5]. (THOMAL, 2007).

The deficit of HT or hypothyroidism is also dysfunction thyroid and can lead to changes in heart electrical activity, evidenced by changes in cardiac inotropic and chronotropismthe [6]. (NASCENT, 2011). In this diagnosis, the gland does not synthesize T_3 and T_4 or only with high TSH levels [7,8]. (Edwards et al., 1991).

For a better understanding of the action of HT on cardiac activity, it is necessary to know the electrocardiographic profile, and the studies may occur in adult rats since they are stable in this phase of life, serving as parameters for the identification of ECG tracing changes in rats with disorders of thyroid hormones [1]. (CHRISTOFOLETTI et al., 2013). In the ECG, imbalances in the sodium or potassium channels, metabolic disorders or electrical changes due to anatomical and physiological abnormalities, affect the amplitude, duration and/or intervals between electrophysiological waves, exacerbating, among the main functional modifications, chronotropic and or cardiac inotropism [9]. (ZORNOFF et al., 2009). The normal profile of the electrocardiographic waves in studies with rats is expressed in the complete order of the P, Q, R, S, and T waves, in which a significant oscillation in the S wave voltage and signs of the absence of the P wave can be observed [1]. (CHRISTOFOLETTI et al., 2013).

Propylthiouracil (PTU) is a drug prescribed for the treatment of hyperthyroidism in humans and, in animal models generally with rodents, has been used to induce in these the clinical picture of hypothyroidism. Data from animal modeling to verify the effect of thyroid hormones (HT) on myocyte gene expression has been supported for clinical studies in humans [10]. (HAJJE et

al., 2014). Morphological and structural changes observed in cardiomyocytes caused by the absence of HT in rats induced hypothyroidism by ingestion of PTU evidenced heart failure by reduction of myocardial blood flow associated with a decrease in the number of arterioles [11,12]. (TANG et al., 2005 apud CHENG et al., 2012). Propylthiouracil (PTU) reduces the peripheral conversion of T_4 to T_3 by inhibiting the Type 1 (D 1) deiodinase present in peripheral tissues and in the thyroid. High doses of PTU have a beneficial action when a faster control of the thyrotoxicosis is desired [13,14]. (Andrade, 2001; Lopes, Vale, Ogawa, 2016).

In hypothyroidism, changes observed on the ECG are generally characterized by bradycardia, reduced P wave amplitude, low QRS complex voltage, attenuation or inversion of the T wave, prolongation of the PR, QRS and QT intervals and, uncommonly, a ventricular tachyarrhythmia [15,16,17]. (Vorges-Uricoechea et al., 2004).

Cardiovascular diseases are the leading causes of mortality and morbidity worldwide. The heart is among the organs most responsive to the action of thyroid hormones, which, under the clinical manifestations of hypothyroidism and human evolution, may present a reduction in heart rate, decreases in contractility, speed of myocardial relaxation, decrease in return increased peripheral vascular resistance.

For this reason, the objective of this study was to evaluate the cardiac performance of hypothyroid Wistar rats induced by the administration of PTU under experimental conditions *in vivo* and *in vitro*, providing valuable information about the cardiovascular pathophysiology caused by this thyroid dysfunction. alterations in electrophysiological parameters. In this study, the Langendorff perfusion method was used to isolate the rat heart for the purpose of the study. This experiment was pioneered in the state of the Tocantins, Brazil, which extends the possibilities of its application to this type of scientific investigation.

This Langendorff method resulted from a slow-paced discovery that lasted more than a hundred years. However, it has the advantage of providing computerized data acquisition, followed by storage and processing to increase electrophysiological and hemodynamic knowledge [18]. (BELL et al., 2011). Several laboratory tests are performed worldwide based on Langendorff's methodology, including technical improvement for new discoveries such as metabolism and coronary regulation studies using conventional chemical methods and magnetic resonance and Doppler echocardiography techniques [19]. (SKRZYPIEC-SPRING et al., 2007).

II. MATERIALS AND METHOD

2.1. Type of study, site, sample, ethical principles

An experiment was carried out using animal modeling of Wistar rats from the laboratory of the Universidade de Gurupi - UnirG, State of Tocantins, Brazil. All treatment, manipulation and euthanasia procedures were carried out in strict compliance with the resolutions of the specific Brazilian Bioethics standards in Experiments with Animals, Law Procedures for the Scientific Use of Animals, N^0 11794 - sanctioned on October 8, 2008 - National Council for Control of Animal Experimentation - CONCEA. This research was approved by the Ethical Committee on the Use of Animals (CEUA) of UnirG University, protocol n° 06/2018.

All the experiments were elaborated, delineated, conducted and carried out in the Laboratory of Physiology of Campus 2, UnirG. Twenty *Wistar* rats (male and/or female) supplied by the clinic's normal central laboratory, fed with standard feed Nuvilab and water *ad libitum, were used*. The animals were kept for at least seven days in the new environment, for the purpose of setting and housed in polypropylene boxes with dimensions 41 x 34 x 16 cm, lined with dry rice straw, in a number of five per box, in an environment with temperature monitored around 25°C.

For control of the circadian rhythm, they were kept in the room with light / dark cycles of twelve hours. The level of the noise intensity of the site is, on average, 54.7 dBA, previously measured by means of a digital decibel meter (IMPAC model IP-130), below the noise considered stressor for these animals. Storage boxes were sanitized three times a week. Throughout the experiment, it was evaluated daily by visual inspection on clinical aspects such as mobility, body weight, water and food intake, eye coloring, degree of coat, behavior, possible wounds, etc. The balance used for weighing the animals is electronic with a scale of up to 7 kg with an accuracy of 1 gram (CE mark, model SF-400). The criteria for inclusion of the animal sample were: 20 Wistar rats (males and/or females), clinically healthy, around three months of age, the weight of 250-500 g, good mobility and normal coat. Although the animals were kept in boxes by gender, this fact was not considered during the data collection, because, in the bibliography, no consensus was found on the influence of gender on electrocardiographic tracings. Obese animals have excluded females in offspring, older than three and a half months of age and with suspected clinical status, avoiding possible biases in the result due to the interference of such factors.

2.2. Design and procedures

The rats were divided randomly and gender into two groups identified in boxes: control (ten mice, five males in a box and five females another) and OCT (ten mice, five males in a box and five females other) [20]. (TOHEI et al., 1998).

Propiltiouracil® (PTU, BIOLAB), a drug used to treat hyperthyroidism and used as an inducer of hypothyroidism in laboratory animals, acts by inhibiting the synthesis of HT and the peripheral conversion of T_4 to T_3, was prepared daily and administered in the amount of 1 mg / mL in the drinking water for 30 days [21]. (FERREIRA et al., 2007).

To overcome the drug-aversive behavior, aspartame PTU was added in the concentration of 10 drops / 100 mL of water, which reduces such behavior. For the animals in the control group only water was supplied, but containing aspartame in the same concentration as that used in the PTU group, in order to reduce the bias by administering the sweetener in only one of the groups. Its mechanism of action is to inhibit the synthesis of thyroid hormones by interfering with the use of intrathyroid iodide (iodine) and the coupling reaction between iodide and tyrosine residues, resulting in iodine disorganization. This mechanism, in turn, results in enlargement of the thyroid gland which is one of the clinical signs of hypothyroidism [22,23]. (MAIA et al., 2013, NELSON, COUTO, 2015).

In rats treated with PTU, blocking of iodine metabolism occurs, leading to an increase in the concentration of iodide observed by the enlargement of the thyroid gland. Inhibition of enzymes specific for deiodases leads to hypothyroidism and an increase in TSH leads to hypertrophy and hyperplasia of the thyroid epithelium and an increase in the concentration of iodide leads to an increase in the volume of the gland [24,25,26]. MOURA; PAZOS DE MOURA, 2004; ANTONIADIS et al., 2003; NUNES, 2003).

In the experimental model of induction hypothyroidism with PTU, the findings of several studies show predominant clinical signs such as reduction of heart and body weight, reduction of hair quality with falls and bruising, reduction of water intake and increase of the volume of the thyroid gland are the signs of the presence of HT deficits [27,12,28,29,30]. (Hahn et al., 2005), and the results obtained in this study are presented in Table 1.

The electrophysiological changes of the cardiac activity in an experimental model of hypothyroidism by ingestion of PTU are confirmed by the evaluation of the ECG profile with significant changes in chronotropism, inotropism, and cardiac dromotropism being a predictor of the thyroid dysfunction signal [31,32,30]. (Engelha et al., 2005).

The diagnosis of hypothyroidism is based on the clinical manifestations associated with the laboratory results through analysis of the reduction T_3, T_4 and increase of TSH or HRT, techniques out of reach in the Laboratory of Physiology of UnirG. Therefore, all mention of PTU-treated rats will be assumptions of being hypothyroid [23]. (NELSON; COUTO, 2015).

After euthanasia, the thyroids were dissected by tracheal cervicotomy, exposed and photographed to assess the volume dimension compared to control animals, thus subsidizing the diagnosis of hypothyroidism (Figure 1).

*Fig.1: Ectoparasitic rat tracheal cervicotomy (Control group) and signs of thyroid gland hypertrophy (Experimental group).
UNIRG of Physiology Laboratory, Gurupi-TO, Brazil, 2018.*

In the description of the Langendorff apparatus (Figure 2) accommodating the camera and the isolated heart perfused by Krebs-Ringer Henseleit solution is acrylic material, robust, with dimensions 20 cm height x 8 cm wide x 12 cm deep. It has four holes through which the Ag / AgCl electrodes pass and another cannulated orifice located in the back (not shown in the figure) where the excess liquid was collected by gravity and scorned in a 2000 mL capacity plastic collection bag positioned in the bottom of the workbench. The temperature gradient of the perfusion solution was on average around 2 ° C, because in the vessel the thermostat was calibrated to about 39 ° C reaching the solution that perfused the heart around 37 ° C. The aeration of the solution moved by atmospheric air pressure occurred by means of an aquarium pump endowed at its end by a porous material and, when immersed in the Krebs-Henseleit Ringer, provided a vigorous ablation.
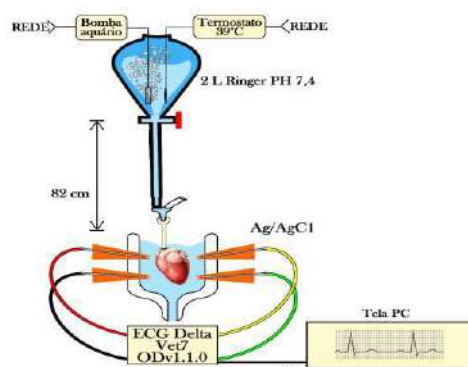
Fig.2 - Langendorff system used to study heart in vitro of control and PTU treated rats. Source: Authors, 2018.

These experimental conditions allowed to conduct studies *in vitro* at a time interval of up to 30 minutes, a period that was enough to obtain ECG records with relative stability. The height of 82 cm equals 60 mmHg within the established standard. A cannula inserted and tethered in the ascending aorta allowed the heart to be positioned vertically. The container fixed to the wall containing solution at a height of 82 cm by gravity perfused the heart, the perfusion flow being regulated by a part provided by an opening/closing mechanism which may enable, in future projects, inputs for drugs and agonist substances or antagonists. Ag / AgCl electrodes were connected to ECG DL 660 (Delta Life), two of them in the atria and two in the ventricles, with the objective of evaluating cardiac work under the inotropic and chronotropic aspects. An acrylic bottle containing the heart was used with the cannula of fixation in the ascending aorta, with Ag / AgCl electrodes coupled to the veterinary electrocardiogram, brand DeltaLife, connected by USB port to the notebook and DeltaVet 7 software for recording and storing the tracings. In the modeling when using animals *in vivo* anesthetized with sodium thiopental (50 mg/kg), these were placed in dorsal decubitus on surgical boards and the four-clawed electrodes were attached to the legs and connected to ECG DL 660 (Delta Life). The rats from the PTU treated

group, protocol *in vivo,* were anesthetized and the electrodes positioned for ECG examination. This Heart 9^0 mouse group treated with PTU, protocol *in Vitro* with the

isolated and perfused heart with modified Krebs-Henseleit solution electrodes placed in the jar for picking up signals and ECG tracing (Figure 3).

Fig.3: Capture of the electrocardiographic tracing of rats treated with PTU - Protocol in vivo and of heart isolated and perfused - Protocol in vitro. Laboratory of Physiology, UnirG, Gurupi-TO, Brazil, 2018.

2.3. Preparation of perfusion solution and Ag / AgCl electrodes

The perfusion solution that was used in the Langendorff preparation was modified Krebs-Henseleit since the commonly used in the Krebs-Henseleit solution is the carbonic acid/bicarbonate buffer, which requires a pressure of the carbogen mixture (95% O_2/5% CO_2).

In the absence of a carbogen cylinder, the buffer system was replaced consisting of phosphate/bicarbonate and used air aeration pressure the following chemical components (in mM): NaCl 125, KCl 4, $CaCl_2$ 2, $MgSO_4$ 1, NaH_2PO_4 1.2, $NaHCO_3$ 13.6 and Glucose 10 (Dynamic brand reagents), having an estimated osmolarity of about 305.6 mOsmol / L at the end.

Strictly speaking, osmolarity should have been measured and corrections made with the amount of glucose to 300 mOsmol / L, but in the absence of an osmometer, the 1000 ml solution thus prepared, was calculated at osmolarity. The pH of the solution was measured using a pH meter (checker, 0-14 pH range, 0.2 hi98103 precision, HANNA brand) and sometimes with a few drops of 0.1 M HCl, sometimes with a few drops of NaOH, 1 M, the mean final pH of the solution was set at 7.42 $\pm$ 0.03 (average of 7 preparations made).

The electrodes were prepared in the following manner: 1.5 g of agar was weighed into a Becker, where 30 ml of 3 M KCl solution was added. Hot mixed until boiled with a glass stick forming a paste which it was immediately sucked through a syringe and inserted into automatic pipette tips, pre-coupled to the chlorinated silver wire (AgCl) and left to solidify. The Ag wire (95% purity) was prepared by first immersing 3/4 of the metal into bleach (sodium hypochlorite) to form a dark portion with AgCl deposits. In the 1/4 Ag portion of the electrodes, the ECG claws were connected.

2.4. Variables analyzed

The variables obtained and analyzed in control rats and treated with PTU, *in vitro* or *in vivo*, were: heart rate (in BPM), amplitudes (in mV) of the P wave, QRS complex and T wave and intervals in the line isoelectric (in ms) of PR, QRS, and QT. All parameters were expressed as mean $\pm$ standard deviation, calculated from various measurements from the same ECG tracings corresponding to individual mice.

Heart rate (HR) was obtained by measuring the RR interval in milliseconds at ECG trace lead 2 at a scanning speed of 50 mm / s. This time, after being converted to seconds, the inverse of this value was calculated and the result was multiplied by 60 seconds, and the heart rate was expressed in beats per minute (BPM). The following is the example: RR interval = 136 ms, converted to 0.136 s. Then, FC = 1 / 0.136 = 7.353 x 60 s = 441.18 BPM.

The measurement of the amplitude of the P wave, identified by the analysis of the electric activity with positive polarity as a curve before the Q wave, was measured from an isoelectric line pointing the beginning and the apex, identifying the end of the P curve in the ECG tracing. The upper and lower limit of the P wave was determined by determining its electrical magnitude in mV. The determination of the P wave of each mouse was obtained by an average of five similar scores.

Measurement of the QRS complex voltage was extracted by analyzing the ECG trace from the lower bound of the complex to the upper limit of the R wave.

Voltage measurement or T-wave amplitude was performed from the upper limit of the waveform of the curve preceded by the S-wave to the lower limit of the isoelectric line of the heart that precedes the appearance of a new wave.

The PR interval can be described as the measurement from the beginning of the P wave to the beginning of the Q wave of the QRS complex. The QRS interval was measured starting from the beginning of the Q wave until the end of the S wave, as shown in the image of one of the ECGs. The QT interval measurement was extracted from the beginning of the Q wave with negative polarity to the lower limit of the isoelectric line marking the end of the T wave and the beginning of a new Q wave.

2.5. Statistical analysis and data presentation

For the analysis and description of sample data in this study, we used the means as measures of central tendency, standard deviation as measures of dispersion of variability inherent in the samples, and coefficients of variation that were demonstrated in percentages.

For the inductive analysis, the *Student's* non-paired and two-tailed-test was used, with the significance level adopted at 5%, that is, all probabilities below 0.05 were considered significant using the Bioestat-5.3 program. The means and standard deviation are presented in the format of tables or graphs and software *Microsoft Office Excel* 2007.

III.   RESULTS

The description of the results of the variables of the electrocardiographic profile of rats of the group treated with PTU had as reference the comparison with the parameters of ECG of healthy control group variables.

Thus there is the electrocardiographic profile of healthy rats (GC): ECG tracingProtocol *in vivo* examination 105 control group (Figure 4): R wave with 23% reduction and 75% decrease in wave amplitude S.

Fig.4 ECG tracing of the control group examination nº 105 and examination nº 121 - Protocol in vivo. UnirG, Gurupi-TO, Brazil. 2018.

In the ECG profile, the electrophysiological tracing was observed in 70% of the sample, with a decrease of 23% in the R wave amplitude and 75% in the S wave, and the other 30% in the control group with tracing presenting 20% of S wave reduction. In this way,

one has to description ofECG results *in vivo* and *in vitro* for heart rate (in bpm); amplitudes of the waves P, QRS et (in mv); intervals of the isoelectric segments PR, QRS and QT (Table 1 and 2).

Table 1. Mean of parameters obtained from ECG tracings in vivo

PARAMETERS	CONTROL	PTU
FC (BPM)	412.24 ± 24.84; 10	235.36 ± 13.63; 10 *
P (Mv)	0.15 ± 0.02; 10	0.15 ± 0.03; 10
QRS (M +)	0.78 ± 0.14; 10	0.90 ± 0.36; 10
T (Mv)	0.18 ± 0.02; 10	0.44 ± 0.16; 10
PR (ms)	35.07 ± 1.70; 10	45.13 ± 1.96; 10 *
QRS (ms)	48.16 ± 3.1; 10	55.93 ± 3.35; 10 *
QT (ms)	90.26 ± 5.23; 10	186.70 ± 5.45; 10 *

Source: Authors (2018). Note: Cardiac parameters (mean ± standard deviation; sample size) obtained from traces *in vivo* of control and PTU treated rats. Heart rate (HR), P, QRS and T wave amplitudes and ranges of PR, QRS and QT isoelectric segments. * (P ≤ 0.05).

Table 2 - Mean of parameters obtained fromECG tracings in vitro

PARAMETERS	CONTROL	PTU
FC (BPM)	134.76 ± 13.06; 5	99.35 ± 18.21; 5 *
P (Mv)	0.12 ± 0.003; 5	0.08 ± 0.01; 5 *
QRS (Mv)	0.70 ± 0.57; 5	0.58 ± 0.38; 5
T (Mv)	0.14 ± 0.01; 5	0.26 ± 0.08; 5
PR (ms)	27.68 ± 1.97; 5	49.65 ± 1.55; 5 *

QRS (ms)	42.45 ± 1.7; 5	49.84 ± 5.01; 5 *
QT (ms)	115.12 ± 8.1; 5	203.41 ± 13.94; 5 *

Source: Authors (2018). Note: parameters obtained from in vitro ECG tracings in the Langendorff assembly (mean ± standard deviation; n sample) in the heart of control rats and treated with PTU. Heart rate (HR), P, QRS and T wave amplitudes and ranges of PR, QRS and QT isoelectric segments. * (P ≤ 0.05)

In the experiments *in vivo* with anesthetized animals (Table 1), there was a 42.9% decrease in the mean HR value in the PTU group compared to the mean value found in the control. In the OCT group, the heart rate was significantly reduced to 235.36 ± 13.63 BPM (t = 14.97, P = 1.33 10-11)and when the control was 412.24 ± 24 BPM examination 162, there was a marked change in the RR interval in PTU treated rats while in the control group the HR was 412.24 ± 24, exam 143, where RR interval narrowing was observed (Figure 5).
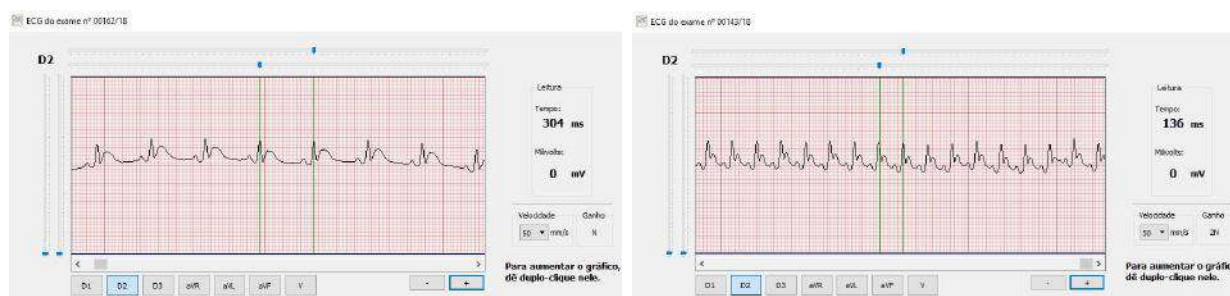
Fig.5. RR interval measured at lead 2 with scanning speed 50 mm/s - PTU-treated mouse (Exam 162/18 - Protocol in vivo) and Rat Control Group (Test 143/18 protocol, vivo UNIRG Gurupi-TO, Brazil, 2018.

Inexperimental *vitro* model, the average value of the OCT group FC in Langendorff preparation (Table 2) were 99.35 ± 18 BPM, where a significant spacing in the RR interval, exam 199, was observed in rats treated with PTU, being 26% smaller in comparison to the control that presented HR equal to 134.76 ± 13 BPM, in which it is observed significantly (t = 3.53, P = 0.0077). smaller spacing RR interval, test 123 (Figure 6) This result agrees with those obtained *in Vivo*.

Fig.6. RR interval measured in the shunt 2 with scan rate 50mm/s in Mouse treated with PTU (Exam 199/18) - Protocol in vitro and Control mouse (Exam 123) - Protocol in vitro.

As for P wave, there was no functional alteration in its amplitude in the atrial chambers in this study *in vivo* performed in control animals and treated with PTU. As average wave amplitudes were 0.15 ± 0.02 P: mV in the control (GC) and 0.15 ± 0.03 mV in the OCT Group (GE), however, with the hearts isolated Langendorff system was observed in mice a 33% reduction OCT on P wave amplitude in comparison to healthy mice the average P wave amplitudes were: 0.12 ± 0.003 mV in the GC and 0.08 ± 0.01 mV in GE, with significant decrease (t = 4.88; P = 0.0012) in breadth P in isolated hearts of rats treated with PTU.

Already in the QRS complex amplitude ratio was found in experiments made *in vivo* conditions of two groups that, ventricular function assessed by analysis of QRS, presented statistically average amplitudes equal (difference was not significant), being 0.14 ± 0.78 mV in the control and 0.90 ± 0.36 mV in the OCT group. In

studies done in vitro, this trend has also been observed, namely, showed no evidence of alteration of ventricular inotropic with 0.70 ± 0.57 mV in the control group compared to the lower average amplitude of 0.58 ± 0.38 mV obtained in the OCT group, although not significant (t = 0.39; P = 0.707). Similarly, there was no significant difference in the amplitude of the T wave, both protocols conducted in vivo as we conducted in vitro of rats OCTS, as compared to control group rats. As the PR interval was noticed an increase of 22% in protocols in vivo in rats OCT, i.e. the time needed for the electrical propagation through the atrial Chambers. This period in rats was 45 ± 2 OCT ms, i.e. higher compared to that achieved in healthy rats, in which the PR interval was 35 ± 2 ms in conducting atrial myogenic, being the PR interval of rats treated with PTU significantly longer (t = 12.3; P = 3.5. 10-10) showing a delay in the conduction disturbance between the SA and AV nodes.

The delay in conducting was corroborated with the in vitro studies of rats, in which the OCTS ECG tracings showed PR intervals with average value equal to 48.7 ± 1.55 DM, which corresponds to an increase of 43% compared to PR interval of 27.7 ± 1.97 ms found in co group role, with t = 19.6 significance; P = 4.8. 10-8.

In the range isoelétrico of the QRS complex was observed an increase of 13.89% in OCT group whose Protocol was in vivo, which had average value equal to 3.35 ± 55.93 ms and significant increase in rats treated with PTU (t = 5.4; P = 3.9. 10-5) compared to the control group, whose average interval was 48.16 ± 3.1 ms. The same behavior was observed in in vitro experiments with isolated hearts, where there has been 14.82% increase in the average range of QRS in rats treated with PTU, that was equal to $49 \ 84 \pm 5.01$, ms. This increase is significative (t = 2.71; P = 0.026) compared to the average control group had this same interval a 1.7 ± 42.45 ms.

The measure of QT interval was extracted from the start of the Q wave with negative polarity to the lower bound of the isoelectric line that marks the end of the T wave and the beginning of a new wave Q. The difference obtained in this interval in rats compared to control OCTS are particularly notable, whether conducted in vivo protocols as in vitro. In experiments conducted in vivo found an increase of 106% in long QT syndrome in the OCT group compared to the control group. In rats, the average of the period OCT QT was 186 ± 5.45 ms, being this significant increase (t = 40.3; 4.3.10-19), because in the control rats the average value was 90 ± 5.23 Ms. In in vitro experiments in the Langendorff method, was found a significant increase of 77% in the QT interval with $203 \pm$

14 ms duration in rat ECG tracings OCT while in control rats the range QT was 115 ± 8 ms ((t = 9.7; P = 10-5).

IV. DISCUSSION

In this research it was ECG changes arising from the low level of hormones HT, i.e. in rats hipotireoideos by induction of the Oct. The explanation of the same was based on evidence obtained, too, in the studies of Klein and Ojamaa (2001) and Dillmann (2002), which showed the influence of HT for three distinct factors: biological Factor, neurofunctional and circulatory factor factor.

The biological factor is triggered when the reduction of the T3reprime gene expression protein synthesis of Alpha-myosin heavy chain (α-MHC) and increases the expression of the heavy chain of myosin beta (β-MHC)[33].(KLEIN; OJAMAA, 2001).

In neurofunctional T3altera reduction factor receptors of Catecholamines in the myocyte and reduces the modulation of cardiac autonomic nervous system function, both in Nice stimulation as rogue [34].(DILLMANN, 2002).

As for the circulatory facto, there is evidence that reduced T3 changes angiogenesis with decreased capillary density, in addition to increased peripheral vascular resistance [33].(KLEIN; OJAMAA, 2001).

It has been found in the protocol in vivo, 42.9% fall in heart rate in the group treated with PTU compared to control, is the same behavior observed in the protocol in vitro com fall of 26% of heart rate. The evidence that links biological factor influence on cardiac cronotropismo, through the action of T3na gene expression of several proteins related to contractility ischemia. These corroborate findings with studies of Ladenson et al. (1992)[35] to demonstrate the increased eleven times, steady-state of MHC gene expression, with minimum reduction of β-MHC, and these findings are evidence of the relationship of the modulation role of T3 in cardiac contractility, with relevance in alleviating speed in the presence of hormonal deficit contraction.

Ohga et al. (2002)[36]. assert that the myocardial dysfunction in hypothyroidism is associated with increased expression of the heavy chain of β-MHC, reduction in Ca2 + ATPase of the sarcoplasmic reticulum, and ryanodine receptors and the increase of Fosfolambam.

In the survey of Danzi, Ojamaa e Klein (2003)[37]. gene transcription of myosin heavy chain of alpha-(α-MHC) protein with contractile function, related to rapid contraction and calcium ATPase (SERCA2) enzyme found in the membrane of the sarcoplasmic reticulum is responsible for absorbing the Ca + 2 during

Repolarization, and mediated by thyroid hormones, are evidence for the bradycardia in hypothyroidism.

In the studies of Tang et al. (2005) [11]. the bradycardia was found as a cardiac functional alteration in hypothyroidism, where reducing triiodothyronine cause impairment of contractility of cardiomiocitos by a change in Ca 2 + ATPase in the endoplasmic sarcoplasmic reticulum (SERCA2) and Alpha-myosin heavy chain (α-MHC).

The bradycardia observed in this research has also been found in studies that link the factor neurofunctional, where T3 appears to act on the sensitivity of the nerve system as nice. The identification of low-frequency components decrease heart rate (LF) and high frequency (HF) observed during the study of heart rate variability (VCF) indicate the state of inhibition of the autonomic nervous system modulation, in especially nice stimulation, and reduction of heart cronotropismo in the presence of hypothyroidism. [38]. (GALETTA et. al., 2008).

Spear e Moore (1973)[39]. ensure that the sinoatrial node was more sensitive to vagal stimulation and that changes in heart cronotropismo can increase the atrioventricular node's response to influences of the autonomic nervous system. These factors reveal the effects of as on pacemaker activity, spread and breadth of the cardiac cycle, as for example, in experimental studies with animals was observed the evolution of arrhythmias arising from the elevation of the activity autonomous. Mcdevitt et al. (1968)[40]. describe that even with inhibition of the autonomic nervous system in patients with hypothyroidism, heart rate was lower than expected for the age. However, in the same experiment, the pace was higher than expected by age in patients with hyperthyroidism. Such findings indicate that the heart rate is mediated by the influence of thyroxine on cardiomiocitos and not by increased sympathetic stimulation of the Catecholamines for excess thyroid hormones [41].(HARRISON, 1964).

In the experiments of Thier, Gravenstein and Hoffmann and colleagues, developed in 1962, an experimental model *in vitro* os Atria hipertiroidismo animals showed a fast heart rate, compared to animals eutireoideos, the result of the relationship of thyroxine in the heart cronotropismo [42,43,44].(MENDELSOHN; ANTONIS, 1961; THIER; GRAVENSTEIN; HOFFMANN et al., 1962; CRAVEY; GRAVENSTEIN, 1965).

Any location of the heart is, a priori, excitable self, however, the cardiac pacemaker or sinoatrial node (AS) is the higher frequency of cardiac action potentials fire spontaneous (PAC), with this, it's generator and controller of the cardiac rhythmicity and seem to occur due to an influx of positive charges through specialized ion channels located in the pacemaker cells, which are activated and inactivated following a spontaneous pattern sequence for the successive shots PAC′s [45].(SILVERMAN; HOLLMAN, 2007).

The influx by ion channels are described as "channels activated by hyperpolarization" (HCN), because, at the end of the membrane potential, Repolarization of a previous PAC these channels, that were until then closed, will open gradually allowing the influx of cations (K^+e Na^+) generating the spontaneous depolarization is needed to achieve the next clock CAP threshold for activation of channels Ca^{+2} voltage-type-dependent L and the current influx of calcium [46].(ACCILI et al., 2002).

The channels HCN, today is well known and characterized molecularly, are part of the family of cyclic nucleotides channels activated by hyperpolarization, belonging to the superfamily of potassium channels with higher density in the SA node cells and closing on last part of the diastolic depolarization [47].(BARUSCOTTI et al., 2005).

Despite being described in cardiac tissue, the channels HCN are found also in the brain, where they operate in the spontaneous generation of action potentials. The magnocellular fibers core supraoptic neurosecretory neurons in the hypothalamus have channels HCN modulated by the nitrérgico system through the gaseous Messenger nitric oxide (NO), which control the clock rate of these neurons by inhibiting the excitability and thus promoting a reduction in the release of vasopressin and oxytocin [48]. (SILVA et al., 2016).

The mechanisms are still unknown, however, there are hypotheses and some evidence that the NO acts directly on the canals HCN inducing a significant reduction in the current influx of cations to bind the cysteine residues forming complexes of S-nitrosotióis [48]. (SILVA et al., 2016). Such evidence open perspectives about the mechanism of action in controlling spontaneous electrical excitability in the SA node when you correlate the nitrérgico system with the channels HCN to explain the bradycardia and the delay in several segments of the ECG observed in animals treated with PTU, *in vivo,* and *in vitro*, with the possibility of hypothyroidism to be associated with greater production of NO.

Bradycardia effect, as well as the consequent delays in cardiac excitability and transmission observed in hipotireoideos rats, can also be interpreted under another approach: the important role of adenosine on neuronal

excitability and synaptic transmission by endogenous modulation. This occurs by means of receptors A1 e A2 in the cardiovascular control exercised by the nucleus of the solitary tract (NTS), through their autonomic projections (sympathetic and parasympathetic). NO is synthesized by The Synthase (NOS) in neurons of NTS, participating in the hypotensive effect and bradycardia triggered by activation of A2A adenosine receptors and activation of astrocytes releasing Ca + 2intracelular, which can produce the [49].(PRIVIERO, 2002).

In this study found no change in the amplitude of the P wave in rats treated with PTU in an experiment *in vivo*. However, the experiment *in vitro* reduction of 33% in the amplitude of the P wave. These findings confirm the results of Panciera (1994), where the experimental model of hypothyroidism in dogs the results reveal reduction of the amplitude of the P and R-wave in ECG tracings. These changes were reversible after hormone replacement. In the work of OZTURK et al. (2012)[50]. the findings showed a deficit in the right atrium with reduced volume and passive emptying fraction and increased in volume and active fraction in the presence of hypothyroidism.

The results of this survey showed no significant differences in the amplitude of the QRS complex, both in vitro and in vivo. Madias (2008) [51] declares that the pericardial effusion and the accumulation of fluid in the place of generation of the action potential, besides reducing the electrical resistance of the extracellular space, are the reasons of the heart and heart of extra influence low voltage of the complex QRS, respectively. Both situations occur simultaneously in hypothyroidism.

In studies of Karatay (1993, apud in Bruchet al., 2001) [52]. the ratio of the low-voltage QRS and pericardial effusion was associated with the driving deficit by the accumulation of fluid in the pericardial space and change in eletrogênese are voltage attenuation factors of the QRS.

Although this work has not found evidence of changes in the amplitude of the T wave in the presence of hypothyroidism, several studies point to changes in myocardial Repolarization in particular in the left ventricle. The findings of Alonso et al. (2015) [53] indicate that hypothyroidism Repolarization changes are secondary to a reduction in external transient potassium current (Ito), while increasing the calcium current of type L (ICa-L). As well as the observed in ECG, impair the T wave and action potentials in patients hipotireoideos as in experimental animal models.

In search of Al-Zaidi, Abdul-Ghafour, and Al-Farttoosi (2010) [54]. in patients with hypothyroidism ECG tracings showed flat and inverted T waves in 27.8%

of the sample result expressive compared to eutireoideos patients who have the same behavior on a path in just 3.4%.

Baker research, Satpathy and Samal (2017) [55]. in a sample of 60 patients with hypothyroidism, in ECG found 40% of low voltage of the complex, 26% of pericardial effusion with diastolic deficit followed by 23.3% flattening of the T wave.

The survey found an increase of 22% in the period of electrical propagation in atrial Chambers in group in vivo de OCT, treated rats with prolongation of the PR interval, this delay in electrical conduction was corroborated in estudyes in vitro observed an increase of 43% in PR interval in ECG tracings on experimental sample compared to the control group. Changes in levels of hormones tiroidianos seems to interfere with the electrical conduction of the atrioventricular node, evident in the increase in PR prolongation of animals of this study.

The findings of Cheng et al. (2009) [56] indicate that the prolongation of PR is associated with the functional activity of the heart change increase in atrial fibrillation (AF), need to use pacemaker and mortality, suggesting that it is not benign in the findings of Routine ECG, as earlier studies indicated. In another study by Cheng et al. (2015) [57]. the finding of the lengthening of the PR interval showed this condition as a Predictor for the emergence of FMD free from any influence of age, sex, and hypertension.

The studies of Sadr-Ameli et al. (1987) [58] point to evidence of the influence of the autonomic nervous system in the PR interval, this condition is explained by the fact that vagal stimulation and inhibition nice promote sinus cycle length elevation and increase atrioventricular nodal conduction, however, vagal blockade reduces the size of the sinus cycle and optimizes the atrioventricular nodal conduction anterograde, these findings corroborate with data already studied previously in animals and humans.

In Schenck, Rizvi, and Lin (2006) [59]. the findings of the cardiac activity in hypothyroidism, in addition to reducing heart rate, the prolongation of the PR interval, the low amplitude of the P wave and the QRS complex, are evidenced driving delays on the electrocardiographic tracings atrioventricular.

En el experimento hubo aumento de isoelétrico QRS 13.89% observado en el grupo PTU en protocolosin vivo, en comparación con la muestra de control. Estos resultados fueron acompañados en corazones aislados vitrocom experimentosin, 14.82% de aumento en la gama media del QRS en ratas tratadas con PTU, en comparación con el control, con P ≤ 0.05 de significación.

The results of this survey corroborate with the works of Sarma et. Al. (1990) [60] and Fredlund and Olsson (1983) [61], the lengthening of the QRS complex and QT are related to changes in cardiac activity in the presence of hypothyroidism. Silvet et al. (2001) [62] and Goat-Schnurbus et al. (2003) [63] found that patients with left ventricular systolic change the QRS elongation were associated with a high incidence of mortality.

In the works of Tiryakioglu et al. (2010) [64] the left ventricular systolic dysfunction in hypothyroidism is associated with the presence of interstitial edema, fibrosis, myocardial hypertrophy by increasing peripheral vascular resistance and the change in contracts protein synthesis by the deficit of T3 (Triiodothyronine).

In studies of Pearce et al. (2010) [65] changes of vascular resistance, peripheral and pulse vasoconstricção were observed and signals associated with prolongation of the QT interval and QRS complex these changes with the incidence of tachyarrhythmia.

In the studies of Gintant, Gallacher and Pugsley (2011) [66] sodium channel currents (In) guarantee the rise and high speed of propagation of the action potential along the ventricular myocardium. Changes in the electrical conduction of the ventricles are associated with reduction In cardiac and current the excitability of this change is manifested with the prolongation of the QRS COMPLEX in ECG tracings.

Kweon, Park, and Cho (2007) [67] described that, among the cardiovascular changes in absence of tiroidianos hormones during the hypothyroidism, heart failure is highlighted with prolongation of the QRS COMPLEX associated with the high rate of mortality. Occasionally there is ventricular tachycardia, however, in this study showed that the replacement of L-Thyroxine reduces ventricular arrhythmia and sudden death.

This research identified that the QT interval increased by 106% in the protocol in alive and in 77% in vitro em compared to experiment in control sample ($P \leq 0.05$). These results resemble studies of Bosch et al. (1999) [68]. where the presence of increased QT in the experimental animal model showed a delayed rectifier K chain (LKs) and was admitted as responsible for the delay of Repolarization in ventricular cardiac myocytes membrane.

In studies of Ferrer et al. (2012) [28] found a prolongation in QTc interval in the presence of hypothyroidism evidencing a change on ventricular Repolarization and showed a 90% increase in the duration of the action potential in cells myocardial hipotireoidianas. According to the authors, this change may be associated with the reduction in the Repolarization of K + currents.

In search of Rubinstein and Binah (1989) [69]. QT elongation was associated with the elevation of the ventricular action potential in hipotireoideos animals, this change was attributed to the reduction of the magnitude of the current L-type Ca (LCA) on the membrane cardiomyocyte.

Yao and Eghbali (1992) [70], in an animal study, they found evidence of the action of thyroid hormones in preventing fibrosis by inducing selective suspension of production of collagen type I this change associated with the excess extracellular proteins causes of edema and seems to contribute to increasing of QT dispersion.

In this study it is concluded that the OCTS administration induced by hypothyroidism in animals, evidenced by increased volumes of the thyroid gland in the animals treated, being this clinical condition promoter of cardiac electrical activity changes obtained in the parameters obtained from ECG tracings.

Cambios funcionales en el corazón se encontraron en la parte más grande en el cronotropismo que en inotropismo, evidencia por bradicardia y principalmente en extensiones de algunos de los principales intervalos en OCT trataron ratas, tanto utilizando el in vitro preparación Langendorff en vivo en los animales anestesiada.

The results obtained by your pioneering character of the methodological point of view, related to Langendorff preparation, can be a motivating factor for the development of future regional local projects addressing the neuroendocrine Physiology axis hypothalamic-pituitary-thyroid, associated directly or indirectly the cardiovascular events. This perspective can subsidize actions in health, especially in the northern region of Brazil.

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Regional development and Organization of space: An Approach to the Dry Port location using the Hybrid Method Fuzzy-AHP

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Abstract — *The choice of an ideal location for a dry port is a complex decision, in which the impacts generated lead to the need to consider multiple criterion, subcriterion and points of view, creating group decision problems. In such complex problems and decisions uncertainty is often present. Therefore, this study employs the Fuzzy-AHP hybrid method in order to minimize the uncertainties arising from the judgments and operation of the multicriterion method. The study involved in its approach companies and municipalities of the region of Greater Vitória in the State of Espírito Santo (ES) and its potential hinterlands. The results indicate that the planning of actions and policies aimed at regional development and organization of space can benefit from this study, because the approach proposed is adaptable to different contexts and particularities.*

Keywords— Dry port; Location of facilities; Multicriterion method.

I. INTRODUCTION

The logistics of cargo handling and distribution has represented a growing challenge for organizations in recent years due to difficulties in the operationalization of deliveries in urban centers (BONTEMPO et al., 2014). For Nguyen and Notteboom (2016), accessibility constraints influence the performance of the cargo flow, as well as restrict meeting the needs of stakeholders.

In this sense, Bask et al. (2014) emphasize that the evolution of the means of commercialization of products, has demanded solutions of movement that consider multiple objectives in the distribution of loads. According to Chen and Notteboom (2014), cargo handling activities have become an important part of the transportation system. According to Feng et al. (2013), these activities contribute directly to regional development because they

are related to space occupation. These authors point out that due to this occupation, cargo movement activities to and from the port are being increasingly directed to the interior (secondary zone), using dry ports and transportation corridors to attend these activities.

The dry ports are inserted in this context as a link between the port and its hinterlands (areas of commercial influence of a port), assisting the operationalization, movement and distribution of cargoes, being an extension of port activities in the interior, acting in the legalization and nationalization of loads with the consenting and intervening agencies (RODRIGUE et al., 2013).

In this sense, the location of facilities is an important decision for the companies, because they have high costs, and once implemented, poorly performed investments are difficult to reverse (CHEN; NOTTEBOOM, 2014). The location of dry ports may be associated with the need to form clusters with load-carrying activities, which must meet and be close to the hinterlands (VAN DEN BERG; LANGEN, 2011).

The decision process on the location of facilities covers the identification, analysis, evaluation and selection among the alternatives (BENTALEB et al., 2016). Because of the complexity involved in analyzing stakeholder judgments, based on the definition of criterion and subcriterion, it is necessary to use multi-criterion methods that collect and measure these judgments (SAATY, 1977).

Conventional approaches to facility location problems, such as the Varignon mechanical model, Hakimi method, p-median problem, multi-product enabled plant problem, and the center of gravity method, tend to be less effective in dealing with the imprecise or vague nature of the linguistic estimate (BENTALEB et al., 2016, NGUYEN, NOTTEBOOM, 2016, KOLAR,

RODRIGUE, 2018). In everyday business, the criterion and subcriterion used to evaluate alternatives for locating facilities are usually expressed in linguistic terms. However, due to the duality observed in phenomena of nature, and which is most often present ambiguously in the judgment and establishment of preferences by the human being, Fuzzy logic, developed by Lotfi Zadeh in 1965, has been used to establish patterns in the context of imprecisely defined criterion and subcriterion (ZADEH, 1965, CHOU, YU, 2013).

Velasquez and Hester (2013), affirm that multicriterion methods do not have in their formulation mechanisms that can attenuate distortions of opinion, and minimize the impacts generated by the lack of effective verticalization of opinions, that is, in everyday, subjective concepts to classify or consider situations of uncertainty need to be addressed.

In this context, this study presents an approach to dry port location using the hybrid multi-criterion Fuzzy-AHP (Analytic Hierarchy Process) method, because with the use of the same it will be possible to perform a hierarchical structure with parity comparisons, allowing a general ordering of importance by criterion, subcriterion and alternative, and, a treatment of the uncertainties present in the decision process, which contributes as a planning tool for actions and policies geared to the regional development and organization of the space. Therefore, this approach was tested in a field study involving the Greater Vitória region in the State of Espírito Santo (ES) and its potential hinterlands.

II. REGIONALIZATION AS A MEANS OF EXPANDING PORT ACTIVITIES

The movement and land distribution of cargo through ports is becoming an important dimension of the globalization of commercial activities (RODRIGUE; NOTTEBOOM, 2010). As a result, structural changes in logistics have generated new patterns of cargo distribution, which require innovative approaches to the hierarchy of port activities and service to the hinterlands (RODRIGUE et al., 2013).

In this context, Henttu and Hilmola (2011) point out that the implementation of dry ports in secondary zone provides a decongestion of activities in the immediate vicinity of the primary zones, due to their ability to perform an integration between the moving system and transport corridors.

For Ducruet et al. (2014), the development of global supply chains has increased pressure on the performance of shipping and port operations, as well as the distribution of cargo to inland regions (port regionalization).

Martínez-Pardo and Garcia-Alonso (2014) argue that in order to have efficient regionalization strategies, the

ports need to know which transport corridors are and can be available. For these authors, the behavior of the hinterlands must be monitored and analyzed constantly, for requiring activities and actions that they use to the structures of the dry ports. In this way, this behavior can serve as a subsidy for the planning of expansions of scope in the cargo handling operations to and from the port.

The regionalization of port activities can be seen as an element that helps to improve the operational efficiency of the port (DUCRUET; NOTTEBOOM, 2012). This improvement, according to Ducruet and Notteboom (2012), occurs through the possibilities of integration of logistic operations, which use dry ports, and which, in most cases, generate cost reduction in distribution activities.

Thus, according to Rodrigue et al. (2013), port regionalization can also be understood as the expansion of the operational activities of the port, going beyond the primary perimeter, aiming to meet the hinterlands foreland (global trade) and hinterlands inland (internal or regional demand), expanding the area performance of the port.

For Ducruet and Itoh (2016), the movement of cargo between ports can be understood as a strategic action that benefits the regional development, due to the internalization of port activities. In this context, dry ports, because they are bonded warehouses, tend to assist port terminals both in catchment and cargo distribution (NGUYEN; NOTTEBOOM, 2016).

Dry ports serve as transhipment points and logistic integration with the hinterlands (MONIOS; WILMSMEIER, 2012). Corroborating, Rodrigue and Notteboom (2010) emphasize that this integration allows regional development, because the dry ports interconnect cargo distribution networks, serving as a link to the ports.

III. LOGISTIC INTEGRATION THROUGH DRY PORTS INDENTATIONS AND EQUATIONS

According to Rodrigue et al. (2013), around the world, dry ports became an intrinsic part of the transportation system, being an important element for expansion of port activities and logistic integration, as it performs both cargo consolidation activities and deconsolidation. For these authors, the massification and concentration of cargo flows in a limited set of ports, created conditions necessary for the existence and use of dry ports.

However, due to the uncertainties provided by commercial relations, according to Falguera (2012), it is important to design a distribution chain that best adapts to market changes, and for that, the levels of service expected by users should be taken in the definition of the location of the dry port.

Monios and Wilmsmeier (2012) point out that the functions of the dry port and the transport connections that connect the distribution networks to the port, are changing. In the past, transport corridors were more static, mainly due to the geographical entrance barrier represented by the location of the port terminal, thus becoming more and more dynamic today. Therefore, these same authors emphasized that the criterion and subcriterion that meet the level of service desired by users should be taken into account when locating the dry port.

In this context, for Bazaras et al. (2015), the transport corridors play an important role in the movement of cargoes, making feasible the continuity of cargo flows, and consequent service to the hinterlands. These authors state that transport costs are considered a dominant factor in the use of these corridors, since they directly influence the needs of the hinterlands.

Because of the accessibility levels that must exist along the transport corridors, the location of dry ports should not only consider the needs of hinterlands as a parameter, but also use stakeholders 'and ports' views and plans (BASK et al., 2014).

In this sense, Ka (2011) points out that the performance of the dry port can be verified by its capacity to integrate the needs of the demand to the transport corridors. According to this author, this condition is necessary because of the influence of the hinterlands on the configuration of these corridors, which therefore requires an evolution of the available infrastructure.

According to Kolar and Rodrigue (2018), dry ports can also be understood as intermodal terminals, having logistical links that may serve different interests. This author emphasizes that these connections allow not only an expansion of port activities, but also the condition of allowing the port to interact with other commercial partners, and even, to meet hinterlands that have overlapping interests.

Considering an environment within the distribution chain, Nguyen and Notteboom (2016) emphasize that dry ports can function as extensions of port terminals, being transhipment points in secondary zones, because they promote a logistical integration in cargo movement. For these authors, in advanced economies, such as North America and Europe, the port authority and operators are primarily responsible for the development of the dry port, with the purpose of solving problems related to the limitation of capacity.

According to Bentaleb et al. (2016), the idea of locating and creating a dry port is to mitigate port congestion by promoting regionalization of activities. These authors point out that a dry port is an important component of the distribution chain, given the efficiency in operations for both importers and exporters.

The use of a dry port includes benefits that go beyond the expansion of port activities, and this use can be incorporated as a management tool by companies, such as the maintenance of strategic inventory of imported goods, raw materials and finished products (NGUYEN, NOTTEBOOM, 2016).

In this way, the location of dry ports around the world, according to Rodrigue et al. (2013), has a functional relationship with the port terminals and the hinterlands, because it is a transhipment point, and with that, fostering logistic integration. For these authors, this location should consider the regional economic, geographic and political scenario, which not only define the logistics functions to be performed, but also the forms of port regionalization, taking into account the relative uniqueness of each configuration required.

IV. MULTICRITERION METHODS TO AID DECISION MAKING

Multicriterion analysis are methods and techniques aimed at supporting decision making, based on the use of several criterion (Velasquez and Hester, 2013). Because it is versatile and applicable in varied everyday cases, this analysis has also been used in localization problems because of its ability to integrate opinions (SAATY, 1977; CHOU; YU, 2013).

According to the literature (KAT et al., 2012, WANG et al., 2016), because there are problems that have different amounts of uncertainty, there are multicriterion methods that help to elaborate specific solutions for some approaches, being able to be cited , because the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), AHP (Analytic Hierarch Process) and ELECTRE (ELimination and Choice Expressing the REality) I, II and III are present in several studies.

In this context, Saaty (1977) emphasizes that the AHP method has the principle of creating a hierarchical structure of criterion, subcriterion and alternatives, a fact that is not observed in other multicriterion methods. Another advantage of this method, pointed out by Saaty (1977), is the consistency check of judgments, resulting in general ordering of criterion, subcriterion and alternatives.

Chakraborty et al. (2013), verified when selecting a facility selection problem, involving multiple criterion and a finite set of alternatives, that the use of the AHP allowed to select a site that meets the needs of the stakeholders, besides promoting an increase in productivity in the network distribution.

Sousa and Boente (2016) use Fuzzy sets theory as a data analysis tool in a decision-making process to evaluate the performance of an institution, in order to reduce the degree of uncertainty in the judgments,

considering the responses related to used, with ambiguity, it was possible to allow the interpretation of linguistic variables.

In this context, Chatterjee (2016) emphasizes that the Fuzzy sets have as principle to treat subjective character problems, which have inaccurate information, quantifying and approaching them by means of a numerical scale. For this author, the main ability of Fuzzy sets is to express a gradual transition between pertinence and non-pertinence, allowing the representation of imprecise concepts expressed in natural language.

Singh (2016) used a hybrid approach between the Fuzzy and AHP sets in a strategic decision-making problem for facility location, which allowed for the selection of a location that brought economic benefits to the supply chain, as well as supply of a better level of services for consumers.

Thus, according to the literature (KA, 2011, CHOU, YU, 2013, CHATTERJEE, 2016), the inaccuracies of the present judgments in the operationalization of AHP can be minimized with the integration of the Fuzzy set theory. According to Singh (2016), this integration is called Fuzzy-AHP (FAHP), which is operationalized through the following steps:

i. The criterion, subcriterion and alternatives are initially defined. Decomposed by two vectors, the first $C_n = (C_1, C_2, ..., C_n)$ representing the criterion, and the second $A_n = (A_1, A_2, ..., A_n)$ is the representation of alternatives;

ii. Subsequently, all the criterion are matched, allowing the observation of more relevant criterion, as well as assigning weights for each criterion, subcriterion and alternatives. According to Saaty (1977), weights are attributed to the alternatives through parity judgments regarding each subcriterion and alternatives (Table 1).

Tab. 1: Relative importance scale in the peer comparison.
Source: [Saaty, 1977].

Saaty scale	Definition
1	Equally important
3	Weakly important
5	Fairly important
7	Strongly important
9	Absolutely important
2, 4, 6 e 8	Intermediate Amounts

The evaluations with the attributions of weights must be made by each of the respective respondents, from this will be generated matrices of evaluations with the answers obtained. In order to maintain the characteristics of the weights, by means of the modal value of the matrices, the consolidated matrices are obtained.

For Saaty (1977), the consolidated matrices verify the logical consistencies of the judgments by the Consistency Ratio (CR) which is obtained by: $CR = CI/RI$. The consistency ratio indicates the reliability of the respondents, in that it has to meet the following condition: $CR \leq 0,10$. The Consistency Index (CI), obtained by the following expression: $CI = (\lambda_{máx.} - n)/(n-1)$, being $\lambda_{máx.}$ auto matrix value and, n the array order. The Random Index (RI) is a tabulated value calculated in a laboratory and changes according to the sample size.

iii. After all the assignments of the weights the transformation of the judgments into a triangular matrix is performed, considering the pertinence function $\mu_A(x)$, which takes a given value in a range [0,1] (fuzzification). This function is obtained from the consideration of the vector represented by (l, m, u) on what l represents the lower limit of the judgment, m the modal value, that is, the value of the judgment, and u describes the upper limit. Thus, considering that $A = (a_{ij})_{mxn}$ is the comparison matrix, where: $a_{ij} = (l_{ij}, m_{ij}, u_{ij})$, it is possible to obtain the following clashes: $l_{ij} = 1/l_{ji}$, $m_{ij} = 1/m_{ji}$, $u_{ij} = 1/u_{ji}$. Therefore, these comparisons will be transformed into triangular Fuzzy numbers in a certain degree of imprecision δ. Following, the opinion of the interviewee, that is, the median analogue (m), along with l and u, are used as imprecise range delimiters, which assists the calculation of numerical approximation. With this, the association of the comparison with the triangular Fuzzy number is obtained the vector: $(m - \delta, m, m + \delta)$ and from it is calculated an inverse vector in which the positioning of the ends is changed, both being used to elaborate the triangular matrix. However, it is important to note that in the case of m be equal to 1, the triangular Fuzzy number will be reached by means of the vector: $[1/(9+\delta); 1, 1+\delta]$. Similarly, another particular case applies when m is equal to 9, and, in this situation, the triangular Fuzzy number is obtained by: $[1/(9+\delta); 9, 9]$. After the construction of the triangular matrix, the sum of the lines that make up this matrix is realized, being in the sequence a parity comparison of the triangular Fuzzy numbers, as for example, being the lines of this matrix

represented by $M_1 = (l_1, m_1, u_1)$ and $M_2 = (l_2, m_2, u_2)$, the comparison of two triangular Fuzzy numbers is obtained by:

$$V(M_2 \geq M_1) = \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}.$$ Thus, the sum of the sum of the columns is reached by: $SSC = (L, M, U)$. Then, after all the summations of the matrix lines are made, a data condensation is done, obtaining the Fuzzy value of synthetic extension (S), which is calculated for each criterion:

$$S_i = S_{Lines_i} \times \left(\frac{1}{U}, \frac{1}{M}, \frac{1}{L} \right),$$ on what S_{Lines_i} is the sum of the line i. In the continuity, for all the lines are made comparisons of the Fuzzy values of synthetic extension, however, for situations in which these values assume negative values, it is assigned value equal to zero in the comparisons.

iv. Continuing the fuzzification, the calculation of the global comparison (d') for each criterion is made after performing the comparisons of the Fuzzy values of synthetic extension, however, the condition for this to happen is that:

$$d'(M_i) = min. \{ V(S_i \geq S_k) \forall (k = 1, 2, 3, ..., n) \leftrightarrow k \neq i \}.$$

To consolidate these calculations, the vector of weights (W'), which is given by:

$$W' = [d'(M_i), ..., d'(M_n)] \forall i = 1, ..., n.$$

v. Finally, the vector of weights is normalized (W'), being obtained a preference ordering, duly adjusted to the Fuzzy numbers.

V. LOCALIZATION METHODS AND TECHNIQUES

The global economic recession has led the port and transportation sectors to excessive use of their operational capacities, and this has led to actions to reduce costs and redesign the use of cargo distribution sites (RODRIGUE et al., 2013). For Feng et al. (2013), an important solution is the location of dry ports as a way of balancing the supply to the needs of the demand, and may even help improve the performance of cargo distribution.

Problems of location of facilities are complex, and, according to Bask et al. (2014), studies of these problems should involve several criterion and subcriterion for decision making, and it is necessary to address the needs of stakeholders. These authors point out that this involvement through multicriterion methods contributes to the spatial development of dry ports, this being attributed to an increased understanding of the services that influence the development of the hinterlands.

By proposing a hybrid method with multicriterion and monocriterion methods to locate a dry port, Bentaleb et al. (2016) verified that the results of the analysis are not necessarily the optimal sites. For these authors, it is necessary to employ a monocriter method to obtain an exact location and closer to the needs of the stakeholders, and with that, to allow the extension of the hinterlands.

For Ka (2011), regional political issues interact and influence the market share of dry ports, defining the modal characteristics to be used, as well as what should be considered in their location. For this reason, this author employed an approach that involved multicriterion methods and Fuzzy sets, obtaining with this a local solution that considers, congregates and minimizes uncertainties of opinions.

Núñez (2016) states that the structure of the global economy, with decentralized production and consumption centers, promotes increased freight traffic around the world, creating significant problems and challenges for the transportation and handling of cargoes. In this context, the author emphasizes that the location of a dry port requires a thorough analysis of the supply chain, using multicriterion methods and techniques that deal with uncertainties in the judgments, as it involves the needs of meeting the demands and the use of more efficient modes of transportation from the energy point of view.

Nguyen and Notteboom (2016) presented a framework for the use of multiple criterion in the assessment of the location of dry ports in developing countries, involving a perspective with several stakeholders, being evidenced the criterion reduction of transport costs as the most relevant, and that the hinterlands and supply chain are directly influenced by the market.

Thus, from the arguments and studies presented in this section, the criterion and subcriterion pointed out in the literature were considered (KA, 2011, FENG et al., 2013, BASKET et al., 2014, BENTALEB et al., 2016, NGUYEN, NOTTEBOOM, 2016 and NÚÑEZ, 2016), which compose the proposed approach of this study for dry port location - Geographic (GEO), Accessibility (GEO 1) and Geographical limitations (GEO 2); Political (POL) - Government support (POL 1) and Regional support and exemptions (POL 2); Industrial (IND) - Local productive arrangement (IND 1) and Perspective for industrial development (IND 2); Operational (OPE) - Time to and from the port (OPE 1), Available infrastructure (OPE 2), Cost of planning routes to and from the port (OPE 3), Available support services (OPE 4) and Rail and highway connection availability (OPE 5); Environmental (AMB) - Environmental restrictions (AMB 1) and Future direction of environmental policy (AMB 2); Social (SOC) - Availability of labor (SOC 1)

and Social level of the population of the region (SOC 2); Economic (ECO) - Land acquisition cost (ECO 1); Investment needed (ECO 2) and Long-term financial return (ECO 3).

VI. METHODOLOGICAL APPROACH

This section presents the methodological approach and the research development. This study was constructed in three stages (Figure 1), in which the survey survey method was used. The data collected served to understand and analyze the studied phenomenon, besides helping to operationalize the AHP and Fuzzy sets. The data collection instrument was a structured questionnaire, in which the criterion and subcriterion of Table 2 were used, was applied to a population composed of 3264 companies present in the municipalities of Cariacica, Serra, Vila Velha and Vitória, all of the State of Espírito Santo (ES), which were selected because they involve cargo movement directly to and from the Port of Vitória (ES), where their hinterlands are located in the northeast and northwest regions of the ES (Aracruz, Colatina, Linhares and São Mateus).

The structuring step was started with a pre-test, in which a structured questionnaire was applied to 5 specialists, in order to verify the theoretical consistency of the instrument, and its context-related language, which was based on criterion and subcriterion pointed out in the literature. After assessing and analyzing this questionnaire, the experts indicated adaptations in their original format to better adapt to the context of the study. Then, as a form of test, the questionnaire adjusted with the suggested adaptations was applied to 15 randomly selected elements of the population (11 companies and 4 municipalities), in order to verify the existence of possible improvements to be performed in the data collection instrument, and textual adjustments are indicated.

Subsequently, the questionnaire was applied to the entire population (3264 companies), and a sample was obtained with 323 answers (319 companies and 4 municipalities). From this result, the second step of the proposed approach performed the reliability and data consistency analysis. The treatment was started with the interval check $|z| < 3$ ($p < 0,001$), for a value of Z_{score} , which was attended, however, 15 elements with values above this range were identified, being characterized as outliers, which along with 3 missing values were removed from the sample. From this treatment, the sample now has 305 valid elements, being considered representative a sample error of 5%, with a confidence level of 95% and a maximum percentage of obtaining of 80%. In addition, a data reliability check was performed, using the internal consistency statistic, using Cronbach's alpha (C_α) which was higher than 0.7, considered acceptable according to Cronbach (1951). To support these analyzes were used spreadsheets and statistical software SPSS (Statistical Package for the Social Science) Statistics Desktop 23.0 trial version.

Then, the third step of the proposed approach, performs the application of the FAHP hybrid method in two phases. The first involved the operationalization of the AHP method, which used the Expert Choice Demo software, which aided the process of analyzing the matrices of judgments. In the second phase, the fuzzification was performed considering the matrices of judgments obtained through the AHP, performing the conversion to Fuzzy sets, and later obtaining a triangular matrix, which allowed to treat inaccuracies originated in the formulation of the matrices of judgments.
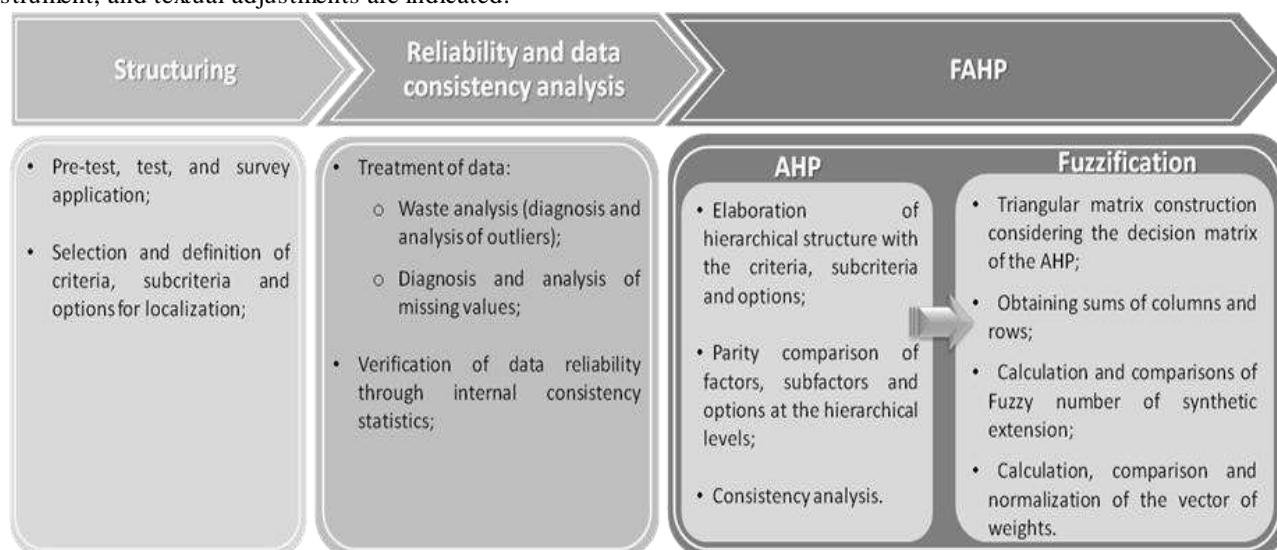
Fig. 1: Methodological steps of the study

VII. RESULTS

From the results obtained by means of the survey type survey, in which pre-test and test were carried out, there was the selection and definition of criterion, subcriterion and alternatives for the location of the dry port (Step structuring approach). Subsequently, 4 potential municipalities (São Mateus, Linhares, Aracruz and Colatina) were selected, which were considered representative from the perspective of companies (Figure 2).

Then, in the second stage of the proposed approach, the data treatment detected abnormalities in the sample, which could compromise the analyzes to be performed. For this reason, when outliers and missing values were detected, these elements were removed from the sample, therefore, when tested again, the sampling had an acceptable internal consistency (all elements within the range $|z| < 3$ and C_α higher than 0.7).

The third step of the proposed approach considering the reliability and consistency of the data obtained through the survey survey, started with the application of the AHP method. To this end, the hierarchical structure elaborated, followed the precepts of Saaty (1977), containing the criterion, subcriterion and alternatives raised, serving as support for the operationalization of AHP. Thus, at the top of the hierarchy is the ultimate goal, which is to choose the most favorable location to locate the dry port, according to the companies' vision. Then, in the second level of the structure are arranged the criterion that indicate the characteristics for site selection, which serve to establish an order of priority. The third level contains the subcriterion, and the fourth the alternatives.
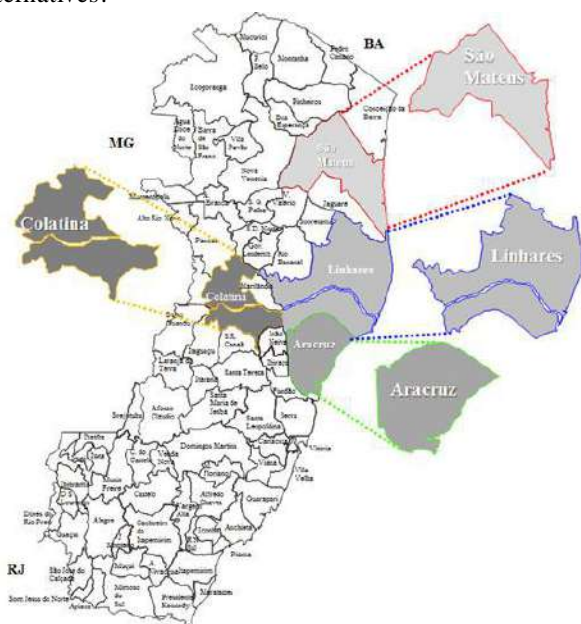
Fig. 2: Study coverage area

The weights of these relationships were obtained in the Expert Choice Demo software, the hierarchical structure and the joint judgments of the criterion, subcriterion and alternatives, as a product of the AHP operation. From this operation, it can be observed that the economic criterion exerts greater influence on the location of the dry port, which can be explained due to the expected financial disbursements and returns. Rodrigue and Notteboom (2012) emphasize that studies on the location of dry ports in secondary zones should focus mainly on financial approaches, due to the needs of cargo movements prioritize the optimization of transport costs.

The results suggest that the respondents consider that all the criterion derived from the literature review are adequate to the localization study (Figure 3). In the absence of redundant data in the hierarchical structure used, however, in case of existence it would lead to new trials (SAATY, 1977). A Consistency Ratio (CR) of 0.8, for Saaty (1977) the acceptable value for judgments to be considered consistent is $CR \leq 0.10$, it can soon be said that the judgments are consistent, corroborating with the relevance indicated in the assigned weights (CHOU; YU, 2013).
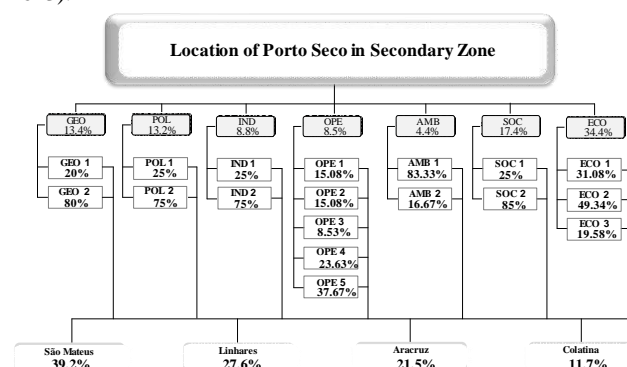
Fig. 3: Result by AHP method

The weights obtained from the criterion and subcriterion provide important information for decision makers, which can be used during the planning and management of cargo handling. Thus, depending on the characteristics and behavior of the hinterlands, the projects and the limits of financing and use of resources, decision-makers can prioritize the items with the highest returns.

Then, the fuzzification process is performed, the second phase of the third stage, the procedure considered the results obtained by the AHP, performing the conversion of the numerical values into a Fuzzy set. This procedure was carried out from the matrix of judgments of the subcriterion and the criterion, as for example Table 2, in which the relative importance of the subcriterion GEO 1 on the subcriterion GEO 2 is demonstrated.

Tab. 2: Matrix of judgments in relation to subcriterion of the Geographic criterion

Subcriterion	Weights	
	GEO 1	GEO 2
GEO 1	1	0.25
GEO 2	4	1

Thus, considering the results of Table 2, it was possible to obtain the pertinence function $\mu_A(x)$, which presented a value of 0.51, and served as a subsidy for the calculation of the transformation process in Fuzzy numbers in a triangular matrix (Table 3).

Tab. 3: Matrix triangular in relation to subcriterion of the Geographical criterion.

Subcriterion	GEO 1			GEO 2		
	l	m	u	l	m	u
GEO 1	1	1	1	-0.26	0.25	0.76
GEO 2	1.32	4	-3.85	1	1	1

Then, considering the results of Table 3, the sum of the rows and columns of this matrix was calculated, and the synthetic extension Fuzzy values were calculated and compared (Table 4). And, from these comparisons, it was possible to obtain the normalized weight vector of the geographic criterion (Table 5). In this way, after finalizing the fuzzification process, it is possible to observe that the respondents consider the subcriterion accessibility (GEO 1) more relevant compared to the subcriterion geographical limitations (GEO 2).

Tab. 4: Sum of the rows and columns of the sub criterion of the Geographic criterion (GEO)

Sum lines		
l	m	u
0.74	1.25	1.76
2.32	5	-2.85
Sum of column sums		
2.32	5	-2.85

Tab. 5: Vector of results by normalized subcriterion

Normalized W'	
GEO 1	GEO 2
0.7685	0.6397

In this way, all the elements obtained by the AHP (Figure 3), presented a value between 0 and 1, these values indicate an acceptable degree of pertinence. However, it was possible to verify and verify that the respondents evaluated the social criterion (SOC) as the most important, in contrast to the result presented by the AHP, in which the Economic criterion was elected. Núñez (2016) attests to these results, affirming in his study that the social criterion directly influences the productivity of the dry port, and that the labor, therefore,

determines the performance in the whole operational process, interfering in the location and profitability of business.

Although the final result of the FAHP indicates the best option being São Mateus, with respect to the criterion and subcriterion there were considerable changes after the fuzzification. In this sense, it is possible to see the difference of the results of the AHP method for the FAHP method, as observed (Figure 4). In the first case, the results suggest an importance of 34.4% of the economic criterion, followed by the social criterion with an importance of 17.4%, in the second case, the most relevant criterion was the social criterion with 20.48%, followed by the economic criterion with 19.99%, that is, if it were to choose the location of a dry port giving greater importance for the economic criterion, as suggested by the AHP method, the choice would be considered deficient, since the social criterion is of greater importance than the economic one, as indicated by the FAHP method.
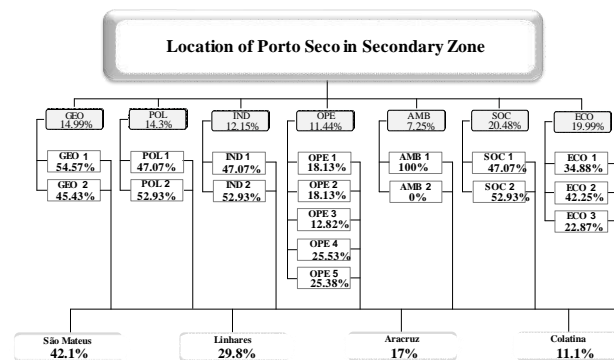
Fig. 4: Result by FAHP method

These changes indicate how important and important it is to adjust inaccuracies, such as changing the priority between economic and social criterion, suggests that planning and action should occur initially to people, not investment. This type of information is necessary to not only guide what should be done when planning a dry port deployment, but what should be done in the short, medium and long term in order to keep the business viable, and can serve needs of the hinterlands.

VIII. FINAL CONSIDERATIONS

The evolution of cargo distribution into hinterlands can be seen as a cycle in the ongoing developments in intermodal transport, since dry ports are necessarily an extension of some port activities. For this reason, the geographical characteristics linked to the modal availability and the capacity of service of the transport corridors have an important role to play in defining this development.

As transport corridors and port terminal activities become integrated, in particular, through the relationship between maritime transport and port operations, the focus of the distribution problem has turned into the hinterlands. Therefore, determining a possible location of a dry port is a complex topic in the literature.

The dry port location approach presented in this study, using the Fuzzy-AHP multicriterion hybrid method, allows selecting sites with desirable performance, both in the present and in the changing conditions, and for this reason, it contributes as a planning tool for actions and policies focused on regional development and space organization.

However, the results suggest that it is necessary to adjust the uncertainties arising from the operation of multicriterion methods. The need for this adjustment can be observed from the comparison of the results obtained by the AHP and the FAHP, in which the judgments could be better understood, as well as verify with more rigor the opinions of the respondents. This verification allowed us to verify that in the analyzed conditions the Social (SOC) and Economic (ECO) criterion are closer, suggesting equal importance, a fact that is not observed in the result presented by the AHP. The approach also allowed to verify the pertinence of criterion and subcriterion for the location of a dry port present in the literature, and to be selected to those that meet the needs of the stakeholders, with this, the municipality of São Mateus was the chosen one. In addition, this approach can be adapted to different realities, which seek to identify the best option for locating facilities.

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Diagnosis of the women waste collectors from the Tabatinga City in Amazon

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Abstract— *The municipality of Tabatinga, distant one thousand and one hundred kilometers from the capital of the state of Amazon, suffers decades of lack of employment. In addition to this problem, the city does not yet have an adequate management system for its solid waste, recyclable materials to ensure their livelihood. Among these collectors were selected eighteen women with the purpose of discovering the work situation of each one of them, as well as social issues of the same. This work aimed to understand the life of the collectors with more scope, outside the limits of the municipal trash, to build a situational chart that can support governmental intervention measures. For that, semi-structured interviews were used "in loco" in addition to a wide and diversified bibliographical research.*

Keywords— *Female Waste Collectors; Solid Waste.*

I. INTRODUCTION

Waste pickers exist for a long time, for Dias (2016) the recovery of materials from garbage is an activity millenarian, in fact, in the middle ages the less favored survived thanks to the remains of the ruling classes.

According to Coelho et al. (2016b), about 1.5% of the world's economically active population in Asia and Latin America obtain their livelihood from selective waste collection activities.

In Brazil, the Institute of Applied Economic Research (IPEA) sought in 2016 to present an estimate of the number of waste pickers active in the national territory, reaching 387,910 individuals (PEREIRA & GOES, 2016). These data are very close to the 398,348 collectors released by the Center for the Study of Metropolis of the University of São Paulo (USP, 2016).

With the introduction of the National Solid Waste Policy, municipalities were forced to close their dumps until August 2, 2014, which did not happen and the dumps survived to this day. With this, Brazil missed a great opportunity to close the dumps and end environmental liabilities generated (LOSS et al., 2015).

II. SSOLID WASTE AND RECYCLING IN BRAZIL

In addition, the use of solid waste in Brazil has led to an increase in the Brazilian population's purchasing power, coupled with insufficient investment in the area of recycling (SANTIAGO et al., 2013; DE SOUZA JUNIOR et al., 2017).

Thus, the Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE, 2017) announced that in 2016, 78.3 million tons of Urban Solid Waste (RSU) were produced, of these only 2.4 million tons. were recycled (BORGES et al., 2017), a very small value that left a niche market with great economic potential.

Brazil loses about R $ 120 billion per year for not allocating adequate waste (BRAZIL, 2018). This considerable amount of money is greater than the total revenue of the Industrial Pole of Manaus of R $ 92.67 million in fiscal year 2018. This resource could generate hundreds of thousands of direct and indirect jobs, as well as reduce the environmental impact of the landed garbage giving greater survival at landfills.

This decade was the scene of two very singular events regarding the management of solid waste in the national territory. The first was the creation of the National Solid Waste Policy, in the form of Law 12,305 / 2010, which is recognized as a legal framework for dealing with waste in the country (DURSO et al., 2017).

Law 12,305 presented modern mechanisms such as the introduction of reverse logistics by production companies, economic incentives for the formation of intermunicipal consortia, valorization of waste collector cooperatives, and the accountability of generators and public power in waste management (SILVA, 2015 b). But in its articles 54 and 55 it is possible to see the key points of this law, in the first are defined the closures of the dumps in a term of 04 years, in the second, it defines that states and municipalities must elaborate their plans of waste management in a term maximum of 2 years from the

edition of the law (BRASIL, 2010; BASTOS & FIGUEIREDO, 2018).

The second event refers to the change of deadlines for the closure of the dumps, giving a survival to this environmental liability. In this case, both Articles 54 and 55 were reassessed and relaxed so that municipalities could adapt to the new national reality. The main change occurred in article 54, where the dates of closure of the dumps were scaled as in figure 01, (SILVA, 2015 a).

Deadlines are already ending, as in the case of the capitals and municipalities that make up their metropolitan region, for them, the closure of the dumpsites in those locations should have happened until the last day of July 2018. What ended up not happening with 136 municipalities of the State of Tocantins. At the time, of the 139 municipalities of Tocantins only Palmas, Araguaína and Gurupi closed their dumps (ERÍLIO, 2018).

Amazonas has 9 municipalities that have international borders with Venezuela, Colombia and Peru. In this case, these municipalities should be in the closure phase of their municipal dumps, the same applies to the municipality of Parintins for having, in 2010, a population of 102,033 inhabitants. (IBGE, 2019).

III. FEMALE WASTE COLLECTORS

Women represent 31% of the people who declared themselves as solid waste pickers in the 2010 census, this corresponds to 136.39 women who have in their waste collection their main source of income (RODRIGUES & ICHIKAWA, 2015; DAGNINO & JOHANSEN, 2017; REGO, 2017). This number, contrary to the idea of many theorists who represented women as the majority in the dumps.

Over time, organizations such as the National Movement of Recycled Material Collectors (MNCR, 2014) and the Center for Studies on Support for Development, Employment and Citizenship (CEADEC, 2016) have erroneously cited women representing 70% of national collectors. There are cities and even states where women are the majority in the dumps, as is the case of Tabatinga, in the interior of the Amazon, but on a national level the reality is different (MOREIRA, 2013).

Fig.1: Deadlines for the closure of the dumps in Brazil.

Women has greater occupational limitations and are vulnerable to work-related illnesses. In the first case, this happens not only in the field of recycling, but also because of the "responsibilities of the home" as well as the raising of children. In the second case, Coelho et al. (2016a) observed that the physical and mental health of cataras is closely linked to precarious working conditions and the unhealthiness of the dump.

Even though they are subject to an unhealthy work environment, to the routines of stressful work, exposure to vectors that are harmful to their health, the collectors have some professional satisfaction (COELHO et al., 2017).

IV. METHODOLOGY

This study was based on exploratory-descriptive research, with solid waste pickers working in the Tabatinga dump.

Only women were selected for this study since, at this moment, the objective is to understand the reason that led them to choose this type of activity as provider of their livelihood and, in most cases, of their entire family. The total sample size was 18 women with ages ranging from 13 to 67 years.

For the structuring of the data, interviews with the collectors were used to obtain the information, making it possible to construct a professional and social diagnosis of this worker. In the semi-structured interviews, the number of dependents was questioned, if the family had this activity as the main income generation, regarding the working day, existence of partner or not, level of education, nationality and if they had any kind of governmental benefit. Physical aspects such as color, age or possible disability were also raised.

The survey of the field data took place between October 8 and 27, 2018, where the researcher, for a better

understanding of the routine of work and to gain the confidence of the workers, remained daily in the dump, coexisting and maintaining a "body to body "with the scavengers.

From this approach of greater presence among the collectors it was possible to get closer to them, formalizing bonds of trust. Thus, the research was elaborated from semi-structured conversations by the researcher and not as a question and standardized answers as usual, thus avoiding that the respondents could give appropriate answers or felt embarrassed to answer any items in the questionnaire.

V. RESULTS

Based on the field research, it was possible to establish as a preponderant profile of waste pickers in Tabatinga as foreigners, over 40, brown or indigenous and without physical disabilities.

All of them work informally since the municipality does not have any organization of scavengers organized, yet it is possible to verify that all follow a common routine learned over the years acquired with the experience of predecessors in the dumps of Tabatinga and Leticia.

We interviewed 18 collectors aged 13 to 67 years. It was verified that most of them were over 40 years old and although high age all showed vigor without health claim.

Only 04 collectors had some document that proved Brazilian citizenship and had residence in Tabatinga, 11 said to live in the Colombian municipality of Letícia and 3 reported living in Santa Rosa in Peru.

In terms of schooling, 55.5% of the interviewees knew how to read and write. The four Brazilians did not know how to read or write, according to them they had access to the school, but preferred to work from an early age to help with the maintenance of the house.

Of the respondents only 05 were not the main providers of the house, being assisted by the companion or another member of the family. In this way 13 are the main responsible for the sustenance of the house, that is, they are the main maintainers of the family.

From the data collected, it was possible to construct an accurate graph for the situational diagnosis of the garbage collectors of Tabatinga. This chart can serve as a tool for future public policy.

From the data collected, it was possible to construct an accurate graph for the situational diagnosis of the garbage collectors of Tabatinga. Figure 02 can serve as a tool for future public policy.

	10 a 20	21 a 30	31 a 40	41 a 50	51 a 60	Over 60
Receive benefits from government	0	0	0	0	0	0
Foreign	1	2	3	5	2	1
literate	2	2	2	3	1	0
Breadwinner	1	2	1	4	4	1
Idade	2	2	3	6	4	1
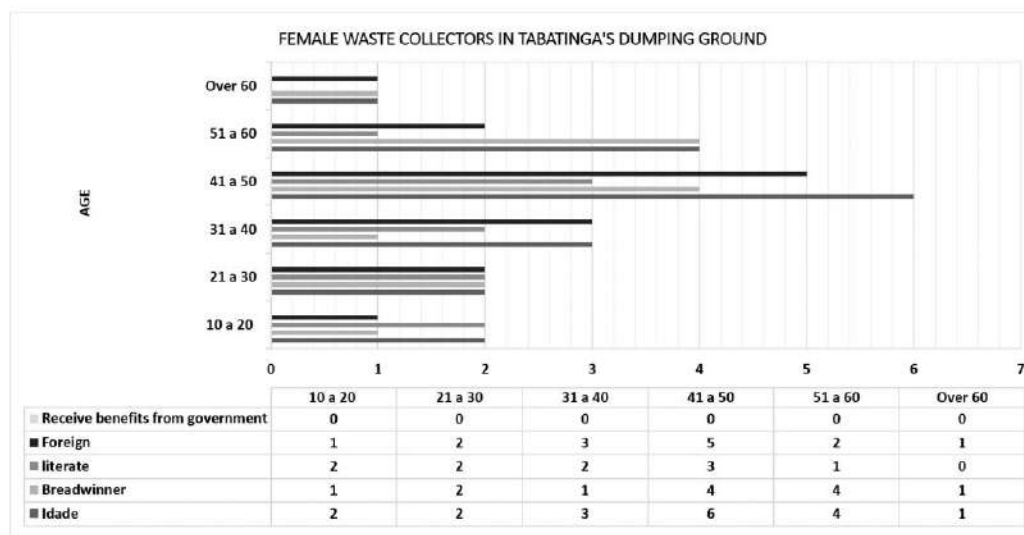
Fig.2: Stuational chart of Tabatinga's female waste collector

Two other questions were possible to answer from the dialogue with the collectors to gain a better understanding of the work in the dump. The first is about the perception of the collectors about their working and health conditions and the second was about their satisfaction as waste pickers.

5.1. WORK CONDITIONS

The Tabatinga's dump has a perimeter of 1,259.27 m which is equivalent to 90,526.27 m2, used in a discontinuous and disordered way. No waste disposal planning is used to make the collectors nomadic within this area.

For scavengers this type of action is a complication since weekly they are forced to redo their coats. Shelters are the

places used for various purposes such as sun protection, improvised individual separation area, the place that the collectors use to store all the material collected during the workday. This change in location constant causes you to spend a lot of time building new shelters.

For the collectors, these constant changes, combined with the lack of individual protection equipment and the exposure to vectors, mean that all interviewees disapprove of working conditions.

The work environment is very conducive to accidents at work, it is a place full of uneven, flooded, with sharp materials, piercing and with various venomous animals.

5.2. ACHIEVEMENT PROFESSIONAL

Although the situation seems precarious and the workplace dirty and unhealthy, the pickers felt fulfilled and happy with the work performed. Although dissatisfaction with working conditions was unanimous among the interviewees, the majority did not see themselves performing other types of work.

Approximately 77% of the interviewees were said to have been professionally held, partly because of their perceived gains above what they earned outside and the sense of freedom because they did not have to meet pre-established hours.

VI.   CONCLUSION

It was possible to conclude that Tabatinga, an Amazonian municipality located in the extreme southwest of the state, working conditions are unhealthy and the collectors are exposed to the most diverse types of diseases caused by vectors and by work accidents.

Even so, only 23% of the interviews say they are dissatisfied and think about getting out of the dump. Most expect an improvement but would not trade this occupation to try and work elsewhere.

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The Time of Application of Maturing Herbicides Affects the Physiological Quality of Canola Seeds

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Abstract— Canola (Brassica napus L. var. oleifera) is a winter growing option for producers, however, harvesting is the phase that requires the most care and decision making to avoid losses in productivity. One of the alternatives that can be used to solve this problem is the application of maturing herbicides. Thus, the objective of this study was to evaluate the physiological quality of canola seeds with the use of herbicides, applied in two seasons, for pre-harvest maturation of the crop. The experimental design was a randomized block design, arranged in a factorial scheme 7x2 + 2 (herbicide x season + control) with four replications. Hybrid 50 canola plants received ammonium glufosinate, paraquat, glyphosate, diquat, saflufenacil, 2,4 - D and paraquat + diuron at two times in the crop cycle (G3 - when the first ten the main stem silica has a width greater than 4 cm, and G4 - when the first ten silicas of the main stem begin to mature), in addition to two unselected controls, for each season, the first being harvested on the day of application of the products, and the second kept in the field until the final cycle of the culture. First germination, germination, seedling length, dry mass, cold test and accelerated aging tests were performed. Herbicides applied in the first season (G3) cause the greatest damage to the seeds, and the plants that remained in the field until the end of the crop cycle and did not receive herbicide application (additional control), result in seeds with better physiological quality. The treatments with diquat, paraquat + diuron and glufosinate of ammonium presented higher efficiency with respect to seed quality, being the best period to carry out the maturation practice in the canola crop in the G4 season.

Keywords— Anticipation of the harvest, Brassica napus L., Maturation of seeds.

I. INTRODUCTION

The canola (*Brassica napus* L. var. Oleifera) is an alternative winter cultivation for the producers due to the lower risk of losses with frost occurrence compared to the wheat crop, which suffers many diseases in the cold season. In addition to the interest of the industry, where bran and oil present excellent quality for human and animal food, canola also stands out for the production of biodiesel (Silva et al. 2011).

There are many factors that have caused losses in canola productivity, among which the harvest is one of the phases that requires the most care and correct decision making to avoid a fall in grain yield that can reach more than 30% of the final result (Silva et al. 2008).

According to Tomm et al. (2009), the harvesting of canola before the ideal maturation point interrupts the filling and formation of grains, limits productivity potential, as well as increasing the chlorophyll content in the oil, which causes higher costs in the processes of clarification and increase in the percentage of discounts in marketing. On the other hand, if the crop is delayed along with periods of heavy rains and high winds, the silica can open and cause soil loss, fungal attacks, insects and plant tipping (Marcandalli et al. 2011).

One of the alternatives that can be used to solve this problem is the application of herbicides for the purpose of maturation of the canola or even to standardize the harvest, being the application realized when the majority of the seeds are mature (Daltro et al. 2010). Thus, mechanized harvesting is facilitated, resulting in lower impurities, better quality seeds, reduced losses in final production, and lower cost in the post-harvest drying process (Silva Neto, 2011).

It is possible to find in the literature several studies that present positive results in relation to the efficiency of products used in crop maturation, which reduce the moisture content and preserve seed quality in beans (Kamikoga et al. 2009; Coelho et al. 2003), which can be used to evaluate the effect on the production of soybeans (Silva et al. 2009).

However, some fundamental aspects should be considered in relation to the use of maturation herbicides in the pre-harvest of canola, such as the choice of the product, the environmental conditions in which they will be exposed, the phenological stage of the crop, and the influence on

the production, germination and seed vigor (Marcos Filho, 2005, Franco et al. 2013). Some authors have verified a loss of herbicide use in soybean seeds (Botelho et al. 2016), wheat (Bellé et al. 2014) and beans (Pinto et al. 2014).

One of the most important factors in relation to the use of maturing herbicides in canola cultivation is the choice of the appropriate season for the application of these products (Franco et al. 2013). According to Silva et al. (2016), the appropriate time of application is of fundamental importance in relation to the efficiency of the product, as well as it prevents losses in productivity. These same authors report that applications carried out far from the physiological maturity of the seeds, or in unfavorable climatic conditions, coinciding with rainy periods, compromise the quality of the seeds, causing their deterioration.

The hypothesis of this study is that the applied herbicides differ in relation to their efficiency under the physiological quality of the canola seeds, and that applications at times closer to the physiological maturity of the crop cycle, stand out as the most appropriate.

In this sense, we objective to evaluate the physiological quality of canola seeds with the use of herbicides, applied in two seasons, for pre-harvest maturation of the crop.

II. MATERIALS AND METHODS

The survey was conducted in two stages, both at the Federal University of Fronteira Sul (UFFS), Campus Erechim/RS. The first phase consisted of the installation of the experiment and application of the herbicides to the field, conducted in the experimental area of the UFFS, and the second one, characterized by the physical and physiological analysis carried out in the Sustainable Management of Agricultural Systems (MASSA) of UFFS, during the years 2017 and 2018.

The area used for sowing of canola was previously managed with the herbicide glyphosate, at the dose of 1080 g.ha-1 of acid equivalent, to eliminate the present vegetation.

Fertilization of the soil was carried out along with the canola sowing, and according to the physico-chemical analysis, following the technical recommendations for the crop (Rolas, 2016), using 350 kg.ha^{-1} of fertilizer with the formulation 05-20-20 (NPK).

Each experimental unit (plot) consisted of an area of 15 m² (5 x 3 m), with sowing performed in the no-tillage system on 06/14/2017, using a seeder/fertilizer with six lines, spacing of 0,5 m between rows, depth of 1 to 2 cm and density of 50 plants m-².

The experimental design was the randomized blocks arranged in a 7 x 2 + 2 factorial scheme, with four replications. In factor A, the herbicides (ammonium glufosinate, paraquat, glyphosate, diquat, saflufenacil, 2,4-D and paraquat + diuron) were allocated as described in Table 1. In factor B, the two desiccation canola Hyola 50, (G3 - when the first ten main stem cells have a width greater than 4 cm, and G4 - when the first ten main stem cells begin to mature), in addition to two unapplied the first harvested on the day of application of the products, and the second kept in the field until the final cycle of the crop, to be harvested.

Table.1: Herbicide treatments and their respective doses, used for the maturation of canola, hybrid Hyola 50. UFFS, Erechim, 2017.

Active ingredient	Dose (g ha^{-1} de i.eore.a)	Commercial Product	Dose (L/kg ha^{-1})
Ammonium Glufosinate	400	Finale	2,0
Paraquat	400	Gramoxone	2,0
Glyphosate	1440	Roundup Original	3,0
Diquat	400	Reglone	2,0
Saflufenacil	49	Heat	0,07
2,4 – D	806	DMA 806 BR	1,0
Paraquat + diuron	400+200	Grammocil	2,0

The herbicides were applied using a CO_2 pressure pressurized precision sprayer equipped with four DG 110.02 fan-type spray tips, spaced at 0.50 m, under a constant pressure of 2.0 kgf cm^{-2} and displacement of 3.6 km ha^{-1}, with flow of 150 L ha^{-1} of herbicide syrup.

Harvesting of each experimental unit was carried out seven days after herbicide application in each season, and it was performed manually using pruning shears, and only the plants of the two central lines of each plot were harvested when 40 to 60% of the seeds of the main branch began to change from green to brown, that is, reaching a maximum of 18% moisture in the field. After harvesting, the plants were packed in paper bags and then subjected to oven drying with forced air circulation and temperature of 35 °C until reaching 9 to 10% humidity. This same operation was carried out for the controls that were harvested on the same date of application of the maturing herbicides.

The other control treatments were collected when the seeds presented to the field, water content of approximately 18%, that is, when the crop cycle was completed.

After the drying of all the treatments and the manual threshing of the silica to obtain the seeds, the second stage of this study was started in the Laboratory of Sustainable Management of Agricultural Systems of UFFS, Campus Erechim. For the determination of the physical and physiological quality of the seeds, the following analyzes were were carried out:

First germination count: was performed together with the germination analysis. On the fifth day after the test installation, the normal seedlings were computed, the results being expressed as a percentage (Brasil, 2009).

Germination: it was conducted according to the criteria established by RAS (Brazil, 2009). Four replicates of 50 seeds per plot were used, totaling 200 seeds per treatment, which were arranged in rolls of germitest paper, moistened with water, in the proportion of 2.5 times the mass of the dry paper, and later packed in a germinator chamber at 20°C. The evaluation was performed at five and seven days, counting the number of normal seedlings, and the results are expressed as percentage of germination.

Seedling length: was performed in conjunction with the germination test and according to the procedures described by Nakagawa, (1999), adapted from AOSA (1983). Ten random seedlings of each replicate were used for each of the treatments, counted as normal at the end of the germination test. The measurements were performed using a millimeter ruler. For the determination of the seedling length, the entire seedling was measured from the apical meristem to the base of the hypocotyl, the results being expressed in centimeters.

Dry mass: only the normal seedlings of each replicate, from the germination test, were considered. After the cotyledons were removed, the seedlings were packed in paper bags and kept in forced air circulation, regulated at 65 ± 2°C for 24 hours. After the samples were weighed in analytical balance to determine the weight of the total dry mass per repetition. Then, the weight expressed in g was divided by the number of normal seedlings of each replicate, which resulted in the weight of dry mass per seedling, expressed as mg/seedling (Nakagawa, 1999).

Cold test: 200 seeds were used for each treatment, which were distributed in germitest paper previously moistened in the proportion of 2.5 times the dry paper weight. The rolls were packed in sealed plastic bags and refrigerated at 10°C, where they remained for 72 hours (Abrates, 1999). Afterwards, the rolls were removed from the plastic bags and transferred to the germinator, set at a temperature of 20°C, where they remained for five days, when the evaluation was performed, computing the percentage of normal seedlings (Brasil, 2009).

Accelerated aging: 200 seeds per treatment were used, which were arranged in a single layer on a metallic screen, coupled in plastic boxes (gerbox), containing 40 mL of distilled water at the bottom. The boxes were sealed and maintained at 42°C and 100% relative humidity for 72 hours in a BOD type germination chamber. After this period, the seeds were submitted to the germination test described above and after five days the percentage of germination was determined by counting the normal seedlings (Brasil, 2009).

Data were submitted to analysis of variance by the F test, and when significant effect was detected, the variables were compared by the Tukey test ($p < 0.05$). The analyzes were performed using the statistical software Winstat - version 2.11.

III. RESULTS AND DISCUSSION

Significant interactions were observed for all variables studied in all tested treatments (herbicides x times). It can be observed in Table 2, in relation to the first counting variable, that in the G4 season (when the first ten main stem silica begins to mature), the seeds presented greater vigor in relation to the first application period (G3 - when the first ten of the main stem are longer than 4 cm).

Comparing the herbicides with each other in the first application period, it was observed that the diquat and the paraquat + diuron stood out in relation to the others (Table 2). In the second application period the additional control presented the best results, followed by the herbicides diquat and paraquat + diuron again. According to Delgado et al. (2015) the reduction or not in the germination of the seeds after application of maturing herbicides, depends on the hybrid and the product used.

Table 2. First count (%) of canola seeds, hybrid Hyola 50, according to the application of treatments and maturation times.

Treatments	Dose (g ha⁻¹ de i.eore.a)	Application times	
		G3	G4
Control	---	17,00 cB[1]	30,00 dA
Ammonium Glufosinate	400	19,25 cB	38,50 cA
Paraquat	400	21,00 bcB	39,25 cA

Glyphosate	1440	17,25 cB	28,00 dA
Diquat	400	38,00 aB	50,75 bA
Saflufenacil	49	24,75 bB	36,50 cA
2,4-D	806	20,00 cB	28,00 dA
Paraquat+diuron	400+200	34,75 aB	49,00 bA
Additional Witness	---	16,75 cB	75,00 aA
General Media	---	32,43	
CV (%)	---	6,36	

[1] Means followed by the same lowercase letter in the column and upper case in the row do not differ significantly from each other by the Tukey test (p ≤ 0.05).

Regarding the germination of canola seeds (Table 3), it was verified that independent of the time, the highest indices were in the additional control, which was left in the field until the crop cycle had ended and did not receive application of the herbicides. Beyond to the additional control, the treatments with diquat and paraquat + diuron presented significant values, regardless of the season in which they were applied.

The variation of temperature and humidity during the maturation time of the silica, associated with the hybrid and type of herbicide to be used, are factors that lead some products to stand out more than others (Mathias et al. 2017).

As in the previous variable, the highest germination rates of the canola seeds were obtained in the G4 season, independent of the applied herbicides (Table 3). It was also observed that the herbicide glyphosate was the one that most affected the germination of the canola in the two periods of evaluation. What can be noticed is that glyphosate is a systemic herbicide (circulates within the plant), influences the metabolism of plants, and consequently, the physiological quality of the seeds, causing phytotoxicity in them.

Table 3. Germination (%) of Hyola 50 hybrid canola seeds as a function of treatments and maturation times.

Treatments	Dose	Application times	
	(g ha^{-1} de i.eore.a)	G3	G4
Control	---	27,00 eB[1]	51,00 dA
Ammonium Glufosinate	400	43,00 cB	58,00 cA
Paraquat	400	38,75 dB	59,00 cA
Glyphosate	1440	23,00 fB	41,00 fA
Diquat	400	51,00 bB	70,00 bA
Saflufenacil	49	41,00 cdB	59,25 cA
2,4-D	806	29,00 eB	46,00 eA
Paraquat+diuron	400+200	49,25 bB	68,00 bA
Additional Witness	---	74,75 aB	94,00 aA
General Media	---	51,28	
CV (%)	---	3,27	

[1] Means followed by the same lowercase letter in the column and upper case in the row do not differ significantly from each other by the Tukey test (p ≤ 0.05).

In a study by Pizolotto et al. (2016) when evaluating different canola crop management systems, concluded that the application with the diquat herbicide reduced harvest losses by 31% to 66%, obtaining higher productivity and reducing costs with drying, which is in agreement with as reported by Esfahani et al. (2012) and Albrecht et al. (2013).

The use of diquat, paraquat and paraquat + diuron did not influence the physiological potential (germination and vigor) in soybean seeds, but when applied glyphosate the damage occurred in the root system of the seedlings (Daltro et al. 2010). These results corroborate with those found with Marcandalli (2011) when observing that glyphosate negatively influenced the physiological quality of soybean seeds.

There were fewer normal seedlings in the germination test when the ammonium glufosinate was used in the bean crop (Pinto et al. 2014). Lamego et al. (2013) tested the ammonium glufosinate in soybean plants, also noticed a reduction in the percentage of germination of the seeds, when applied later.

Mata et al. (2015) verified differences in the percentages of germination among eight bean cultivars, using different pre-harvest herbicides, among them, diquat, saflufenacil and glufosinate ammonium. On the other hand, Agostinetto et al. (2001) reported, in rice surveys, that paraquat, ammonium glufosinate and glyphosate, when applied during physiological maturation, did not affect the qualitative characteristics, besides bringing benefits to accelerate the harvest period of this crop.

The same observation made by Kappes et al. (2009) and Botelho et al. (2016), where they verified that the percentage of germination was superior in seeds from soybean plants without application of maturing herbicides (harvested along with the other treatments), compared with the use of diquat and paraquat.

As for the first germination count (Table 2), it was verified that the performance of the seedlings was not significant, however, comparing the application times, it is noticed that the G4 season presented a higher percentage of seedlings considered normal. In addition, germination percentages lower than the standard established by Normative Instruction No. 45, dated 09/17/13, of the Ministry of Agriculture (ABRASEM, 2014), where the minimum germination required for the marketing of canola seeds is 80%. With the exception of the additional control in the second season of application, which germinated 94%, all other treatments, in both seasons, obtained inferior results.

The highest seedling lengths were obtained in the second application season, regardless of the treatment that was used, except for the additional control that there was no differentiation between the G3 and G4 seasons (Table 4).

Once again, the additional control and diquat herbicide stand out in relation to the others in both seasons of herbicide application, revealing that this product causes less phytotoxic effect for canola. In contrast, treatments with glufosinate ammonium and 2,4-D showed the smallest lengths of seedlings. This divergence of results can be explained by the existence of biotic (fungi) and abiotic factors (environmental conditions) that tend to influence plant maturation.

The use of the diquat herbicide in pre-harvest of two soybean cultivars did not cause significant differences in seedling length when compared to the control without desiccant application (Daltro et al. 2010). Already, Toledo et al. (2012) verified a reduction in the development of soybean seedlings, due to the use of the herbicide glyphosate, compared to the absence of the application, regardless of the season used.

Similar results to this work were observed by Vanzolini et al. (2007), where they concluded that the test of seedling length is effective to detect differences in vigor level, where the larger the seedling, the greater the viability of the seed. Unlike Braccini et al. (2003), where the seedling length test for the evaluation of the physiological potential of soybean seeds is not considered adequate.

In a study by Krenchinski et al. (2017) evaluated the application of maturing herbicides in the wheat crop and their effects on seed productivity and quality, concluded that carfentrazone - ethyl and clethodim reduced the vigor of the seeds produced, and paraquat reduced the length of seedlings. There was also a reduction in productivity when the herbicides glufosinate ammonium, paraquat, glyphosate, clethodim and diquat were used.

Table 4. Length of seedlings (cm) of Hyola 50 hybrid canola seeds as a function of treatments and maturation times.

Treatments	Dose (g ha⁻¹ de i.e or e.a)	Application times	
		G3	G4
Control	---	2,60 gB[1]	3,20 gA
Ammonium Glufosinate	400	2,77 fB	3,09 gA
Paraquat	400	3,53 dB	4,93 dA
Glyphosate	1440	3,90 cB	5,17 cA
Diquat	400	4,10 bB	5,32 bA
Saflufenacil	49	3,01 eB	3,85 fA
2,4-D	806	2,77 fA	2,71 hA
Paraquat+diuron	400+200	2,99 eB	4,78 eA
Additional Witness	---	7,06 aA	7,05 aA
General Media	---	4,04	
CV (%)	---	1,52	

[1] Means followed by the same lowercase letter in the column and upper case in the row do not differ significantly from each other by the Tukey test (p ≤ 0.05).

The results show for the dry mass variable that in the G3 season the worst treatments were expressed by the

application of paraquat + diuron and the additional control, the others all were better or equal than the

application in G4. Lamego et al. (2013) when applying pre-harvest maturing herbicides to soybeans, verified that seedlings from the most advanced maturation stage R6 (pods with granulation and 100% green leaves) presented lower weight of mass dry. This in part can be explained by the temperature oscillation in the greenhouse and energy drop when the seedlings were being dried.

Again the herbicides 2,4 - D (first season) and glyphosate (second season) caused the lowest values of dry mass

transfer. This result may be due to the lower seedling length and the percentage of germination. In this case, it is suggested that the use of these herbicides coupled to excess moisture, may have been absorbed by the seeds, and, thus, cause delay in the emergence of the same. In addition, because they were two systemic herbicides, they influenced the metabolic processes of the seeds. In both seasons, the additional control has the best dry mass indexes.

Table 5. Dry mass (mg) of Hyola 50 canola hybrid seedlings as a function of the treatments used during maturation periods.

Treatments	Dose (g ha^{-1} de i.e or e.a)	Application times	
		G3	G4
Control	---	2,7 dA[1]	2,2 dB
Ammonium Glufosinate	400	3,0 bA	2,7 cB
Paraquat	400	2,7 dA	2,7 cA
Glyphosate	1440	2,6 dA	2,0 dB
Diquat	400	2,7 dA	2,7 cA
Saflufenacil	49	2,8 cdA	2,7 cA
2,4-D	806	2,3 eA	2,2 dA
Paraquat+diuron	400+200	2,9 bcB	3,3 bA
Additional Witness	---	3,4 aB	3,7 aA
General Media	---	3,0	
CV (%)	---	3,08	

[1] Means followed by the same lowercase letter in the column and upper case in the row do not differ significantly from each other by the Tukey test (p ≤ 0.05).

The same happened with Ferreira et al. (2007) observed shortening of cotton seedlings caused by phytotoxicity caused by systemic herbicides (glyphosate and 2,4 - D), which is usually more harmful compared to the effects caused by contact products. According to the same authors the systemic herbicides are absorbed in the place where the drop was intercepted, but also perform their function in other parts of the plant, in a toxic way. However, the contact herbicides destroy the plants or the parts on which it is applied, but it has no direct action on roots, bulbs, rhizomes, and generally, its action is less prolonged.

Glyphosate caused abnormalities in soybean seedlings with thickening, longitudinal streaking and hypocotyl yellowing, inhibition of primary root development and secondary root emission (Funguetto et al. 2004). The same was observed by Tillmann and West (2004) when they verified that the glyphosate interferes negatively in the germination and the initial development of the soybean seedlings.

The cold test (Table 6) presented similar results to the other germination and vigor tests, where the additional control in both seasons, together with the herbicides glufosinate ammonium (G3 and G4 epoch) and diquat (G4 epoch) were higher than the other treatments, while paraquat + diuron expressed the lowest percentage of normal seedlings. When comparing the seasons with each other, with the exception of the control, all other treatments presented significant results in the second application period (G4).

Plants that receive the application of maturing herbicides well before the time of physiological maturity, cause seeds with few reserves and consequently less vigor (Lamego et al. 2013). Seed quality loss after physiological maturity depends on the species, the hybrid and the conditions imposed on seeds in the field (Marcandalli et al. 2011).

Table 6. Cold test (% germination) in Hyola 50 hybrid canola seeds as a function of treatments and maturation times.

Treatments	Dose (g ha^{-1} de i.e or e.a)	Application times	
		G3	G4
Control	---	57,25 bA[1]	52,00 cB
Ammonium Glufosinate	400	59,00 bB	68,50 bA

Paraquat	400	32,50 cB	54,00 cA
Glyphosate	1440	31,00 cB	35,00 deA
Diquat	400	36,00 cB	73,00 bA
Saflufenacil	49	18,00 dB	37,00 dA
2,4-D	806	34,50 cB	51,00 cA
Paraquat+diuron	400+200	6,75 eB	31,00 eA
Additional Witness	---	96,00 aA	94,00 aA
General Media	---	48,13	
CV (%)	---	4,70	

[1] Means followed by the same lowercase letter in the column and upper case in the row do not differ significantly from each other by the Tukey test (p ≤ 0.05).

These results differ from those obtained by Kappes et al. (2009), where the application of diquat resulted in a lower percentage of normal soybean seedlings in the cold tests. Caierão and Acosta (2007) concluded that the use of glyphosate did not affect the germination of barley seeds.

In relation to the accelerated aging test (Table 7), all treatments presented higher results in the second application period with the additional control, followed by paraquat + diuron, diquat and glufosinate ammonium.

Again, the second season of application stands out for presenting more developed plants and less sensitive to herbicide application.

According to the analyzed variables, it can be observed that, independent of the herbicides used in this study, the application season with the greatest results was the G4 season, that is, the stage at which the canola plants are entering physiological maturation and more near the end of their cycle.

Table 7. Accelerated aging test (%) in Hyola 50 hybrid canola seeds as a function of treatments and maturation times.

Treatments	Dose (g ha⁻¹ de i.e or e.a)	Application times	
		G3	G4
Control	---	9,00 gB[1]	22,75 eA
Ammonium Glufosinate	400	21,00 cB	41,00 bA
Paraquat	400	16,00 efB	30,00 dA
Glyphosate	1440	14,00 fB	33,00 dA
Diquat	400	23,00 bcB	42,00 bA
Saflufenacil	49	17,25 deB	36,75 cA
2,4-D	806	20,00 cdB	31,25 dA
Paraquat+diuron	400+200	25,00 bB	44,00 bA
Additional Witness	---	67,25 aB	81,00 aA
General Media	---	31,90	
CV (%)	---	4,11	

[1] Means followed by the same lowercase letter in the column and upper case in the row do not differ significantly from each other by the Tukey test (p ≤ 0.05).

It is possible to apply maturing herbicides in the canola crop, and the most appropriate time corresponds to eight days before the normal harvest period (Silva et al. 2011). The same authors also report that the application in previous periods can cause losses in seed productivity, quality and its components, which was observed in parts of this study.

The best season for application of maturing herbicides in soybean cultivation is when the plants are with about 80-90% of the vegetables with brown staining and water content in the seeds of 45 to 60% (Lacerda et al. 2005). According to Santos et al. (2004), knowledge of the appropriate season for the application of herbicides

aiming at the anticipation of the harvest, is of fundamental importance to obtain a maximum number of viable seeds, as well as to avoid that seed quality and productivity are affected.

Pre-harvest management techniques, such as herbicide maturation, may potentiate the amount of intact silica in the plant and thus favor considerable increases in seed productivity (Coimbra et al. 2004). However, depending on the way this practice is performed, as well as the period that the herbicide is applied, it can cause damages in the quality of the seeds, besides causing residues of the product in its composition. However, if the application is performed correctly, there may be greater uniformity of

crop maturation, reduction of losses, and obtaining higher physiological quality seeds.

IV. CONCLUSION

Plants that remained in the field until the crop cycle (additional treatment) and did not receive herbicide application showed higher physiological quality seeds in all analyzed variables.

The applications carried out in the G3 season cause the greatest damage to the seeds, with more evident damage to the herbicides glyphosate and 2,4 - D.

The diquat, regardless of the season of application, presents significant results in relation to all variables analyzed and other treatments, as well as the herbicides paraquat + diuron and glufosinate ammonium.

There is the possibility of application of maturing herbicides in the canola and the most appropriate moment to its use is in the G4 season.

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Elucidating the Chemical Properties and Potential Applications of Wood vinegars Produced by Controlled Thermal Treatments

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Abstract— *Wood vinegar (WV) has been used for ages as fertilizer and antimicrobial agent, but its impacts on ecosystems are not well understood. Our objective was to investigate potential uses for WVs made from biomass resources and evaluate conditions for possible agronomic, chemical/pharmaco-chemical purposes and potential impact on the environment. We studied four woods vinegars made by slow pyrolysis using: Cambara (WV_{Cam}), Eucalyptus (WV_{Euc}) at 350ºC for 72 h, Nim (WV_{Nim}) and Nim mixed with fresh Nim leaves and branches, soaked into WV_{Nim} (WV_{Mix}) at 120ºC for 40 h. WVs from WV_{Mix}, WV_{Euc} and WV_{Cam} demonstrated significant potential chemical products, while WV_{Nim} for pharmaceutical purposes. WVs can be used to partially substitute fertilizers and chemicals, most especially WV_{Mix}. Soil bacteria tests suggest a concentration of 0.8% or less for WVs application in soils. No WVs tested presented risk for environmental and human health due to absence of carcinogenic poly-aromatic hydrocarbons (PAHs).*
Keywords— biomass, controlled pyrolysis, pyroligneous acid.

I. INTRODUCTION

Large amounts of agricultural residues, such as sawdust, sugarcane straw and rice husks are produced worldwide annually, mainly in developing countries like Brazil. Current disposal methods for these residues are not usually adequate and have been responsible for a wide environmental impact [1]. Thermal treatments, such as pyrolysis, could be an alternative for treatment of these residues, converting biomass into bio-products with higher added value [2–4], such as wood vinegar [5]. Traditional vinegar production utilizes sugar crops that compete with food as feedstock. There are newer

processing technologies, via thermal means to produce similar wood vinegar products.

Thermal conversion technologies, such as controlled pyrolysis may be optimized to generate specific ranges of organic liquids through the condensation of the gaseous products during the thermal treatment. The ranges of chemicals and their properties vary according to operational temperature and exposure time (Capareda, 2013).

This study investigates the chemical characteristics of WVs made using different biomass resources and using controlled thermal conversion processes and conditions to generate highly valuable chemicals or pharmaco-chemicals including agronomic chemical substitutes. The study also identifies risks to the environment through its agronomic use. The overall goal is to find high value chemicals and products from materials that are onsidered wastes. The specific objectives are as follows:

 a. Evaluate wood vinegar for its agronomic fertilizer or chemical partially substitutes,
 b. Identify wood vinegar whose chemical components are considered beneficial and suitable high value chemical products, such as potential for pharmaco-chemicals, and
 c. Evaluate other properties such as various poly-aromatic hydrocarbons (PAHs) that are potential risk for environmental and human health

Review of Related Literature
1.1. Thermal Conversion Processes

Wood vinegar, also called pyroligneous acid or wood distillate, is the water soluble organic fraction of the liquid that is produced during the pyrolysis of biomass [6], many times treated as pyrolysis residue. The pyroligneous acid is brown, with strong smoke smell

liquid produced by a heating biomass in oxygen-limited conditions [2,5,7]. When the gas generated from thermal treatment is cooled, it condenses into liquid [8–10] and generate wide range of chemicals.

The controlled pyrolysis of many different types of wood can be used to produce various wood vinegars including Eucalyptus [11,12], Bamboo [12,13] and others. The chemical and physical properties of wood vinegar can vary, depending on the wood materials, kiln designs and reaction conditions, including heating rates and reaction temperature [7,14,15].

In Brazil, the most widespread type of kiln is the hot-tail ('*rabo quente*' in Portuguese), made with clay bricks and mortar [16]. In this country, WV has been used as a fertilizer and pesticide, however improperly, without any dosage control, which may cause accumulation of chemicals compounds in the soil, such as some carcinogenic poly-aromatic hydrocarbons – PAHs. Other pyrolysis systems used auger to introduce the material to the reactor or the highly advanced fluidized bed pyrolysis systems [17].

1.2. *Valuable Chemical Compounds from Thermal Pyrolysis Processes*

The liquid components in pyrolysis processes from various wood products contain more than 200 compounds, including phenols, poly phenols, acetic acid [18], ketones, ester, aldehydes and alcohols [19]. Because of their low pH and high organic load, they cannot be disposed to the environment without treatment [20]. It must be properly diluted or neutralized prior to disposal.

The manufacturing conditions for the production of wood vinegar is so variable that products can differ in chemical composition and toxicity. Products can be divergent that it can pose human health risks as reported in several documents [21–23]. Thus, the same risks must be considered if these chemicals are used for animal or soil purposes. For example, some PAHs have high environmental stability and they are rapidly transported to the human through the food chain [24,25].

The US Environmental Protection Agency (1993) has listed 16 PAHs as priority control pollutants, including naphthalene, acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benza(α)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(α)pyrene, indeno(1,2,3-cd)pyrene, dibenz(α,h) anthracene and benzo (g,h,i) perylene. Not all PAHs are carcinogen and must be used appropriately and at proper concentrations.

1.3. *Beneficial Antimicrobial Properties and Soil Microbiota Improvements*

Depending on the dosage, wood vinegar exhibits a high degree of antimicrobial activity against various microorganisms [5,26], such as *Legionella pneumophila* [27], *Escherichia coli* and *Corynebacterium agropyri* [9]. Wood vinegar also has antioxidant activity [5,18,26,28].

Wood vinegar are also considered as mosquito repellents [29] and antifungal [18,30]. It can stimulate plant growth [9,19,31,32], can be used as fertilizer [8] and control weeds [32,33].

In addition, wood vinegar can be developed into useful sterile products for medical, aquaculture and livestock breeding applications [5]. It has shown benefits as animal diet or feed ingredient [34–36]. Finally, it has numerous dermatological purposes in humans [37] and used for smoked food products [38].

Wood vinegar's impact in the environment can be predicted by soil microbiota, which is easily altered by soil changes [39,40]. WVs can also be used as bio-indicators of high sensitivity that reflect environmental conditions [41]. Among these bio-indicators, microorganisms functional groups density, such as bacteria, is one of the most effective indicator [42]. The quantification of colony forming units (CFU) has been used to estimate the variation in bacterial density in ecotoxicology studies [43].

II.   MATERIAS AND METHODS
2.1. *Wood Vinegar Formation*

We studied four woods vinegars (WV) which were made for local farmers in Brazil, for use on their farm: (1) WV_{Cam}, made of Cambara (*Qualea* sp.) sawmill waste, in Sinop-MT, Brazil; (2) WV_{Euc}, made of Eucaliptos (*Eucalyptus sp*) in Vilhena –RO, Brazil; (3) WV_{Nim}, made of Nim (*Azadirachta indica*), in Brasnorte–MT, Brazil and (4) WV_{Mix}, made of Nim (*Azadirachta indica*), mixed with fresh Nim leaves and fine grinded branches, soaked into WV_{nim} (1:1 v/v) for 2 weeks, in Brasnorte–MT, Brazil.

The WVs were produced in hot-tail kilns on a small scale, originally for agronomic purposes. WV_{cam} and WV_{euc} were thermally treated into sealed furnace, to prevent air from entering, at around 350 °C for 72 h. WV_{nim} and WV_{mix} were thermally treated into sealed furnace, at around 120°C for 40 h. All of these thermal processes are in batch mode. WVs were obtained by condensing the pyrolysis vapors in the chimney. The pyrolysis liquids were left to sit until separated into three layers: at the top is a light oil; on the bottom is the sticky wood tar and in between lies the organic portion with the majority of refined wood vinegar.

2.2. *Wood Vinegars Chemical Characterization*
2.2.1 *Inorganic Elemental Analysis, Total inorganic/Organic Carbon and pH*

The unknown chemical composition of WV from different plants can be estimated by a comparison with the mass spectral libraries available on gas chromatography mass spectrometry (GC-MS) database [44,45]. This technique is an easy, cost-effective and sensitive method to identify and quantify the chemical compositions of natural products.

The WVs were treated with phosphoric acid 1% to measured total carbon (TC), total inorganic carbon (TIC), total organic carbon (TOC), using TOC-Analyzer (Elementar Analysersystem GmbH). Additional WVs inorganic elemental analysis was performed [46] to determine the total Ca, Mg, Cu, Mn, K and Zn, by extraction with nitric-percloric acid solution and determination by atomic absorption spectrometry. The total P was analyzed by colorimetry.

WVs pH titration curves were measured by incrementally adding 0.5 ml of 0.1 N NaOH to a 50 ml of WV. After each increment, the solution was stirred until the pH stabilized.

2.2.2 Organic Chemical Analysis

The organic compounds were analyzed by GC-MS, using Agilent 7890 GC apparatus (Wilmington, DE. USA) equipped with a 5975C MS detector and 7683B automatic liquid sampler with a capillary column: HP-5MS 5%-phenyl-95%-dimethylpolysiloxane (30 m, 0.25 mm i.d., film thickness 0.25 μm) (J&W Scientific, Folsom, CA. USA). The oven temperature was programmed to start at 150°C (1 min), increase to 210°C at 15°C min^{-1} (10 min), and then increase by 5°C min^{-1} to 310°C for 1 min. The injector temperature was set at 270°C in splitless mode, when 1 μl of sample was injected. The mass selective detector temperatures of the ionization chamber and MS Quad were set at 230 and 150°C, respectively. The electron ionization energy was 70 eV, and the mass range was m/z 30–500 (amu). Results (chromatographic peaks) from WV samples were used to identify the organic compounds by comparison with the experimental m/z values of the compounds from NIST data base. Only those compounds with match above 70% were considered. The relative percentage was calculated by the relation between the peak area of the compound identified and the sum of the peak areas of all majority compounds in the chromatogram.

2.2.3 Poly-aromatic Hydrocarbon (PAH) Analysis

The total PAH analysis was measured in triplicate. About 4 g of sample with 20 ml of toluene were agitated for 30 min at 50% on an Kline agitator NT151 (Novatecnica, SP. BRA). Then, the sample was sonicated for 30 min in an ultrasonic bath (Quimis, SP. BRA). After the extraction, the sample was centrifuged at 4500 rpm

for 5 minutes on a Sigma 3-16KL centrifuge (Sigma Laborzentrifugen GmbH, DE). The supernatant was collected in a glass tube. The solid residue was extracted twice. All the supernatant were cleaned up on a silica gel column (3 cm) and then eluted with heptane. The solvent was evaporated under vacuum at 60°C until a volume of 1 ml is reached. The samples were analyzed using the same apparatus used for the organic compounds analysis. However, the oven temperature was programmed to start at 50 °C (2 min), increase to 150°C at 10°C min^{-1}, then increased to 280°C at 5°C min^{-1} and held for 9 min. It is then ramped up at a rate of 40°C min^{-1} to 310°C. It is held at this temperature for 8 minutes.

The majority and main chemical and/or pharmacy usefulness of the organic compounds found by GC-MS were investigated by the SciFinder® (scifinder-cas.ez103.periodicos.capes.gov.br) and ChemSpider (http://www.chemspider.com) databases.

2.3. Wood Vinegar Antibacterial Tests

We assessed the antibacterial effects of wood vinegar in four types of soils: (1) crop: integrated system with a sequence of soybean and maize, this last one intercropped with pasture; (2) pasture: *Urochloa brizantha* cv. Marandu (L); (3) planted forest: *Eucalyptus urophylla* x *Eucalyptus grandis* hybrid and (4) native forest: classified as "Evergreen Seasonal Forest" soil.

Soil samples were collected in 2016 during the dry season from 0 to 10 cm using a sterile Dutch Auger. The sample was composed of twenty samples per plot.

The antibacterial study was adapted from [47]. Dilution was performed starting from 10 g of soil with natural moisture in 90 ml sterile phosphate buffered saline (PBS: 1.44 g ml^{-1} Na_2HPO_4, 0.24 g ml^{-1} KH_2PO_4; 0.20 g ml^{-1} KCl, 8.00 g ml^{-1} of NaCl and pH 7.4).

The dilution of about 10^{-3} was plated onto 10% Trypticase Soy Agar plates (TSA-Merk) with WV$_{Cam}$, WV$_{Euc}$, WV$_{Mix}$ and WV$_{Nim}$ at 0.8 and 100%. The antibacterial tests were performed with five replicates and incubated for 7 days at 28°C and related with the biological oxygen demand (BOD). The quantification of total bacteria was carried out by Colony Forming Units (CFU).

2.4. Statistical Analysis

The WVs chemical properties and antibacterial tests were compared among various treatments by performing Tukey´s test. The p-value of less than 0.05 was considered significant. Statistica Soft Version 10 was used in the statistical analysis of all the data generated from these studies.

III.   RESULTS AND DISCUSSION

a.   *Wood Vinegar Chemical Characteristics*

3.1 Chemical Fertilizer Potential

Table 1 shows the pH, complete elemental analysis important for fertilizer and nutrients as well as total organic and inorganic carbon. These properties will represent the wood vinegar's capability to partially substitute the use of chemical fertilizers. Of fertilizer importance in the concentrations of macro-nutrients (phosphorus and potassium), two of the basic inorganic chemical fertilizer component.

The other elemental components are also vital nutrient needs of plants. Among the WVs samples tested, WV_{Euc} and WV_{Mix} showed potential fertilizer P and K substitute having the highest concentrations. WV_{Euc} had reported P and K concentrations of 20.3 and 69.8 mg/ℓ, respectively. WV_{Mix} had 23.4 mg/ℓ of P and similar 69.8 mg/ℓ of elemental K. WV_{Mix}, contained the highest concentrations of Mg and Ca with concentrations of 7.84 and 122.71 mg/ℓ, respectively. Hence, the elemental components of WV_{Mix} is an excellent potential supplement to other high-quality fertilizers inputs.

For example, it has been reported that WV has traditionally been applied in the growing of tea. Report showed that it increases the yield by three times the level of useable phosphoric acid. Plants roots secrete organic acids which dissolve and absorb phosphoric acid in the soil and it is thought that organic acids in WVs have the same effect [48].

Table 1 also showed the total organic carbon (TOC) data showing high values for WV_{Cam} and WV_{Euc} (258.6 – 275.6 mg/ℓ). High TOC levels indicate great material accessibility with microorganisms. This property may play the role of stimulators (or sometimes inhibitors) of plant growth and plant development because of its high carbonaceous components. This is especially true for low-molecular weight organic compounds [49].

The use of WV as fertilizer is gaining importance in many crops. It cannot act as substitute for soil fertilization, but it can supplement a sound soil fertilization program [8]. However, its utilization is generally based on local knowledge and not scientific research [50], which poses certain environmental risk for soil and water contamination, toxicity and impact on soil microbiota.

It is important to note that, because of low pH values and the high TOC values, the WVs described above will have considerable organic load. Hence, none of WVs should be disposed to the environment indiscriminately. Proper treatment or identification of recommended application rate as pesticide or chemical fertilizer in soil agriculture must be known. The beneficial effect of WVs in soil or plant are directly related to the dosage used [9,32,51].

The pH of WVs can be correlated inversely with titratable acidity [38]. Unlike strong acids that are fully dissociated, WV acids are only partially ionized. It could be attributed to differences in its buffering capacity, **Fig 1**. WV_{Nim} and WV_{Mix} contents have narrower working ranges for buffering than WV_{cam} and WV_{euc} do. It can positively be correlated with carbonyl and carboxyl groups content on WVs, **Fig 2**.

In addition to potential chemical fertilizer and substitutes, WVs could be recommended as co-solvents for agrochemicals. The majority of agrochemicals are dissolved most easily and their effectiveness most enhanced if they are mixed with organic acid solutions [48]. The pH is a critical factor in the effectiveness of many pesticides and growth regulators, some pesticides particularly carbamate and organophosphate insecticides are broken down when combined with high pH water.

The rate and severity of the reaction is determined by how susceptible the pesticide is to hydrolysis [52]. A pH of 5.5 to 6.5 is the ideal one for mixing most pesticides. This is the primary reason that most commercial pesticides indicate in their directions the addition of a buffering or acidifying agent into the spray tank [53].

WV can act as a pH buffer and an acidifying agent for mixing pesticides that require low pH. This buffering and acidifying behavior will allow the plant to absorb nutrients more readily [54]. Such mixture between WV and pesticides no doubt improve cost and can even increase the effectiveness of the pesticide [55,56].

3.2 Phenolic Compounds

WVs contains around 68 kinds of organic compounds belonging to 4 main groups, **Fig 2**. These groups include carbonyl, carboxyl, phenolics, silicates and others. The chemical composition of WVs are quite variable as shown in **Table 2**. The primary reason is that the chemical characteristics of products are so much dependent on the wood source and the thermal treatment processes. These include temperature, retention time, and even particle sizes or granulometry [57].

Phenols are the primary chemical grouping found in the WV liquid product. The relative phenolic composition ranking and of increasing order is as follows: $WV_{Euc} < WV_{Cam} < WV_{Nim} < WV_{Mix}$. Some phenolic compounds shown in **Table 2** are as follows:

1. Guaiacol is used as an antimicrobial agent [58,59], the compound reduces gastric erosions induced by classic anti-inflammatory drugs (ibuprofen) [60]. It is also considered an antidiarrheal agent [61] and an antioxidant [5];

2. Creosol is used as flavor enhancing standards, food and cosmetic component standards [62], and an antidiarrheal agent [63];

3. Eugenol is considered an antioxidant [64,65], an antimicrobial agent [64,66] and anti-inflammatory substance [67];

4. Kaempferol is considered an antioxidant and an anti-inflammatory agent [68]. It has been used as agent for the treatment of Alzheime's disease [69], and an intervertebral disc degeneration treatment compound [70]. Further, it has been used in Leishmanial chemotherapy [71] and as cancer therapeutic agent [72] and,

5. Syringol is used as an antioxidant [5,73].

As previously cited, phenolic compounds have antibacterial properties [74,75], including membrane-disrupting agents [76,77]. This chemical characteristic justifies the higher numbers of pharmaco-chemical compounds in this group.

Note that while those compounds are found in the liquid product, some separation techniques must be developed to recover them in pure form. This should be the subject of future research.

3.3 Carbonyl Groups

The carbonyl group appears in WV_{Cam}, WV_{Euc}, WV_{Nim} but was not found in WV_{Mix}. This results made it clear that the chemical output product of a certain biomass resource changes and can be affected by the various pyrolysis processes used, including how the material was processed (e.g. a case for Nim leaves and fine grinded branches effusion on WV_{Nim}).

The main composts derived from the carbonyl group, widely used in the chemical industry are as follows:

1. The compound 5-methylfurfural is used as a chemical for the synthesis of fine chemicals manufacture [78,79]. It is also used as a potential candidate for therapy of sickle cell disease [80];

2. Acetol is an important intermediate product used to produce polyols and acrolein [81]. It is being widely used as a reduced dye in the textile industry [82]. Moreover, it is used as a skin tanning agent in the cosmetic industry and to give the unique aroma and flavor to foods [83];

3. Furfural is a chemical used for the synthesis of fine chemicals manufacture [84]. It is also commonly used as sustainable intermediate for the preparation of a great variety of chemicals, pharmaceuticals and furan-based polymers [85], and,

4. Cyclotene only appeared in WV_{Euc} and is reportedly used as anti-inflammatory agent [86,87].

Likewise, techniques must be developed in the future for effective separation, isolation and purification of these valuable chemicals.

3.4 Carboxyl Groups

The main chemical compound in the carboxyl group is acetic acid. The percentage composition ranged from 8.1 to 20.74%. This is the major chemical compound in all WVs studied. This is perhaps the primary for the WVs low pH values and buffering capacity as demonstrated in **Table 1** and **Fig 1**.

Acetic acid has been widely used in chemical industries, with wide range of uses, such as the production of polymers derived from vinyl acetate production of purified terephthalic acid. This compound is used to produce polyethylene terephthalate (PET). Acetic acid may be precursor or as raw material for acetic anhydride and acetate esters production and are widely used as solvents [88,89]. These upgraded acids from acetic acid are commonly used in the food industry as acidity regulator [90].

The primary industrial method for production of acetic acid is the carbonylation of methanol. The current method for commercial production of this chemical consumes fossil fuels [91]. The production of these organic acid chemicals by pyrolysis of wood can be a promising approach to obtain renewable chemicals or precursors.

Likewise, there is an additional challenge to efficiently separate the organic acids from a mix of multiple diluted components. This necessary step will improve the purity of other valuable organic acids with similar properties with acetic acids [92]. The chemical industry widely uses the distillation process to separate and purify chemical compounds based on the differences in boiling temperature of the components [93,94]. Other novel and cost-effective methods of separation must be studied. This should be the subject of future research.

3.5 Poly-aromatic Hydrocarbon (PAH) Group

Shown in **Table 3** are various concentrations of PAHs found in WVs. The total parent PAH concentrations ranged from 44.77 to 357.12 ng g^{-1}. One agronomic purpose of WV is to partially substitute fertilizers and pesticides. Contamination rates must be considered however as it may potentially cause cancer to humans once such chemical is spread throughout the surface of the soil. Some PAHs have lipophilic nature, that is, they are easily dissolved and transported by human cell membranes [95].

According to one study [96], the Danish PAH Soil Quality Criteria (SQC) limit in soil is 1000 ng g^{-1}. This

was set for the protection of the environmental and human health. This concentration is much higher than the concentrations found in WVs studied. While some PAHs compounds were found, those analyzed in WVs had no potential carcinogenic risk. The major seven carcinogenic compounds reported but were not found in this study are as follows: Benzo(a)anthracene, Chrysene, Benzo(b) fluoranthene, Benzo(k) fluoranthene, Benzo(a) pyrene, Indeno(1.2.3-cd) anthracene, Dibenz(a,h) anthracene [97]. For example, naphthalene is a common compound found in most household mothballs. The other, acenaphthylene, is a compound found in coal tar and used as ligand in some organometallic processes.

Several factors, such as biomass and temperature, affect yields and distribution of PAHs formed. Thermal PAH formation can occur over a wide range of temperatures. At low temperatures, the compound distribution is governed by thermal stability and the most stable isomers are formed, while at high temperatures, PAHs of higher formation enthalpy can be generated [98].

b. Wood Vinegar Antibacterial Effects

Plating of soil onto treated plates showed that total cultured bacterial densities were significantly different among types and concentrations of WVs, **Table 4**.

The soil's bacteria were tolerant to WVs assessed at 0.8% for soils cultivated with crop, pasture and native forest. The same was not observed to the soil cultivated with Eucalyptus. This suggested a WV concentration for agronomic purposes of 0.8% or less.

Soil bacterial growth was mightily affected for WVs at the 100% rate, except for WV_{mix} in soils cultivated with crop and pasture. WVs have anti-microbial compounds that affect directly the bacterial growth as well as some organic acids and phenolic substances.

WV_{Euc} and WV_{Cam} had the highest toxicity index for soil bacteria. This behavior is due to the higher concentration of anti-microbial compounds in these two WVs. Hence, one must act with due diligence on the use of these compounds as crop soil enhancement for improved and better beneficial microbial growth. Of course, the opposite is also true, that is, WVs may be used to minimize harmful microbiota proliferation in some soils.

IV. CONCLUSION

This study has shown that the chemical composition of wood vinegars (WVs) varied with feedstock, pyrolysis temperature and exposure time. Numerous valuable chemicals were found in the liquid condensate after immediate cooling of the gaseous products produced.

This study has shown that some wood vinegars have high amounts of macronutrients P K, Mg (WV_{Euc} and

WV_{Mix}) and Ca (WV_{Mix}), that are partial substitute of chemical fertilizers. The high amounts of TOC in some WVs (WV_{Cam} and WV_{Euc}) showed potential as good material substrate for microbial growth that also act stimulant for plant growth.

The main constituents of the organic portion of WVs were found to include four major compounds groups in order of increasing amounts as follows: (a) phenols, (b) carboxyl groups, (c) carbonyl groups and (d) silicates. Some phenol compounds found were shown to have anti-microbial properties, as antioxidants and anti-inflammatory compounds and as food additives. The carbonyl groups showed importance in the chemical industries as pre-cursors to high value chemicals in the pharmaceutical industry. On the carboxyl group, the primary and most common organic acid compound found was acetic acid, another important chemical industry ingredient that may be used to replacer fossil fuel based chemicals.

This study has further shown that WVs have potential uses as chemicals (on syntheses, adhesives and food flavoring), pharmacological (cancer treatment, antioxidant, anti-inflammatory agents) and agronomic purposes (as a partial substitute of chemical fertilizers and pesticides), with highlight to WV_{Nim} for both pharmacy and agronomic purposes.

WVs used for agronomic purposes must be diluted; based on bacterial densities in soil, we suggest dilution of 0.8% or less. This study also found that there are no significant hazardous and toxic compounds such as oly-aromatic hydrocarbons (PAH) and hence, it is safe to use as chemical alternatives. More studies are warranted in the future to carefully separate, isolate and purify these valuable chemicals for their proper commercial use.

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Table 1. Wood vinegar pH, elemental analysis and inorganic/organic carbon components

Wood Vinegar	pH	Zn	Mn	Mg	Ca	K	Cu	P	TIC	TOC
					--- (mg ℓ^{-1}) ---					
WV$_{Cam}$	2.68d	0.13d	5.63a	0.76c	4.87b	3.33b	-	0.49b	1,64ab	275,59a
WV$_{Euc}$	2.76c	1.60b	2.05b	7.12b	3.58c	69.84a	0.19	20.29a	2,29a	258,57b
WV$_{Mix}$	3.70a	1.13c	1.71c	7.84a	122.71a	69.84a	-	23.40a	0,95b	92,44d
WV$_{Nim}$	3.49b	2.23a	1.05d	0.45d	0.88d	3.48b	-	1.64b	1,02b	109,89c

Table 2. Chemical compounds of wood vinegars analyzed by CG-MS

Compounds	Relative Percentage (%)				Usefulness	References
	WV$_{Cam}$	WV$_{Euc}$	WV$_{Nim}$	WV$_{Mix}$		
5-methyl-2-Furancarboxaldehyde or 5-methylfurfural	3.84	0.89	0.24	-	Chemical for synthesis - manufacture of fine chemicals[1,2], potential candidate for therapy of sickle cell disease[3]	[1][53]; [2][54]; [55].
1-hydroxy-2-propanone or acetol	0.43	1.78	-	-	Important intermediate used to produce polyols and acrolein[1]; widely used as a reduced dye in the textile industry[2] and as a skin tanning agent in the cosmetic industry, to give aroma and flavor to foods[3]	[1][57]; [2][58]; [3][56].
1-hydroxy-2-butanone		0.38	-	-		
2-Cyclopenten-1-one	0.44	0.54	-	-		
2-methyl-cyclopenten-1-one	0.32	0.31	-	-		
2-Furancarboxaldehyde or furfural	-	3.04	1.59	-	Chemical for synthesis - manufacture of fine chemicals[1], sustainable intermediate for the preparation of a great variety of chemicals, pharmaceuticals and furan-based polymers[2]	[1][59], [2][60].
2-acetylfuran	0.5	0.4	-	-		
3-methyl-2-cyclopenten-1-one	0.39	0.6	0.29	-		
2,3-dimethyl-2-cyclopenten-1-one		0.76	0.56	-		
2-hydroxy-3-methyl-2-cyclopentene-1-one or Cyclotene		1.5	-	-	anti-inflammatory[1,2]	[1][61]; [2][62].
3-Ethyl-2-hydroxy-2-cyclopenten-1-one		0.46	-	-		
Methyl 4-Hydroxy-3-methoxybenzoate	0.46	-	-	-		
Carbonyl	**12.76**	**10.66**	**2.68**	**-**		
					Manly uses are in industrial chemical, for	

					Description	Reference
Acetic acid	10.28	20.74	9.26	8.1	production of polymers derived from vinyl acetate production of purified terephthalic acid, which is used to produce polyethylene terephthalate (PET) raw material for acetic anhydride and acetate esters, which are, like acetic acid itself, widely used as solvents[1,2]. In the food industry is used as an acidity regulator[3]	[1][63]; [2][64]; [3][65].
propionic acid	0.82	1.21	0.66	-		
ethenyl ester	0.72	-	-	-		
butanoic acid	0.36	0.43	-	-		
octanoic acid	0.28	-	-	-		
4-hydroxy-Butanoic acid	-	0.34	-	-		
Carboxyl	**12.46**	**22.72**	**9.92**	**8.1**		
3,4-Dimethoxytoluene	-	-	0.83	-		
2-methoxy-Phenol or Guaiacol	6.6	-	4.68	6.97	Antimicrobial[1,2], reduce gastric erosions induced by classic anti-inflammatory drugs (ibuprofen)[3], antidiarrheal agent[4], antioxidant[5].	[1] [66]; [2][67]; [3][68]; [4][69]; [5][4].
4-methoxy-3-methyl-Phenol	0.93	-	0.78	-		
1,2-dimethoxy-4-ethylbenzene	-	-	0.48	-		
2,6-dimethyl-Phenol	0.52	-	0.25	-		
2-methoxy-5-methyl-Phenol	0.95	-	0.67	-		
2-methoxy-4-methyl-Phenol or creosol	11.70	4.76	6.64	7.00	Flavor Standards, Food and Cosmetic Component Standards[1,2], antidiarrheal agent[3]	[1][70]; [2][71]; [3][69].
2-methoxy-3-methyl-Phenol	-	0.42	-	-		
2,3,6-trimethyl-Phenol	0.55	-	0.35	-		
2-methyl-Phenol or o-cresol	2.42	5.52	1.87	2.36		
Phenol	1.75	1.64	0.98	2.67		
4-ethyl-2-methoxy-Phenol or	8.92	5.11	9.88	10.38		
4-ethyl-3-methyl-Phenol	0.77	-	-	-		
3-ethyl-2-methoxy-Phenol	-	0.5	-	-		
3-ethyl-5-methyl-Phenol	0.38	-	-	-		
2-ethyl-Phenol	0.30	-	0.61	-		

Compound					Function	References
2,5-dimethyl-Phenol	0.91	-	1.12	1.15		
2,4-dimethyl-Phenol	0.49	-	1.93	1.43		
3-methyl-Phenol	-	1.32	1.92	-		
2-methoxy-4-propyl-Phenol	3.46	1.61	5.50	5.53		
2,6-dimethoxy-4-(2-propyl) Phenol	0,48	-	-	-		
2-ethyl-4-methyl-Phenol	-	-	0.31	-		
2-ethyl-5-methyl-Phenol	-	0.62	-	-		
2,3-dimethyl-Phenol	-	-	0.76	-		
Eugenol	-	0.82	1.86	1.79	Antioxidant[1,3], antimicrobial[2,3] and anti-inflammatory[3]	[1][72]; [73, 74]; [3][75].
2(1-methylethyl)Phenol	-	-	0.90	-		
2-methoxy-4-(1-propyl-Phenol)	0.48	0.32	-	-		
2-methoxy-4-(2-propenyl) Phenol	1.16	-	-	-		
3,4-dimethyl-Phenol	0.77	0.43	2.06	1.15		
3,5-dimethyl-Phenol	-	-	-	2.10		
3,4,5-trimethyl-Phenol	0.81	-	-	-		
3-ethyl-Phenol	-	-	0.67	-		
4-ethyl-Phenol	1.44	0.39	-	-		
2.3.5-trimethyl-Phenol	-	-	1.52	-		
2-(4-methylpropyl)Phenol	-	-	0.42	-		
2,6-dimethoxy-Phenol or syringol	3.17	11.22	5.20	9.29	antioxidant[1,2]	[1][4]; [2][34]
2,4,6-trimethyl-Phenol	-	-	0.54	-		
4-propyl-syringol	3.10	5.74	8.19	7.07	*a.*	
4-methyl-syringol	4.48	-	-	6.24	*Component of wood adhesives[1]*	[1][76].
4-ethyl-syringol	-	-	-	11.48		
4-Allyl-2,6-dimethoxy-Phenol	-	1.22	1.60	-		
Kaempferol	-	8.26	4.64	-	Antioxidant and anti-inflammatory[1,6]; Alzheimer[2], Intervertebral disc degeneration[3], Leishmanial chemotherapy[4] and uterine fibroids[5] treatment; Cancer therapeutic agent[1,7]	[1][77, 78]; [79]; [3][80]; [81]; [82]; [77]; [7][83].
Phenol	**58.26**	**50.22**	**66.30**	**79.46**		
7,8-dimethylbenzocyclo octene	4.55	-	9.87	-		
Silicates	**4.55**	**0.27**	**9.87**	**-**		
3,4-dimethoxy-	0.82	-	0.83	1.16		

toluene					
1,2,3-trimethyl-benzene	-	-	0.42		
3,4,5-trimethoxy-toluene	-	-	1.88	3.42	
Benzenethanol or Phenylethyl alcohol	4.33	-	-	-	Chemical for synthesis[1], Anti-ifective agent and desifectant[2] [1][84], [2][85].
1-etil-4-methoxy-benzene	-	-	0.51	-	
Others	**5.62**	**-**	**3.64**	**4.58**	

Table 3. Concentration of individual and total PAHs in the wood vinegars

Polyaromatic hydrocarbons	WV_{Cam}	WV_{Euc}	WV_{Nim}	WV_{Mix}
	-- (ng g^{-1}) --			
Naphthalene	18.73	1.663	-	11.34
2-Methylnaphthalene	5.25	-	-	-
1-methylnaphthalene	151.72	105.78	18.03	11.74
Acenaphthylene	134.00	45.35	22.75	8.91
Acenaphthene	31.49	47.41	-	7.20
Fluorene	10.50	0.83	-	0.80
Phenanthrene	4.81	13.06	3.99	2.81
Anthracene	0.58	6.97	-	4.10
Fluoranthene	-	-	-	-
Pyrene	-	-	-	-
Benzo(a)anthracene	-	-	-	-
Chrysene	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-
Benzo(a)pyrene	-	-	-	-
Indeno(1.2.3-cd)anthracene	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-
Total	**357.12**	**221.08**	**44.77**	**46.90**

Table 4. Bacterial densities in soils cultivated with crop, pasture, Eucalyptus and native forest under wood vinegar (WV) rates

WV (%)	Soils							
	Crop		Pasture		Eucalyptus		Native Forest	
0	223.6	a	248.2	a	332.2	a	330.8	a
WV_{Mix} 0.8	183.4	a	264.6	a	235	b	301.6	a
WV_{Nim} 0.8	207.8	a	217	a	190	bc	268.2	a
WV_{Euc} 0.8	186	a	242.8	a	240.6	b	210.4	ab
WV_{Cam} 0.8	171.2	a	236.4	a	205.25	bc	272.6	ab
WV_{Mix} 100	211	a	210.8	a	141	c	151.2	b
WV_{Nim} 100	50	b	68.2	b	148	c	5.5	c
WV_{Euc} 100	12	b	16.8	b	5.6	d	6.8	c
WV_{Cam} 100	4.6	b	32.4	b	1	d	0	c

* Mean values of five plates per soil x wood vinegar assessed.
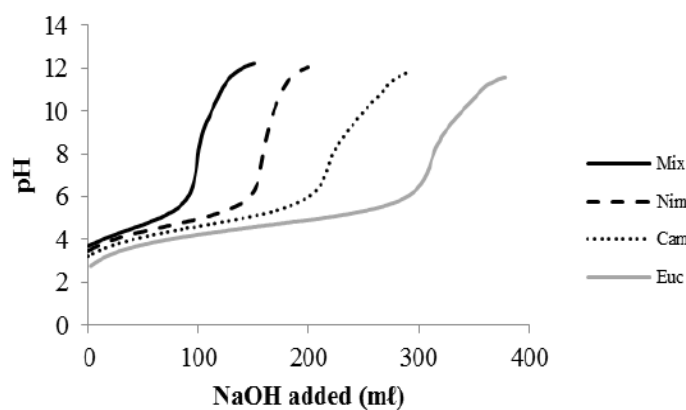
Fig.1: Titration curves for the wood vinegars made with Cambara (Qualea sp.), Eucaliptos (Eucalyptus sp), Nim (Azadirachta indica) and Mix (Azadirachta indica) mixed with Nim leaves effusion.
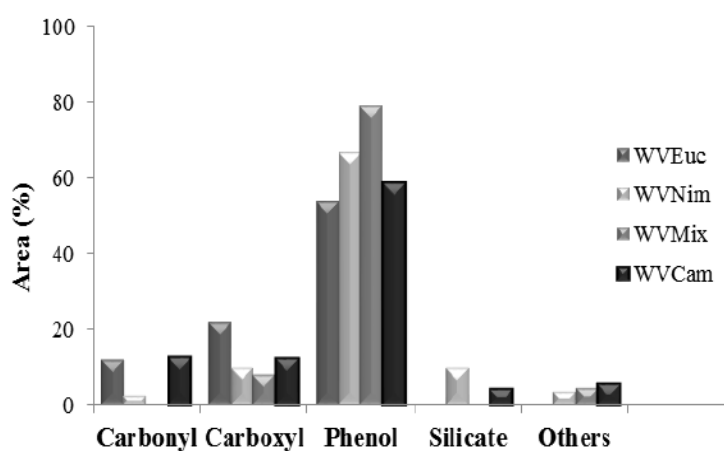
Fig.2: Wood vinegar characterization by chemical groups.

Storm hit Coastal Belt of Digha gets affected in many ways

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Abstract— Digha placed in Midnapur district and coastal belt with wide mudflat and various marine specimen attracts tourists, students of Marine Science, EVS, Zoology, Botany & Oceanography. Storm hit areas frequently faces multifarious problems and sacrifice life due to insufficient shelter for fishermen and other people lives below poverty line. Forest department of West Bengal must take arrangement to provide more plants to grow beside coast and help to combat storm. Fishermen who live on only by capture fishes from Sea (Bay-of-Bengal) always risks their life. Weather condition fluctuated and takes life every year (more than 1000) need immediate attention for betterment of their lifestyle because businessmen gets profit by exporting fish catch from there.

Keywords— Midnapur, Storm, EVS, Oceanography, Fishermen.

I. INTRODUCTION

Marine environment with salty weather in air faces climate change without prior intimation to take sufficient arrangement to save life of human who lives to entertain tourists (5000 everyday) ,students and different professionals of many faculties (Art, Science and Commerce).Hotel industry and Fishery in coastal belt are two major income source in Digha. Pristine look in sea beach gets profit and people stay to faces risks. Tourism in West Bengal need care to get better arrangement for the people who serves there. Storm (Fani, 3rd May ,2019) devastated land and take lives away. Many fishermen couldn't return home from sea. More plantation helps to reduce wind speed and maintain sea shore. Many cartilaginous and bony fishes are captured everyday (Ray and skates and edible Hilsa and Bhetki for commercial purpose). Traders assembled there to get profit from them. Marketing and transporting live fishes you can visualize in MOHONA.

II. MATERIALS AND METHOD

Fig.1 – Route map of Digha in West Bengal

Route map will help you to reach destination Digha in west Bengal. Roaring of sea you will visualize in 24 hours because high tide is dangerous. Boulders are affected with high waves. (2-4 ft high).

Fig.2- Waves in Bay-of-Bengal, Boulders and trees in beach
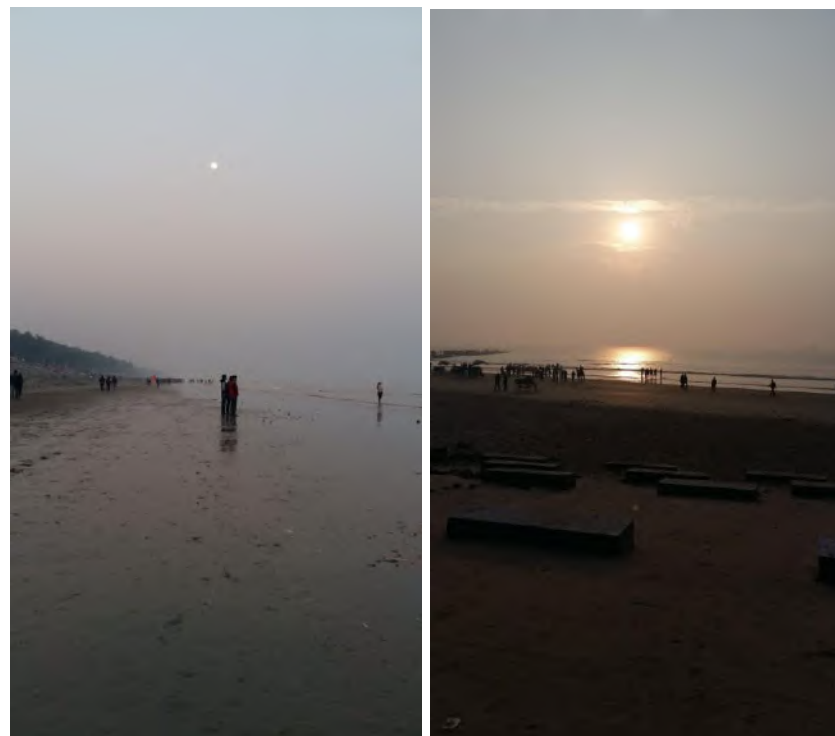
Fig.3 Evening and morning in sea beach

Fig.4 Capture fishery by coastal fishermen.

Fig.5 Ice blocks for transportation and net for capture fishes in sea.

Due to weather change and unpredictable cloud and cyclone Digha sea beach with 5000 gathering everyday needs improvement.

My digicam (CANON 8X zoom) helps to get real pictures of their lifestyle . My mobile with (SAMSUNG A5) helps to capture moments of Digha's tourists and fishermen.

Though municipality of Digha helps tro improve environment in many ways still life of coastal population are in risk.

III. DISCUSSION

Quality of fish muscle tissue and shell fish muscle tissue is deteriorating due to hotel sewage and mal practice of different tourists of all corners of India and abroad. Use of plastic is another reason of marine water pollution. Cleanliness requires and more facilities requires for day visit of tourists. Public toilets and shelter for poor people who earn money to run family by risking their lives need good accommodation for hearse climate.

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Implantation of a Boarding System for Supervision and Angulometric Tilt Adjustment of beds in the ICU of the Adriano Jorge Hospital Foundation in Manaus-AM

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Abstract—*Concern about the high mortality rates in ICU beds in Brazil, as a result of the acquisition of Pneumonia associated with Mechanical Ventilation (PAV), triggered a series of movements in an attempt to establish procedures for its prevention. Studies indicate that the maintenance of decubitus between 30 ° and 45 ° of inclination, attenuates the invasive effects of mechanical ventilation equipment and promotes the favoring of diaphragmatic performance, significantly reducing the hospitalization time of patients submitted to mechanical ventilation. However, the Hospital Infection Control Committee (CCIH) of the Hospital Adriano Jorge Foundation (FHAJ), through its collaborators, found difficulties in the regulation of ICU beds, due to the lack of adequate measurement equipment for regulation. Through the implantation of an embedded system in Arduino microcontroller and the association of several components of sensing and communication, the development of the inclination measuring device became possible. Equipped with an alphanumeric LCD display and an Ethernet network module, the auxiliary supervision and adjustment device proved to be the solution for the decubitus regulation process, since besides allowing local real-time gauging and visualization, the module provided the sending of information to the Hospital's internal network (LAN), enabling general monitoring from the computer screen. With the built-in audible alert system for improper slopes, the correct angulation for PAV prevention could be maintained at optimal levels, eliminating human failures from carelessness and giving patients greater treatment safety.*
Keywords—*Clinical engineering, hospital automation, pneumonia.*

I. INTRODUCTION

The Adriano Jorge Hospital Foundation (FHAJ), belonging to the Indirect Administration of the Executive Branch, belongs to the health institutions of the State of Amazonas, linked to the Unified Health System (SUS). Currently has 188 beds, available to the Surgical, Medical and Orthopedic Clinics; 12 beds for the Intensive Care Unit (ICU) and the Surgical Center for Orthopedics and General Surgery [1].

The anousy infrastructure and the limitation of resources destined to the acquisition of new medical equipment of high technological value, makes it impossible to follow up and support the new discovered procedures, and consequently the appropriate treatment to patients hospitalized in these hospital units. The current picture differs from private hospitals, where supplies are abundant and equipment with state-of-the-art technology. However, for both cases, the absence of important functions in hospital equipment becomes clear when analyzing the relevance of the application, although there is the possibility of implanting such systems.

Through the application of microcontroled hardware, the present work aimed to offer, at low cost, the necessary assistance tool for the treatment of patients submitted to mechanical ventilation, aiming at reducing mortality rates and providing the required security in the process of Angulometric adjustment.

II. THEORETICAL REFERENCE
2.1 The problem of pneumonia associated with mechanical ventilation (PAV)

Pneumonia can be defined as an inflammation of the lung tissue that affects the small air sacs called pulmonary alveoli[2]. There are several factors that lead to the

development of respiratory infection, among them is Ventilation Associated Pneumonia - PAV. The onset of this infection is directly related to the use of artificial mechanisms for oxygen supply, the affected part being the majority of the patients found in intensive care units.

PAV is the main nosocomial infection in patients requiring mechanical ventilation (MV). In fact, it is not associated with ventilators, but rather with the artificial ducts that persist during the treatment with invasive mechanical ventilation. MV prolongation is a complicating factor for the increase in mortality and morbidity in ICUs, since the risk factor for nosocomial pneumonia increases from six to twenty times in patients with orotracheal intubation and MV [3].

In a database analysis comprising more than 8,000 patients on mechanical ventilation for more than 24 hours, 9.3% of pneumonia was reported, with the mean time being between intubation and the diagnosis, of 3.3 days. In a study conducted in 99 Brazilian hospitals, pneumonia accounted for 28.9% of all nosocomial infections, and of these approximately 50% occurred in mechanically ventilated patients. An increase of 13.3 days in ICUs was estimated due to the acquisition of VAP, being rated as the second most common infection and the third in the field of mechanical ventilation, accounting for 63.7% of the cases[4].

2.2 Angulometric adjustments in ICUleeds for pav reduction

The disposition of the patient in the bed is one of the factors that can intervene directly in respiratory mechanics in patients submitted to mechanical ventilation (MV). Depending on the positioning imposed on mechanically ventilated patients, there may be a favor in diaphragmatic performance [5]. In addition to reducing the risk of pneumonia, some postural arrangements may directly affect the possibility of better distributed alveolar ventilation, as well as the possible reduction of the risk of lung injury induced by ventilation [6].

According to the *IIIConsensoBrasileiro de VentilaçãoMecânica*[7], an important intervention that can be used to attenuate the PAV is the elevation of the head of beds between 30 and 45 degrees of inclination, avoiding the probability of aspiration of enteral nutrition and of the gastric substance during reflux. The degree of random elevation of the backrest and the length of stay in the horizontal position are aggravating factors for VAP, since low elevations are intrinsically associated with increased gastric content aspiration [8]. In this way, it is recommended to raise the head in the 30 ° to 45 ° range.

A studyentitled "*Impacto de ação educativa na manutenção do decúbito elevado como medida preventiva de pneumonia associada à ventilação mecânica em*

Unidade de Terapia Intensiva" [9], developedattheUniversity Hospital of Londrina, proposedaneducationalaction for 49 healthprofessionals. At the time, it was found that the lack of clarity about the importance of maintaining high decubitus was shown to be the main risk factor for patients undergoing mechanical ventilation. In order to remedy the problem, educational interventions were promoted with health officials in order to alert the severity of hospital pneumonia and the need to implant and supervise daily maintenance of the elevated decubitus.

According to the study, after the educational action and the insertion of illustrative posters above the beds, showing the importance of angulation adjustment, an increase in the mean of backrest angulation was observed between the pre-intervention period (27.85 ± 6,76°) and the first month after intervention (30.71° ± 9.06°), with progressive reduction of this average in the subsequent periods when the poster was withdrawn. The observation of the progressive decline in adherence to this recommendation was also confirmed by another study [10], where it was observed a decrease in inclination from 28° to 22° in a few weeks.

III. METHODOLOGY

Scientific research was based on the imminent need for a real-time angles measurement equipment, pointed out by the Director of Teaching and Research of the Hospital Adriano Jorge Foundation. From the literary research, which pointed to the global problem of Pneumonia Associated to Mechanical Ventilation, a prototype was developed in order to aid in the regulation and adjustment to optimal levels.

The starting point for the elaboration of the prototype was the identification of possible elements that could meet the needs of the project. As a fundamental element, the GY-541 Module that uses the MPU6050 IC was the one chosen for measuring slope angles, because it presents versatility and good price. However, because it is characterized as accelerometer and gyroscope and not an angulometric sensor, the variables of measures had to be manipulated through mathematical relations to reach the ends.

Knowing that the sensor has 3 axes of measures agreed as axis x, y, z, and that the sensor has 16-bit accuracy, totaling 216 = 65,532 measured analogue levels in unit of measure "g", was made from the acceleration of the gravity, calibrations with the sensor positioned horizontally (Fig.1).

Fig. 1: Sensor Calibration
Source: Arduino IDE Serial Monitor

From the transformation of variables, it was possible to obtain the readings at practical levels for the angulometric calculation. All the received responses are represented in accelerations in the 3 axes of the sensor and, through the mathematical relationship listed below(1).

$$\theta_x = \tan^{-1}\left(\frac{a_x}{\sqrt[2]{a_y{}^2 + a_z{}^2}}\right) (1)$$

It was possible to transform the acceleration into angulometric values (Fig.2).
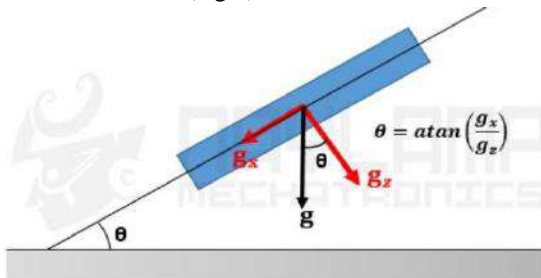
Fig. 2: Two-dimensional transformation relation
Source: www.naylampmechatronics.com

Once the angles were obtained, the next step was the interconnection between all elements for sampling and communication. All values, then controlled by the Arduino Nano microcontroller, were manipulated to provide the man-machine interface. The data needed to be shown to the user, therefore, LCD display for local sampling and Ethernet module were used to send information to the internal network of the hospital, being possible the monitoring and supervision from any computer connected to the network.

In addition to the elements described, also included were the audible alert items, for angles outside the specified range, and potentiometer for adjusting the contrast and brightness of the LCD display (Fig.3). Subsequently, the angulometric sensor was separated

from the set by USB cable, in order to provide greater malleability in positioning below bed headers.
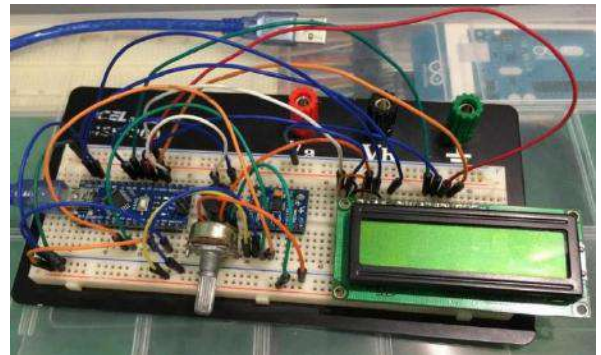
Fig. 3: Prototype in protoboard test
Source: Author, 2019

IV. ANALYSIS AND DISCUSSION OF RESULTS

Faced with the need of the Adriano Jorge Hospital Foundation, studies on possible solutions to the problem were put in focus. Considering the existence of such functionalities in beds of high monetary and technological value, the possible proposal should use two perspectives: efficiency and low cost. Both have been achieved, in addition to paving the way for possible implementations. All the components used in the elaboration of the model have undergone adjustments - both in the physical characteristics and in the logics - to obtain the best arrangement among the elements.

With the arrangement made, the communication between the subsystems became effective, allowing the heat dissipation and easy removal of components for possible maintenance. The device was subdivided into two sets: the first for visualization and control, consisting of microcontroller, display, battery, keys, buzzer, potentiometer, wires and connectors; the second restricted for measuring measurements, consisting of sensors, boards, wires and cables connected via USB. The conditioning and the final arrangement have two forms of power: mobile (battery) and fixed (electric grid), and buttons for sectioning and switching, costing $ 44.25 (Fig. 4).

Fig. 4: Final prototype
Source: Author, 2019

Methods previously adopted by the Hospital Infection Control Commission (CCIH) team could be considered archaic and ineffective. In the first attempt to obtain adequate adjustment (Fig. 5), a goniometer (medical instrument for measuring angles) was used, and a blue tape attached to the wall behind the bed for calibration of the slope. The intention was to raise the headboard until it was positioned above the blue ribbon. The applied method failed because it was necessary to elevate and front view simultaneously, requiring two employees for the procedure.
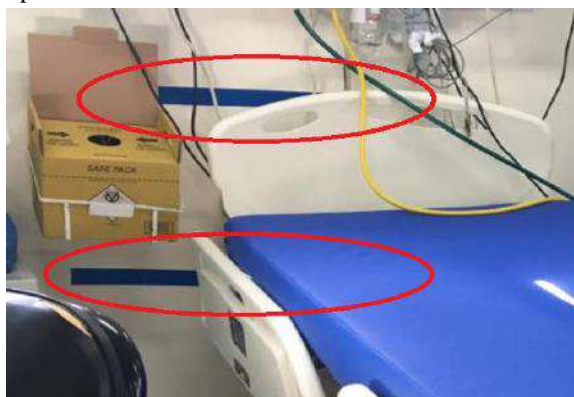
Fig. 5: First adjustment attempt
Source: Author, 2019

In the second attempt (Fig. 6), two small-sized ribbons were interposed between the lateral body support and the lateral bed support. By means of the lifting process, it is known that at some point the ribbons would align, indicating the predetermined correct angulation. The method made it impossible to select angles of inclination, since it was necessary for this purpose, the application of several tapes in the same place, besides making the work exhaustive and difficult to visualize.
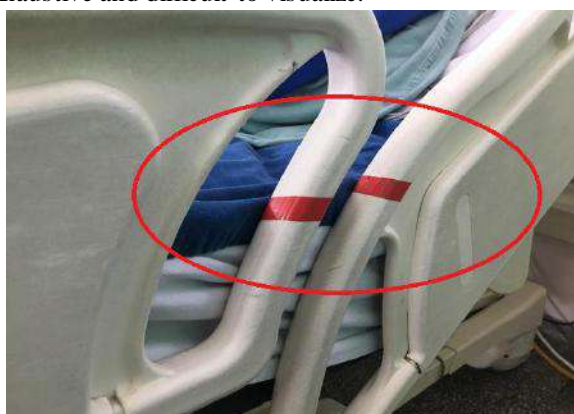
Fig. 6: Second adjustment attempt
Source: Author, 2019

The angulation accuracy acquired by the accelerometer sensor was ± 0.05 degrees, making the module highly effective for the desired application. In addition, the sensory measurement levels were the best, and the device could operate in adverse conditions such

as: lack of light, high levels of vibration and humidity, and temperatures between -20ºC and 85ºC. These characteristics added to practicality and mobility allowed the device to be adjusted in all places near the ICU beds (Figures 12,13).

Fig. 7: Device under ICU bed test
Source: Author, 2019

After performing tests at the Hospital Adriano Jorge ICU and proving its effectiveness by local servants, it was possible to perceive that the proposed solution would also cure the difficulty found in the research carried out at the University Hospital of Londrina[8], where the progressive reduction in the angulometric levels of beds after the educational action could be noticed. Through the technological application, the ability to visualize values and the sound signals embedded in the device - similar to the car seat alert system - corroborated with the elevated decubitus, since for positioning below 30 ° and above 40º, sound signals were issued, "obliging" the regulation.

Through the Ethernet interface and the RJ45 network connection port, the device has been enabled to connect to the Hospital's local network, and data can be read from any computer in the foundation. With this increase, and subsequent replication of the device for each ICU bed, it will be possible to create a bed supervision system in real time, with a history of measurements, calculation of averages of elevation of decubitus in the treatment of the disease, identification of each patient in the period of hospitalization and, monitor positioned in the therapy center for general visualization of angulometric levels.

At the end of the results, the Hospital Adriano Jorge Foundation started using a device capable of accurately expressing the values obtained in the bed slope adjustment process, making it the only public hospital in the region to use the technology. And, as a result of the visibility achieved, feasibility studies are being carried out for possible implantation in other Public Health Units.

V. CONCLUSION

The use of engineering for the purpose of treating patients in hospital units was always present. A hospital complex is endowed with numerous assistance tools, which together enhance the clinical treatment and reduce the average time of hospitalization of patients. However, like all new technology introduced in the market, the investment required to acquire these modern equipment is extremely high, making the implementation of these devices in public health institutions, considering the current Brazilian political scenario.

Given the social perspective, the care given to low-income patients must be equated with those received by the wealthiest population. Although there is no possibility of obtaining all the equipment found in large private hospitals, alternatives with reduced costs need to be idealized and developed for medical treatment in public health networks. In this sense, this work was presented as an alternative accessible to the current means of life support, exhausting all the deficiencies of angulometric regulation and enabling the insertion of new components of sensing and communication in a single module.

At present, the beds found in the ICU of the FHAJ, are equipped with mechanical systems for lifting the set of platforms. Motors associated with the gear set can be manipulated from manual and selective control and the user can select the correct incline from the display on the designed measuring device. In a second stage of work, the independent subsystems that now function in a mutual and complementary way, could be converged to a single monitoring and control system, due to the fact that the designed hardware has a built-in microcontroller.

In short, through the use of care equipment used to prevent pneumonia, the reduction of the average time of hospitalization of patients can be achieved, as well as the consequent reduction of costly costs to the public coffers, thus allowing the redirection of resources to related areas.

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Internationalization and Corporate Social Responsibility: A Survey of Scientific Production Disseminated in Brazilian Database

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Abstract— Faced with a globalized market, companies that already work with Social Responsibility have a greater possibility of competitive insertion in other markets. The synergy between the themes Internationalization and Social Responsibility was the driver of this bibliometric research carried out in three Brazilian databases aiming to analyze the researches that approach the two themes concomitantly and that contain links with the business dynamics. The sample comprised 17 articles that, after the filters, totaled 8 articles produced between 2007 and 2016. As a result it can be seen that the insertion of responsible or sustainable practices are a source of opportunity for business abroad.
Keywords— Internationalization. Social responsibility. Scientific production.

I. INTRODUCTION

Organizations are challenged to survive in an increasingly demanding market. Globalization, increased competition, consumer-oriented legislation are some of the factors that compel organizations to review their strategies and to better prepare themselves to meet market demands and achieve their goals.

One of the most recent strategies used by companies to establish and extend their markets is the so-called internationalization, whether through export or investment in other countries. However, this process is not simple. In addition to internal factors, organizations need to be prepared for the challenges posed by the external environment, which are even more complex because they involve a new country.

Adapting to the culture, legislation and politics of a new country are challenges to be overcome by companies seeking internationalization. Issues related to corporate social responsibility must also be in the "adaptations package". The legal framework for corporate social responsibility and customs varies from country to country.

In this context, it is possible to observe a relationship between corporate social responsibility and the process of internationalization of organizations. As a result, this article proposes to analyze selected researches that were published in the period 2007 to 2016, which address the theme of Internationalization, Corporate Social Responsibility and are linked with business dynamics.

II. CORPORATE SOCIAL RESPONSIBILITY (CSR)

Corporate Social Responsibility (CSR) has been discussed since the end of the 19th century. However, a deeper approach to the issue came in the mid-twentieth century, when discussions about the environmental issue and the social role of organizations became more intense. Although the theme is relevant, there is no consensus among the various authors about its conceptualization. This is mainly due to its breadth.

For the Ethos Institute (2017),

> *Corporate Social Responsibility is the form of management that is defined by the ethical and transparent relationship of the company with all the public with which it relates and by setting business goals that promote the sustainable development of society while preserving environmental and cultural resources for generations, respecting diversity and promoting the reduction of social inequalities.*

According to Oliveira (2005, p.3) , "CSR refers to the way companies act, how they impact and how they relate to the environment and its legitimately interested parties (the so-called *stakeholders*, government and society in general)" and Jones (1980) argues that actions taken for the good of *stakeholders* can only be considered socially responsible and do not aim at financial returns.

To Donaldson & Preston (1995, p.12) , "according to *stakeholder* theory, the satisfaction of various *stakeholder*

groups is instrumental to corporate financial performance."

According to Keller (1993), the strengthening of corporate image is achieved through the strengthening of its brands, through publicity of initiatives of social responsibility, aiming to create a brand of high value for companies and their *stakeholders*. Such value, in this case, is perceived by the public - internal or external - as a consequence of the delivery of a high number of benefits that satisfy their needs at a satisfactory cost.

Robert (2003) argues that effective social responsibility, which means, taking responsibility for activities and their social consequences is only possible through the sensitization of the individual, since companies are devoid of sensitivity and responsibility, with these actions belonging to individuals.

The authors mentioned have a common vision when they emphasize the importance of corporate social responsibility to *stakeholders*. Almost in a redundant way, they make it clear that in order to have social responsibility, it is necessary that the components of this society - represented here by the *stakeholders*, obtain some kind of benefit.

As the company itself is one of the components of this society, it will also benefit directly or indirectly from the results derived from the social responsibility management processes.

For Lindquist (1975), the image, from the organizational point of view, is what people feel and think about a product or institutional brand. This author emphasizes that this process is subjective, because it depends on the observer and the organization that transmits the image, and consists of a combination of symbolic, cognitive, emotional and functional elements. The image that different publics have about an organization can be defined, therefore, by the attitudes and communications of this company with its *stakeholders*, as well as by the context in which the different publics and companies are inserted.

According to Keller (1993), the strengthening of corporate image is achieved through the strengthening of its brands, through publicity of initiatives of social responsibility, aiming to create a brand of high value for companies and their *stakeholders*. Such value, in this case, is that perceived by the public - internal or external - as a consequence of the delivery of a high number of benefits that satisfy their needs at a satisfactory cost.

Both Lindquist and Keller address the importance of social responsibility to the image of organizations. This image, according to theory, is formed by the *stakeholders* through the identification of the role played by them, for the benefit of society. These benefits can be translated

into a concrete action, as a project to recover a polluted river, or in an abstract action, as the form of treatment used to its employees, for example.

According to McWilliams and Siegel (2001), the term refers to actions that promote some social good that go beyond compliance with laws, thus assuming a character of voluntarism.

According to Davis (1973, p . 311), "It is the company's consideration and response to issues that go beyond economic, technical, and legal demands for social benefit together with the traditional economic gains the company seeks. "

Both in the view of McWilliams and Siegel as in that of Davis, it is possible to identify a tendency towards voluntarism. A number of other authors on this topic emphasize that "true social responsibility" is one that is voluntarily practiced by organizations, and does not aim at interests in any way. However, not all of them act in this way, and therefore the institution and enforcement of legislation is necessary.

In Carroll's (1999) view, there is a diversity of concepts about social responsibility. The concept of social responsibility is usually associated with sustainable development, socio-environmental responsibility and sustainability.

For the Commission of the European Communities (2001, p. 4) , "Corporate Social Responsibility is essentially a concept whereby companies decide on a voluntary basis to contribute to a fairer society and a cleaner environment. "

The approach of Carroll and the Commission of the European Communities is focused on the natural environmental issue. This is due to discussions about the impacts of business activities on the environment. It is true that corporate social responsibility is not exclusively focused on environmental issues, but it is also a fact that this area has a strong influence on the institutional image formulated by society.

According to Carroll (1979), CSR is classified into four categories according to the main motivation of the act: (a) Economic: the main function of for-profit companies; (b) Legal: because it is inserted in society, it must be in accordance with the established codes and norms; (c) Ethical: it concerns implicit relational codes that are not necessarily described in the form of law; and, (d) Discretionary: it involves actions of a strictly voluntary nature.

Carroll (1999) emphasizes that Corporate Social Responsibility can contribute to the strengthening of the brand. That way it can directly help in the financial return for the companies. Drucker (1984) shares this idea, adding that CSR should be seen as a business opportunity.

Based on the Efficient Market Theory, Mackey and Barney (2007), assume that the information of engagement in socially responsible activities can reflect in the share price and in its market value. In this way, investments in social responsibility actions configure to the extent that investors look for such a characteristic when choosing the shares they will acquire.

Emphasis is placed on the vision of the strategic role of social responsibility for organizations and their ability to generate value. It is argued that social responsibility generates a competitive advantage to the organization from the differentiation of its products and services (Porter and Kammer, 2002).

Authors such as Carroll, Drucker, Mackey, Barney, Porter and Kamer also emphasize the results of the social responsibility process. These authors emphasize the possibility of obtaining benefits derived from this process, either in the improvement of the company image, in the strengthening of its brand, in the improvement of its competitiveness or in the formulation of its strategies. The fact is that investments in social responsibility can generate value and bring financial returns. This can even attract new investors, which is very positive for the organization.

Internationalization

Internationalization has been intensifying since the beginning of the 1990s. Among the factors that contributed to this process is the change in the structure of world trade.

With the advent of globalization, international competition and competitiveness between companies has increased considerably. To stay competitive, many companies saw internationalization as an opportunity to expand their business. However, the theme of internationalization is very broad and complex, and therefore requires a detailed analysis of the concepts of the various authors who approach the theme.

Cavusgil, Knight and Riesenberger (2010) refer to the term international business or cross-border business, characterizing it as:

The performance of trade and investment activities by companies, across borders between countries, by which companies organize, supply, manufacture, market and conduct other value-added activities on an international scale.

Broadly and comprehensively, internationalization can be defined as a growing and continuous process of involving the operations of a company with countries outside its home base. Although it contains the word "process", this definition does not indicate that internationalization should necessarily be composed of evolutionary characteristics through strict sequential and imposing stages (GOULART; BRASIL; ARRUDA, 1996).

For Wafo (1998), the internationalization process began before the First World War, when Western European investors used a fraction of their economies to finance foreign governments and companies in other parts of the world. At the time, almost all company internationalization came from England, France and Germany, in the form of creation or financing of mines, plantation fields, public utilities, railways and ports, mostly in Africa and Latin America.

Similarly, the internationalization of a company can be defined as any activity carried out in order to expand its operations beyond its country of origin, which includes transactions (marketing of products, brands and patents), direct investments (opening of factories, services and *joint ventures*) and special projects (HRDLICKA et al., 2008).

Based on the authors' discourse on internationalization, it is noted that this is an irreversible process, mainly because its basis is related to the process of globalization and expansion of companies. The expansion process can be related not only to saturation in its home markets but also to the strategies of maintenance and growth of its brands, products and services, in order to add value on an international scale.

The process of internationalization of companies involves two main instances: i) external markets servicing via exports and ii) foreign direct investment. Involvement in globalized markets requires the company to respond to the challenges of accelerating change, operational complexity and increasing competition (CRAIG and DOUGLAS, 1996).

According to Jiménez and Delgado (2012), companies go through three stages in their internationalization processes. In the first, the impacts of multinationality and lack of experience act negatively on performance, since the firm faces problems that are largely unknown. In the second phase, by acquiring the necessary knowledge to manage operations abroad, the increase in the degree of multinationality is accompanied by an increase in performance up to the third stage. In the latter, the management of operations abroad becomes excessively complicated, which implies degradation of performance.

This growing process of engagement with international operations can be essentially developed in two ways: *inward* and *outward* . Inward internationalization is characterized by imports, manufacturing licenses, technology purchases or franchise contracts from foreign companies. Outward internationalization occurs through exports, franchising, and direct foreign investment. The combination of these

two forms allows the deepening of the process of internationalization of companies (BARRETTO and ROCHA, 2003).

Despite the existence of several studies related to the subject, there is no conclusive recommendation on the right time for entry into the foreign market, although the literature has exemplified advantages to the first entrant, however the pioneerism also does not guarantee the success of international operations (PENG, 2008) .

For Buckey and Casson (2001), in the processes of internationalization, cultural distance is an important factor in the choice of the type of foreign market. Organizations with little experience prefer short cultural markets.

According to Johanson and Vahlne (1977, p. 3) , "the greater the company's experience in the international market, the lower the risk and uncertainty of the operation, creating conditions for greater involvement and the identification of political risks related to destiny country. ".

Regarding the implementation, it is possible to verify that the internationalization process is not only by exports. It can also be characterized by the investments of domestic companies abroad.

Another point that must be taken into account in the process of implementing internationalization is the lack of experience of companies in these new markets. In addition, cultural difference can be a deterministic factor for the success or failure of the process. In this sense, a thorough analysis of these factors is necessary to determine the pros and cons and thus decide on the investment.

According to Rocha (2002), the internationalization of Brazilian companies was boosted in the 1970s, but despite this, it has been slow and late.

The low level of internationalization of Brazilian companies is due to innumerable factors, such as the attractive domestic market and the technological lag of certain sectors, which contribute to the permanence of companies in the domestic market (BARTLETT and GHOSHAL, 2000).

Rocha (2003) cites as factors that hinder the process of internationalization of Brazilian companies the difficulties caused by geographic and linguistic isolation, cultural formation and the impact of the environment on business motivations.

The search for learning and skills development; search for economies of scale; saturation of the domestic market; customer support; appreciation of the brand; access to resources and strategic assets, are driving factors in the search for internationalization by Brazilian companies. (CYRINO and BARCELLOS, 2006).

According to Garrido (2009), the mode of entry into an international market is based on an institutional arrangement that makes it possible for products (technology, human skills, management or other resources of a company) to enter international markets. The strategies for this include objectives, targets, resources and policies that guide the international business of a company for a period sufficient to achieve sustainable growth in the foreign market.

The fact that the Brazilian internationalization process originated in the 1970s did not guarantee a great evolution in this direction. Factors already mentioned as the lack of structure, technology, geographic isolation and domestic demand have limited the growth of internationalization. On the other hand, the same deficiencies that presented themselves as limiting factors, in a way, ended up driving some companies towards the internationalization process. One of these factors was the search for learning and developing skills. The saturation of the market for some products and economic liberalism through economies of scale further endorsed this process.

One of the risks of the internationalization process is related to the policies of the country in which it is intended to act. Lack of knowledge about internal policies, ethical standards, and legislation can compromise the whole process. Legislation varies from one country to another, so it is necessary to be open to adaptations.

In this sense, they are related to issues related to corporate social responsibility. There is no way, in an internationalization process, to succeed without considering this variable. What is ethical in one country may not be in another, because ethics has as limiting factor the geography and culture of a people.

III. METHODOLOGICAL PROCEDURES

In order to analyze the researches that deal with the theme of Internationalization and Corporate Social Responsibility, a bibliometric study was carried out. The research contemplates three scientific databases, having been used the keywords *internationalization* and *responsibility*, because this way contemplates the concomitant use of the two words. The criteria were defined by searching for those keywords entered in the fields: title, subject or abstract. The searches were delimited by articles. Year of publication was not set for any of the searches. In this way, the research was carried out with the filters shown in Table 1 below:

Fig. 1: Filter for the selection of articles

BASE	KEYWORDS LOCALIZATION	PUBLICATION TYPE	YEAR
PORTAL DE PERIÓDICOS CAPES/MEC	TITULO	ARTIGO	NÃO DEFINIDO
PORTAL DE PERIÓDICOS CAPES/MEC	ASSUNTO	ARTIGO	NÃO DEFINIDO
SCIELO	RESUMO	NÃO DEFINIDO	NÃO DEFINIDO
SCIELO	NÃO DEFINIDO	NÃO DEFINIDO	NÃO DEFINIDO
SPELL	RESUMO	NÃO DEFINIDO	NÃO DEFINIDO
SPELL	NÃO DEFINIDO	NÃO DEFINIDO	NÃO DEFINIDO
SPELL	RESUMO	ARTIGO	NÃO DEFINIDO

Source: elaborated by the authors

The sample was composed of 17 articles. On database, the composition is distributed by 3 articles in Capes; 6 articles in the Scielo database and 8 articles in Spell. For the analysis of the data, a previous screening was conducted considering the authors, year of publication, place of publication, making a second filter of the articles that were duplicated. Thus, our sample is composed of 14 articles.

The variables analyzed in the articles are: (a) Objectives and Results; (b) methodological profile; (c) demographics of the first author; (d) study geography; (e) concepts used related to the themes of internationalization and responsibility; (f) citations of bibliographic references for the topics of internationalization and responsibility; (g) identification of the academic theory used.

The first stage of analysis focused on the concepts of Internationalization and Responsibility, where three articles were identified that were not related to companies, that is, they discussed the processes of

internationalization of knowledge of the Universities and the Social Responsibility conferred upon them. In addition, three other articles were identified that, although related to the complexities of the organizations, two dealt with the responsibility in the perspective of the management related to the decision making of these agents considering the internationalization context; and another brought the perspective of corporate social responsibility, but since it was a quantitative study, used internationalization as a variable called the level of internationalization of the company where it organized the companies surveyed in national or multinational. This analytical filter removes 6 articles from our sample. Thus, our sample is composed of 8 articles, described in Table 2.

Fig. 2 Analyzed articles

ORDER	TITLE	YEAR	NUMBER OF AUTHORS	FIRST AUTHOR	SOURCE
1	A influência da Responsabilidade Socioambiental no processo de internacionalização: o caso da Electro Aço Altona	2007	3	SOUZA, Vanessa S. Fraga de	Revista de Ciências da Administração
2	Gestão da Inovação Tecnológica para o Desenvolvimento Sustentável em Empresas Internacionalizadas	2009	4	GOMES, Clandia Maffini	Gestão & Regionalidade
3	Reforma estrutural e proatividade ambiental: o caso das empresas brasileiras	2010	4	ABREU, Monica Cavalcanti Sá de	Revista de Administração Mackenzie
4	Orientação da gestão sustentável de uma empresa química com atividade internacional	2013	3	DIAS, Valeria da Veiga	Revista Eletrônica de Negócios Internacionais da ESPM

5	A responsabilidade social como fator na estratégia internacional: o estudo do caso Natura	2007	3	SERRA, Fernando a. Ribeiro	REAd. Revista Eletrônica de Administração
6	O agronegócio e o problema do trabalho infantil	2010	1	MARIN, Joel Orlando Bevilaqua	Revista de Sociologia e Política
7	Internacionalización responsable: una perspectiva desde los TLC	2016	4	MAJÍA REÁTIGA, Camilo	Estudios Socio-Jurídicos
8	Internacionalização, Disputas Sociais e Ação dos Intermediários na Construção da Responsabilidade Social Empresarial Brasileira.	2015	2	NOVAES BOTTA, Elisa Nogueira	Estudios Sociales (Santa Fe)

Source: elaborated by the authors

In the second stage, the selected articles were analyzed considering the theoretical reference presented in this article. In the next topic the results are described.

IV. ANALYSIS AND RESULTS

This session is divided into two topics. In the first one, it is presented a descriptive statistics of the production that compose this study. In the second topic, we demonstrate a bibliometric analysis considering the analyzed variables.

DESCRIPTIVE STATISTICS OF ANALYZED PRODUCTION

Analyzing productivity, it is observed that it has on average 0.8 articles produced per year. Analyzing the co-authorship, it is observed that 75% of the articles are produced by a group of 3 to 4 authors. Graph 1 shows the distribution of co-authors.

Graph 1: Co-authoring of scientific production
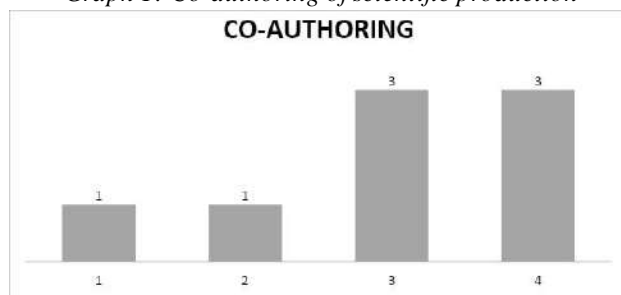
Source: elaborated by the authors

It is observed in this initial analysis that this thematic is little explored by the researchers. Based on this sample, a qualitative analysis will be carried out on the researched and published content.

QUALITATIVE ANALYSIS OF THE ANALYZED PRODUCTION

Of the published articles composing this sample, 63% are case studies and 38% are theoretical studies. The case studies are of companies with headquarters or branch in Brazil and that participate in the process of internationalization. The theoretical studies are related to the effects of the international agreements in the management with social responsibility of the organizations, of these studies two present the Brazilian field and one presents the field of Colombia. The location of the first author contemplates the place of study defined to do the research.

Table 3 shows the methodological profile (63% case study, 38% theoretical study), the demography of the first author (83% Brazilian authors, 13% Colombian author) and the geography of the study that accompanies the demographic statistics of the first author.

Fig 3: Fields of study

ARTICLE	METHODOLOGICAL PROFILE	AUTHOR DEMOGRAPHY (1º)	Study Geography
A influência da Responsabilidade	Case Study	Professor at FURB - Universidade Regional	Eletro Aço Altona, catarinense organization in Blumenau/Santa Catarina

ARTICLE	METHODOLOGICAL PROFILE	AUTHOR DEMOGRAPHY (1º)	Study Geography
Socioambiental no processo de internacionalização: o caso da Electro Aço Altona		de Blumenau/ Santa Catarina, South of Brazil.	(Brasil), from the international market of Steel.
Gestão da Inovação Tecnológica para o Desenvolvimento Sustentável em Empresas Internacionalizadas	Case Study	Universidade Federal de Santa Maria-RS-BRASIL	Brazilian company from the industrial and equipments sector from the southern region of Brazil.
Reforma estrutural e proatividade ambiental: o caso das empresas brasileiras	Multivariate case study	Professores from UFC-Universidade Federal do Ceará with a P.H.D. degree from *Cambrigde*	Petrochemical companies, steel mills, textiles and footwear established in DIFFERENT Brazilian states. A) PILOT: three large textile companies, located in the state of Ceará B) seventeen textile companies located in the states of Ceará (9), Pernambuco (4), Rio Grande do Norte (3) and Paraíba (1) C) petrochemical was carried out in six companies and involved petrochemical companies installed in two major petrochemical complexes; Bahia (3) and Rio Grande do Sul (1) states, followed by companies established in Ceará (1) and Rio de Janeiro state (1). D) steelmakers were in the south of Brazil, which means that six steel companies were located in São Paulo (2), Minas Gerais (2), Espírito Santo (1) and Rio Grande do Sul (1). E) The shoe industries were visited in Rio Grande do Sul (3), with one in the state of Ceará
Orientação da gestão sustentável de uma empresa química com atividade internacional	Case Study	PhD student in Agribusiness-UFRGS, Professor of the Undergraduate Course -UFSM, Professor of the Undergraduate and Postgraduate Course at Palotina College -FAPAS, Professor UCE / RS.	Group, composed of 400 companies, present in 84 countries and with approximately 60,000 employees. In Brazil since 1972, the first headquarters of the company was installed in the Santo Amaro neighborhood, in São Paulo. It expanded its operations with the support of two branches: in Porto Alegre and Paraíba
A responsabilidade social como fator na estratégia internacional: o estudo do caso Natura	Case Study	Unisul *Business School*	Natura Cosméticos
O agronegócio e o problema do trabalho infantil	Undefined. Classified in this research as theoretical study.	Professor at Universidade Federal de Goiás - PHD in Sociology at UNESP.	Brazil

ARTICLE	METHODOLOGICAL PROFILE	AUTHOR DEMOGRAPHY (1º)	Study Geography
Internacionalización responsable: una perspectiva desde los TLC	Undefined. Classified in this research as theoretical study.	Professores from *Universidad del Norte* (Colombia)	County of *Barranquilla* (Colômbia)
Internacionalização, Disputas Sociais e Ação dos Intermediários na Construção da Responsabilidade Social Empresarial Brasileira.	Undefined. Classified in this research as theoretical study.	UFSCAR/SP_Nucleus of Studies in Economic and Financial Sociology	BRAZIL

Source: elaborated by the authors

Regarding the sample research, it was systematized by objective and result obtained, as presented in Table 4. The analysis of these topics comprises an immersion of the research in the topic under study: Internationalization and Social Responsibility. The authors' findings point to a synergy between themes due to the international agreements established between countries, that is, social and environmental responsibility is inherent in the global and technological agreements required in commercial relations. Companies that already work with Social Responsibility have a greater possibility of competitive insertion in other markets, however, sustainable management is still not aligned with the organization's' strategy.

Fig. 4: Conducted studies

TITLE	OBJECTIVE	RESULTS
A influência da Responsabilidade Socioambiental no processo de internacionalização: o caso da Electro Aço Altona	Evaluate how the Social and Environmental Responsibility (SER) Strategy could contribute to the international competitive insertion of an organization.	SERs strategy contributes to the international competitive insertion of an organization, occurring mainly through the implementation of Global Standardization Network Systems tools.
Gestão da Inovação Tecnológica para o Desenvolvimento Sustentável em Empresas Internacionalizadas	It is proposed to understand how the practices of technological innovation management with socio-environmental responsibility influence the internationalization process of Brazilian companies.	Characteristics and practices of management of innovation for sustainable development identified that the socio-environmental issue is part of the company's global and technological definitions, taking into account the institutional interests and interest groups involved in business action
Reforma estrutural e proatividade ambiental: o caso das empresas brasileiras	It is to identify whether environmental strategies have been influenced by the degree of internationalization. Pressure, size and pressure from stakeholders.	Modern preventative environmental approaches appear in large companies that have international investors and operate in Markets.
Orientação da gestão sustentável de uma empresa química com atividade internacional	How does a chemical company with international action guide its management towards sustainable practices considering its strategic proposal? Assumption: The greater the degree of internationalization of the company, the greater the use of sustainability practices in its management.	Sustainable management is still very much linked to support tools and not as part of building the company's strategy although it is possible to perceive that it is seeking greater involvement in this sense when they begin to review their strategies.

TITLE	OBJECTIVE	RESULTS
A responsabilidade social como fator na estratégia internacional: o estudo do caso Natura	Analyze the actions taken by the company regarding socio-environmental responsibility and internationalization, based on the company's annual social responsibility reports from 2001 to 2005	Analyze the actions taken by the company regarding socio-environmental responsibility and internationalization, based on the company's annual social responsibility reports from 2001 to 2005
O agronegócio e o problema do trabalho infantil	Analyze the reasons for the mobilization of agribusiness entrepreneurs in the fight against child labor	There are interrelated human rights and international competition
Internacionalización responsable: una perspectiva desde los TLC	To determine the inclusion and linkage in the free trade agreements signed by Colombia with the United States and Canada, commitments on corporate social responsibility, based on the analysis of the content of the main instrument on the subject: The United Nations Global Pact (2013).	It is reasonable to say that the Global Pact is undoubtedly an instrument that incorporates, with great success, great breadth and scope, protection of human rights, labor rights, environmental care and the fight against corruption. These trade agreements influence the actions of the organizations for the commercial interest with the agreed countries
Internacionalização, Disputas Sociais e Ação dos Intermediários na Construção da Responsabilidade Social Empresarial Brasileira.	1: indicate the transformations that social responsibility has suffered in the last decades in Brazil 2: identify the main characteristics of the Brazilian consultancies, which arose due to the evolution and legitimation of the theme in the business environments	Evolution that social responsibility has suffered since its emergence in Brazil. In the beginning, during the 1960s, it was associated with philanthropy, but two decades later, it passed and was seen as a business strategy. Services aimed at ethical and responsible management have undergone a change of cognition: they have changed from social responsibility to «sustainability consulting».

Source: elaborated by the authors

We analyzed the conceptual understanding of the theme of internationalization and social responsibility that deal with research based on this sample, which is presented in Table 5 per article.

Internationalization is considered as a pressure that companies undergo in their management process to conform to global practices of socio-environmental responsibility and technological processes.Some authors present the incremental processes related to the internationalization that companies undergo, but most are about the influence of management in internationalization.

Social responsibility results in a change in organizational culture and values, yet it is absorbed by firms as external pressure from new markets through the guidance of tools that drive internal processes. Companies that can align with their strategies as a fundamental criterion in business development allow organizations to create or sustain a recognized competitive advantage in international markets.

Fig.5: Key Concept on Internationalization and Social Responsibility

ARTICLE	INTERNATIONALIZATION	CORPORATE SOCIAL RESPONSIBILITY
A influência da Responsabilidade Socioambiental no processo de internacionalização: o	It can be defined as the process of progressive involvement in international operations (WELCH, LUOSTARINEN, 1999)	Social Responsibility starts to be discussed as an Organizational Strategy that uses mainly external orientations and tools as normalizations to conduct the process

ARTICLE	INTERNATIONALIZATION	CORPORATE SOCIAL RESPONSIBILITY
caso da Electro Aço Altona		
Gestão da Inovação Tecnológica para o Desenvolvimento Sustentável em Empresas Internacionalizadas	Internationalization of R & D activities, a global cooperation network is formed, involving companies, universities, research centers and the governments of several countries to promote the development and diffusion of innovations through these arrangements.	Corporate social and environmental responsibility is a continuous and progressive process of involvement and development of the company's citizen competences, with the assumption of responsibilities on social and environmental issues related to all the publics with which it interacts; RSA here understood as the duty or obligation of the organization to respond - to all interested parties - for the impacts or damages to man and the natural ecosystems, caused by his acts, processes and products, once introduced into the public field.
Reforma estrutural e proatividade ambiental: o caso das empresas brasileiras	Environmental strategies are influenced by the degree of internationalization	He assigned responsibilities and communicates the actions taken in favor of the natural environment. Invested in environmental, health and safety projects to become a benchmark in environmental and social responsibility.
Orientação da gestão sustentável de uma empresa química com atividade internacional	The process of internationalization occurs gradually and tends to increase its international involvement regardless of the strategic decisions taken (JOHANSON and WIEDERSHEIM-PAUL, 1975, JOHANSON, VAHLNE, 1977, 1990).	Elkington (1998) with the triple bottom line - will be treated through the nomenclature sustainability social responsibility, which are much more than compliance with environmental and social laws, because they result in a change in culture and organizational values, so that this new concept of sustainability becomes a fundamental criterion in the development of the business and an opportunity that can be used to create or sustain a competitive differential.
A responsabilidade social como fator na estratégia internacional: o estudo do caso Natura	Internal innovation skills have created a culture of innovation that enables a consistent international performance (Porter, 1996).	Social responsibility is not an explicit requirement in any international law, it is increasingly becoming one of the components for success in international action. Responsibility is one of the possible sources of competitive advantage for a company (CLARKSEN)
O agronegócio e o problema do trabalho infantil	It relates international pressures to the external barriers of companies	It links the action of companies with the importance for the social changes that are taking place.
Internacionalización responsable: una perspectiva desde los TLC	International agreement influence on the management with Social responsibility by the company	Pressures from external agreements on corporate social responsibilities.
Internacionalização, Disputas Sociais e Ação dos Intermediários na Construção da Responsabilidade Social Empresarial	Linked to the entry of Corporate Governance in Brazil international practices.	It will rely on the culture of social responsibility disseminated in business environments

ARTICLE	INTERNATIONALIZATION	CORPORATE SOCIAL RESPONSIBILITY
Brasileira.		

Source: elaborated by the authors

The analysis included the theories used by the researchers to understand the field of internationalization. In this way, Table 6 was elaborated with the summary of the theories used, being worth mentioning that only three articles used in these studies are endorsed by the traditional academy.

Fig. 6: Theoretical Frameworks

ARTICLE	ACADEMIC THEORY
A influência da Responsabilidade Socioambiental no processo de internacionalização: o caso da Electro Aço Altona	Industrial organizational theories, (HYMER, 1960), a Internalization Theory(BUCKLEY; CASSON, 1976) e o Ecletic Paradigm (DUNNING, 2000), Uppsala (HÖRNELL; VAHLNE; WIEDERSHEIM-PAUL, 1973; JOHANSON; WIEDERSHEIM-PAUL, 1974; JOHANSON; VAHLNE, 1975, 1990)
Gestão da Inovação Tecnológica para o Desenvolvimento Sustentável em Empresas Internacionalizadas	Uppsala Model
Orientação da gestão sustentável de uma empresa química com atividade internacional	Industrial organizational theories, (HYMER, 1960), a Internalization Theory(BUCKLEY; CASSON, 1976) e o Ecletic Paradigm (DUNNING, 2000). The Networks Theory, which for Carneiro and Dib (2007) amplifies the possibilities of answers offered by the Uppsala Model. Johanson and Wiedersheim-Paul (1975) companies move towards internationalization according to a series of incremental steps.
A responsabilidade social como fator na estratégia internacional: o estudo do caso Natura	Internationalization model proposed by Vernon (1996),

Source: elaborated by the authors

It is observed that these studies on the degrees of internationalization by which the company passes are still not really used in the analysis of the case studies, considering internationalization a phenomenon through which companies seek new markets and suffer influence in their management.

V. CONCLUSION

The studies on the concomitant theme of internationalization and corporate social responsibility are still incipient. The researches in Brazil are concentrated in Santa Catarina, São Paulo and Ceará, with methodological proposal of Case Study in its majority.

It is observed that the insertion of responsible or sustainable practices is a source of opportunity for business abroad, because it requires the management of the organization to prepare for action under environmental legislation, global requirements, raw materials and ecologically correct processes. These changes include insertion of tools that propose controls on the processes, that alter the corporate culture, including in the technological issues.

Organizations that align with the corporate social responsibility perspective in the case studies are better prepared to market globally. The fact that these organizations are inserted in new markets, besides the national market, is a stimulus to act in a sustainable way, because in the Brazilian market the studies indicate that the return is low, slow and brings little visibility to the companies.

It is also observed that the topic of internationalization is treated as new markets, with little consideration of the internationalization schools and the different degrees that companies acquire in this process. In this way, it is suggested that studies of this nature parallel the levels of internationalization and the strategic alignment of social responsibility in corporate management.

For future research, it is suggested to broaden the research to a database of other countries, seeking a greater number of studies in order to know the state of the art of this subject, thus considering other cultural perspectives.

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Flexibility of Posterior Muscle Chain in Amateur Soccer Athletes

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Abstract— *Soccer is a sport characterized by short duration and high intensity motor actions, alternated with periods of motor action of longer duration and lower intensity. Those particularities can cause a high number of injuries, since they require a high physical capacity of the athlete, becoming a reason of concern on part of team. Thus, the objective of this study has been to assess the flexibility of the posterior muscle chain of amateur soccer athletes. That is a cross-sectional and descriptive study, linked to the research entitled "Physiotherapeutic performance in orthopedic and sports dysfunctions". For development of the research were evaluated 32 male athletes, aged between 17 and 20 years and with current contract in the club. Participant athletes have been interviewed individually, and the questionnaire developed by researchers was applied and Wells bench linear test (sit and reach) was used to assess the level of flexibility of the posterior muscle chain. According to the study, 56.26% of the athletes presented flexibility at an unsatisfactory level, while only 18.74% presented high flexibility. It was observed that only in midfield the athletes presented a predominance of above-average flexibility (23.52%) and in all other positions the highest percentage index was for poor flexibility. It has concluded the posterior muscular chain in soccer athletes presents a high index of flexibility classified as bad, which can impair performance and generate injuries, provoking a large number of disadvantageous events.*
Keywords— *Posterior Muscle Chain. Flexibility. Soccer.*

I. INTRODUCTION

Soccer is one of the most popular sports in the world and it has been gaining more and more followers to this practice. According to International Federation of Soccer (FIFA), the sport has around 200 million practitioners in 186 countries registered [1]. It is a sport practice characterized by short duration and high intensity motor actions, alternated with periods of motor actions of longer duration and lower intensity [2].

Those particularities can lead to a high number of injuries, since they require a high physical capacity of the athlete, becoming a reason of concern on part of team. Injuries to lower limbs (LLI) correspond to the most frequent ones in soccer, mainly bruises and muscular injuries [3; 4; 5]. A study by Macedo et al. (2017) emphasize that flexibility deficit may be associated with muscular injuries and the presence of global shortening of posterior chain can result in 14 times the chances of sports injuries.

According to Veiga, Daher and Morais (2011), field soccer player generally adopts a hip and knee semiflexure posture during the game, and this posture can be static, making the posterior muscular chain susceptible to shortening. Therefore, limited flexibility and imbalance of forces, those athletes are more exposed to injuries such as muscular stretches, bruises and ligament ruptures.

Since regular practice of soccer has presented significant lesion rates, this study aims to evaluate the flexibility of the posterior muscle chain of amateur soccer athletes, which will allow the enrichment of scientific literature, enabling the professional physiotherapist new understandings and interpretations treatment and prevention based on evidence.

II. MATERIALS AND METHODS

This is a cross-sectional and descriptive study, linked to research entitled "Physiotherapeutic performance in orthopedic and sports dysfunctions", approved by the Research Ethics Committee, through opinion No. 2,418.72.

The research took place in a soccer club in Vitória da Conquista-Bahia; and the researchers

authorized to collect data went to the club, then the participants have been informed about objectives of research, as well as volunteer participation, starting data collection after signing the Term of Free and Informed Consent. Participating athletes were interviewed individually, and the questionnaire elaborated by researchers containing information such as name, age, height, position in field and possible injuries that may have occurred was applied to them, and after, evaluation of level of flexibility through sit and reach test (Wells Bank).

For development of research were evaluated 32 male athletes, aged between 17 and 20 years old and with an existing contract in the club, being adopted as an inclusion criteria those athletes who are in the club for more than 3 months. Participants were interviewed individually, and the questionnaire elaborated by researchers containing information such as name, age, height, position in field and history of the athlete's absence for at least one day after their occurrence, limiting their participation in training and games obtained by high reporting, and after, evaluation of level of flexibility [8; 9].

To assess the level of flexibility of the posterior muscle chain, we used the Wells bench linear test (sit and reach). The bench measures 35 cm in height and 40 cm in length and has a standard ruler at the top, exceeding the footrests by 15 cm. The evaluated athlete should be barefoot and sit facing the apparatus with the soles of feet touching the box, knees should be completely extended and feet propped up. Arms should be fully extended on surface of the box with hands overlapping (with fingers coinciding) and in contact with the sliding marker. He should flex his torso slowly trying to push the marker as far as possible. There are 03 (three) attempts, keeping each distance for at least 01 (one) second, considering the average of values reached. The evaluator should observe and ensure that the evaluated does not flex the knees and that the movement is being performed according to the protocol. Following the parameters of the Canadian Standardized Test of Fitness (CSTF), subjects aged 15-19 years were classified as excellent (> 43cm), above average (38-42cm), average (34-37cm), below mean (29-33cm) and bad (<28cm) [10; 11].

Data have been tabulated and analyzed on a software version 20.0 SPSS (Statistical Package of Social Science), using descriptive statistics. For descriptive analysis of data, absolute and relative frequencies, mean and standard deviation had been used.

III.   RESULTS AND DISCUSSION

Thirty-two athletes, aged 17 to 20 years old, with a mean of 18.03 ± 0.89 years have been evaluated in the current study. According to the study, 56.26% of athletes have presented flexibility at an unsatisfactory level (poor or below average), while only 18.74% have had high (above average or excellent) flexibility, as it can be seen in Table 1.

Table 1. Classification of athletes' flexibility according to Canadian Standardized Test of Fitness. Vitoria da Conquista / BA, 2019.

Flexibility	n	%
Bad	13	40,63
Below-average	5	15,63
Average	8	25
Above-average	5	15,62
Excellent	1	3,12
Total	32	100

Source: Research data.

According to the positions analysis, it was observed that only in midfield the athletes presented a predominance of above-average flexibility (23.52%) and in all other positions the highest percentage index was for poor flexibility, as demonstrated by in Table 2.

Table 2. Classification of flexibility according to field position. Vitoria da Conquista / BA, 2019.

	midfielder (%)	striker (%)	back (%)	defender (%)
Excellent				1(25)
Above average	4(23,52)		1(20)	
Average	5(29,41)	1(16,67)	2(40)	
Below average	1(5,90)	2(33,33)		1(25)
Bad	7(41,17)	3(50)	2(40)	2(50)
Total	17 (100)	6 (100)	5 (100)	4 (100)

Source: Research data.

Flexibility, according to Achour Junior (2011) is the name attributed to motor capacity, defined as muscle-articular amplitude at an optimum level, without injury. That ability has an important role in neuromuscular function, as it is responsible for maintaining an adequate range of motion of joints, as well as facilitating the improvement of sports techniques, because it generates greater mechanical muscular capacity allowing a lower energy expenditure in use and can be considered a preventive factor in sports [7].

It has been verified, in current study, that 56,26% of athletes have presented flexibility at an unsatisfactory level (bad or below average), corroborating with the findings of Veiga, Daher and Morais (2011), in which they have pointed out that athletes have already presented a greater predisposition to decrease flexibility and that, independently of athletes with or without injury, they had reduced flexibility above 60%. In agreement with our work, Ferreira and Crispiniano (2012) found index equivalent to 98% of presence of hamstring shortening in 20 players.

In soccer players flexibility is an important factor to be evaluated, since it is a sport that requires acceleration and deceleration movements with sudden changes of direction, which causes friction that can lead to injuries mainly in the hamstring muscles. According to Achour Junior (2011), injuries in that muscle group represent 40% of the cases in soccer players and studies show that shortening of the posterior chain results in 14 times more chances of establishing sports injuries in adult life [6; 12]. It is noteworthy that injuries are a serious problem for the player, causing them to be removed for treatment, resulting in financial losses for the club, the athlete and others involved in his career, in addition to the late return and fear of returning activities [5]

The predominance of poor flexibility is also demonstrated when it is evaluated according to the position in field, since in the present study it was observed that in all positions the greater portion of athletes presented with below-average or poor flexibility. According to the literature, each player has a different level of metabolic demand, which requires and generates different adjustments in the processes of power production, flexibility and energy consumption [14; 15].

Despite the aforementioned reality, it was possible to identify that the midfield position was the one that presented more individuals with flexibility above the average (23.52%) in comparison to the other positions. It is noteworthy that, according to literature, when the athlete has optimal levels of flexibility, there is an improvement in joint amplitude, strength and speed of movement during sports activity, making them easier to perform and more precise [7]. Those aspects can be further substantiated by studies such as that of Santos Filho (2002), which describes that physical characteristics of midfielders are aerobic resistance, strength, coordination, agility and speed of reaction, while defenders present resistance, strength, coordination, flexibility, drive and agility.

It is valid to conjecture the hypothesis that differentiated training protocols among positions of athletes may influence the anatomo-physiological and biomechanical aspects of the athletes.

In this sense, as a limitation of the present study, we highlight the question of the type of study developed, which was a descriptive study, which proposed only to track the posterior chain flexibility in soccer athletes, so it was not possible to generate analysis statistic with relation of chance and comparison.

IV. CONCLUSION

In that way the flexibility of the posterior chain in soccer athletes presents a high index of flexibility classified as bad, which can damage performance and generate injuries, causing a plenty of disadvantageous events, such as distance of athlete from training and games, expenses financial support for the club and sponsors and late return to official activities.

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Method of Problem Analysis and Solving applied to Quality and Productivity in a Furniture Industry

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Abstract— *This study proposes the application of the Method of problem analysis and solving (MAPS) in conjunction with the quality tools, aiming to reduce requests for the number of technical assistance in a planned furniture industry. The methodology used in this research was a case study, in which the eight steps of the method were applied in order to identify the root cause of the problem and to point out through its action plan its solution. At the end of the process, the method obtained satisfactory results, with a 58% reduction in the number of technical assistance and with savings of around 49% in the costs generated by the occurrence of failures, causing financial gains for the company surveyed. In addition, this research contributes to the dissemination of the concepts of quality tools for solving problems, as well as optimizing the performance improvement of production processes and quality management in the fabrication of planned furniture.*

Keywords— *Quality Tools. Quality. CQ Story. Quality Control.*

I. INTRODUCTION

Nowadays, obtaining quality index combined with productivity, cost reduction, customer satisfaction and respect for the environment have become essential for the permanence and survival of organizations in adapting to the competitive pressures of the competitive market (JITPAIBOON; RAO, 2007; COBERO *et al.*, 2014). Within this context, the challenge of companies to seek productivity with the least possible loss depends not only on the modernization of process technologies, but also on an engaged and specialized team, a fast service and efficiency in the management of production costs(LAKHAL *et al*, 2006; BOURKE; ROPER, 2017).

According to GALINARI *et al*, (2013), in this respect, one of the markets that stands out in the search for standardized management projects is that of planned wood furniture. This is due to the fact that the sector has differentiated characteristics, such as the high use of natural inputs, with customized designs to the consumer's taste, furniture design with the incorporation of new technologies and concepts, aiming the durability of the products.

The furniture sector in Brazil is evident in the transformation industry segment, gaining notable gains in the manufacturing area due to the significant improvement in quality, due to the advent of new methodologies in the area of production aimed at the pursuit of excellence (ABIMOVEL, 2017). One of the methodologies we can highlight is the Method of Analysis and Problem Solving (MAPS).

The MAPS has emerged as a strategy to improve the quality and productivity of organizations, widely used in Japan, is one of the managerial level tools that has the purpose of acting against an undesirable problem or to improve the current condition of a productive process. The problems are identified, treated and improved through sequential steps aimed at reducing costs in manufacturing processes (HERRON; BRAIDEN, 2006; ORIBE, 2012).

The application of MAPS aims to collect, organize and analyze information related to the process flow diagram of the products, being composed of actions of prevention and reduction of problems, using tools such as Cause and Effect Diagram, Pareto Chart Action Plan (5W1H), among others (HORA; COSTA, 2009). The MAPS is a disciplined management strategy that seeks continuous improvement by reducing waste and emphasizing the company's profitability, based on speed

and efficiency. Promotes gains in quality through defect reduction (AVRILLON, 2005).

The method, according to Teixeira *et al (*2012), can be applied in any organization or segment, and can be applied in several sectors simultaneously, and for this, there is a need for participation of all the employees who are involved in the process.

The proposed model aims at applying tools that minimize or eliminate the occurrence of product failures and reduce the technical assistance they provide to ensure productive competitiveness. These tools seek problem-solving in a step-wise manner that helps improve processes and consequently the quality of what is offered in order to achieve customer satisfaction in the short term.

The MAPS methodology appears in this context to help visualize and reduce the number of technical assistance, presenting the changes and gains resulting, judging the viability of its use. The choice of this object of study was due to the important role that companies of the furniture industry represent for the economy of a country, considering that these companies constitute a field of study little explored.

According to GODOY *et al*., (2012), there are several obstacles in the implementation of quality concepts in the furniture industry. This involves a number of factors, such as variety in raw material prices, unit production, process steps being mostly handcrafted, need for skilled labor, productive structure and complex equipment to serve various segments and market niches related to larger contact with demanding customers. These factors have a direct impact on the quality of the products, resulting in customer dissatisfaction and consequent disloyalty of the company to the market.

Thus the application of MAPS in the planned mobile industry resulted in adding value to the final product, generating satisfaction to its target audience and as a consequence the reduction of calls in after-sales services (technical assistance) and cost reduction. To INGLIS (2002), the after-sales service is an important sector for collecting data on the customer's vision in relation to the performance of the final product and should be used to strengthen the customer relationship and generate profit for the organization, not costs due the delivery of products outside the specifications.

II. LITERATURE REVIEW
2.1 METHOD OF PROBLEM ANALYSIS AND SOLVING OR QC STORY

The MAPS, also known as Quality Control Story (QC Story), started in Japan in the 1950s, resembles the history of Quality Control activities and has the ability to systematically improve company performance through

competencies and learning skills to solve organizational problems (CASTRO *et al.*,2011).

In Brazilian companies, the introduction of MASP was made by Falconi Campos in 2004, which adapted the Japanese version of the *Union of Japanese Scientists and Engineers* (JUSE), called QC Story to the Brazilian context (ORIBE, 2012).

According to CASTRO *et al.* (2011) and CARPENETTI (2012), MAPS or QC Story is the most detailed management tool of the Shewhart cycle or Deming cycle, originating from the PDCA cycle: Plan (planning), Do (execution); Check and Act. Although MASP derives from the PDCA cycle, they are commonly confused in the literature.

According to CARNEIRO *et al* (2012) the methodology focuses on quality improvements to make processes more organized and avoids waste related to time and money until its solution through corrective and preventive actions in an orderly manner. It is formed by a set of principles or methodological steps that help to evaluate, control or improve a process from the perspective of quality and must be dominated by all the people of the company (PUJO; PILLE, 2002).

O MAPS "Is one of the methods of systematic solution of problems currently recommended by the Brazilian Quality Union for the development of quality improvement projects" (ORIBE, 2012).

According to COLENGUI (2007), "MAPS is a prescriptive, rational, structured and systematic method for developing an improvement process in an organizational environment, aiming at solving problems and obtaining optimized results."

2.2 HISTORY OF MAPS OR QC STORY

According to ORIBE (2012), started in the scientific revolution between the sixteenth and eighteenth centuries in Europe with the thinkers Copernicus, Kepler, Descartes, Bacon and Galileo, who laid the scientific method for describing nature, accurate measurements and induction of new theories based on experiments. This methodology served as the inspiration for several philosophical tendencies such as rationalism, empiricism and pragmatism.

In the 1930s, in the United States, Walter Shewhart, created the cycle, called Shewhart, inspired by Taylor, following the production of 3 stages. This precept had the objective of scientific knowledge as a means to obtain a concrete and practical result for life. This model is taken by Deming to Japan in 1950, which became known as the Deming cycle (CAMPOS, 2012)

In Japan this cycle was adapted with new roadmaps, emphasizing the documentation and

presentation of the history of improvement work, hence it was known as QC Story. In the beginning, this method had a descriptive character, in order to report simply how the improvements were made on the factory floor and called them QC Story (the history of quality control) (ORIBE, 2012)

Later, QC Story shifted from a staff-focused reporting method to communication and learning to a problem-solving method that focused on the organization for continuous improvement and profit (CAMPOS, 2012). In the 1980s, QC Story, through Kume, came to be known as an effective method to solve organizational problems, with optimized results, through stages and tools giving more distinction to each activity (COLENGUI, 2007).

In Brazil, in 2004, through Falconi Campos, QC Story became known as the Problem-Solving Method (PSM). This method became popular as MAPS, Method of Analysis and Problem Solving and became a fundamental part for Quality Control to be exercised.

It is one of the most widespread methods for solving problems in organizations, and according to CAMPOS (2012), it can be used both to maintain quality and to eliminate chronic errors.

Table.1: Process Control Method / QC-Story.

PDCA	Flow chart	Phase	Target
P	1	Problem identification	Clearly define the problem Recognize its importance
	2	Observation	Investigate the specific characteristics of the problem with a broad view and from various points of view
	3	Analyze	Discover the root causes
	4	Action plan	Develop a plan to block root causes
D	5	Action	Block the root causes
C	6	Verification	Check that the lock has been made
		Blocking was effective	If yes, continue to step 7, otherwise return to step 1
A	7	Standardization	Preventing

| | 8 | Conclusion | recurrence of the problem |
| | | | Recap the whole process of solving the problem for future work |

Source: MARIANI (2005), HOSKEN (2005), CARPENETTI (2012) e CAMPOS (2012)

First step: Identification of the problem

It is the first step of MAPS, where the type of problem to be solved is clearly identified. Data is used to check for inconsistencies in an equipment or process. Once the problem is identified, the goals and indicators that can help in the final stage of the process are defined. Nominating those responsible, proposing dates and limits for solving the problem Segundo LAU (2015), the identification of the problem has the objective of selecting a topic from a series of possibilities and applying criteria such as the comparative analysis of losses, gains and frequency on a problem and to ascertain its outstanding priority over the others.

To ROONEY; HOPEN (2004), the identification of the problem has to be well structured and the root cause must be identified so that the problem is eradicated, that is, that there is no risk of the problem returning. Table 2 presents the steps in how to identify the problem.

Table 2 – Identify the problem.

Step 1 - Identify the problem	
Flow	Tasks
1	Define the problem
2	Issue history
3	Present current losses and gains
4	Analyze the pareto chart
5	Nominate those responsible

Source: adapted from ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015)

Second step: Observation

In this step the complete investigation phase of the problems occurs. The issues in question should be investigated and the team should collect the most current data, which is critical to the success of the third step. The objective is to develop a solid understanding of the current state of the company in relation to the problem and its consequences (CARPENETTI, 2012).

According to CAMPOS (2012), also insert at the end of this stage, that well-made observation minimizes the amount of factors to be considered and with this

facilitates the process of analysis of causes. For this the observer needs to collect information about the time, the moment the problem occurred, the location and in which types of products or services occurred and the symptoms, such as their manifestation characteristics.

Thus, the observer should not focus on the causes, but only look at how the problem is inserted. Table 3 shows the steps of observing the problem.

Table 3: Step 2 – Observation of the problem.

Step 2 – Observation of the problem	
Flow	Tasks
1	Discover the characteristics of the problem through data collection,
2	Local observation

Source: adapted from ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015).

Third step: Analysis to discover the causes

The objective of this step is to analyze the root causes of the problem, because when they are not properly identified, time and money are wasted in the organization. In this step it is fundamental to test and confirm if the chosen causes are in fact responsible for the problem (CAMPOS, 2012).

Because it is a problem of unknown causes, it is a stage that needs more time to be executed, because many difficulties appear and this is when more than one cause affects the result and their effect is not easily separable, which can make confusing the analysis of the causes (ANDERSEN; FAGERHAUG, 2006).

The analysis of the causes must be done in a scientific way, using the quality tools, so that the actions to be determined in the next steps are precise and the efforts minimized. Table 4 presents the steps in how to analyze the problem.

Table 4 – Analysis of the problem.

Step 3 - Analysis of the problem	
Flow	Tasks
1	Define the root causes
2	Choice of the most likely causes
3	Verification of the hypothesis
4	Confirmation of the actual cause

Source: adapted from ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015).

Fourth stage: Action plan

It is the stage that occurs the development of a plan of actions that makes possible the solution of the problem. The purpose of this step is to define actions on the root causes and not on the side effects (LAU, 2015). CAMPOS (2012), suggests the division of two steps: the definition of the strategy, where it is the choice of the best alternative solution among the possible causes and the elaboration of a plan of action, where the corrective actions necessary to eliminate the causes of the problem are defined.

Finally, a plan of action needs to be developed to identify the actions, the people responsible and deadlines for implementing the chosen solution. It should answer at least five basic questions: what, how, when, where and by whom it should be done. Table 5 presents the steps of the action plan.

Table 5 – Action plan.

Step 4 - Action plan	
Flow	Taks
1	Define the action strategy
2	Develop a plan of action to achieve goals

Source: adapted from de ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015).

Fifth stage: Execution of actions

The purpose of this step is to apply the action plan and block the root causes of the problem and to ensure that all those involved in the process have understood and agreed to the proposed measures. It is a step where all good and bad actions and results should be noted with the date they were taken.

The fifth stage of MAPS is divided by two tasks: The training of the employees involved and the execution of the actions.

ANDERSEN; FAGERHAUG (2006), mention the need to record all the results obtained so that they are used in the verification phase and recommend that follow-up activities be reviewed and corrected until the desired results are achieved. Table 6 presents the steps in the execution of the problem.

Table 6 – Execution of the problem.

Step 5 – Execution of the problem	
Flow	Tasks
1	Training of those involved in the process
2	Execution of the action

Source: adapted from ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015).

Sixth step: Checking action effectiveness

In this step we check the action plan solved the problem, and make sure that the problem will not occur again. If the solution fails to return to the second step (observation).

To CARPENETTI (2012), the verification of the results consists of collecting data on the positive and negative variations on the final effect of the problem, making it possible to conclude whether or not the improvement actions are effective. The problem can only be completely resolved if the actions implemented are under control and present results in accordance with the established goals, with no negative and undesirable effects. In addition, verification should not be done only in terms of quantitative results. It should also be related to the intangible benefits such as improving leadership, skills and teamwork and not forgetting about the learning gained from the process. Table 7 shows the steps in how to verify the problem.

Table 7 – Check the problem.

Step 6 - Check the problem	
Flow	Tasks
1	Compare results
2	List the positive and negative effects
3	Finding whether or not the problem is continuing

Source: adapted from ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015).

Seventh stage: Standardization

The action plan is adopted by default. At this stage you need to establish a system of periodic checks to verify compliance with standard operating procedures. To CAMPOS (2012), the standardization has to follow a formal procedure so that the task is performed without problem recurrence. Standards should become a habit of employees. Standardization includes documents, employee training, communication and monitoring of results in the use of the standards defined by the action plan. One of the typical problems at this stage is the elaboration of documents by people who are unaware of productive areas, which impairs labor productivity and interferes with the expected result. Table 8 presents the standardization steps.

Table 8 – Standardization.

Step 7 - Standardization	
Flow	Tasks
1	Define the standard
2	Communication
3	Training
4	Tracking the use of the standard
5	Prevent against recurrence of the problem

Source: adapted from ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015).

Eighth stage: Conclusion

Eighth stage objective is to evaluate the application of MAPS to this problem, strengthening the lessons learned in new opportunities for improvement.

Carpenetti (2012) recognizes that the solution of a problem can never be perfectly solved, the search for perfection can be unproductive and demotivating, even if the goal has not been achieved, a list of what has been and has not been accomplished during the development of the method to increase the efficiency of future work, that is, aiming at a new cycle of Maps application.
Table 9 shows the completion steps.

Table 9 – Conclusion.

Step 8 - Conclusion	
Flow	Tasks
1	Relate the remaining problems
2	Plan future work
3	Reflection

Source: adapted from ANDERSEN; FAGERHAUG (2006), SELEME; STADLER (2008), CARPENETTI (2012) e CAMPOS (2012), LAU (2015).

MAPS AND QUALITY TOOLS

The concept of "quality" in industries is defined as meeting customer needs, preventing and managing failures including actions for their patches (ZU, 2009).
Quality tools are tools used by organizations to improve the effectiveness and efficiency of the quality system in an organization (ALSALEH, 2007).

To CARNEVALLI *et al*. (2008), meeting the needs of the customer, aiming at continuous improvement of products and services produces considerable advantages to organizations compared to their competitors. This practice is one of the functions of quality tools.

Quality tools can be divided into two groups, according to TAGUE (2005); SOUZA (2008):
– Non-statistical tools: 5W1H, operational definitions, sequential charts, cause and effect diagram, flowchart, check sheet and brainstorming;

– Statistical tools: stratification, Pareto graph, histogram, correlation diagram and the statistical process control chart (PCP).

When applying MAPS to solve problems, organizations need to use some quality tools. This means that only MAPS is not enough to address the root causes of problems effectively. It is necessary that the tools assist the process, that is, they are the resources to be used in the method (CAMPOS, 2012).

To TAGUE (2005), the tools of quality are the materials that will be used in a work (method) to build an enterprise and shelter people (problem).

In the present work, some of these tools will be applied, in which the following concepts are demonstrated.

Brainstorming:

To PASQUALINI; SILDENBERG (2012, p. 53), brainstorming "is a group process in which individuals express ideas freely, without criticism, in the shortest possible time in order to generate innovative ideas or solutions that take a particular project forward."
In this sense, brainstorming arises to propose solutions to the identified deficiencies in organizations (Cooper et al., 2008; Garcia et al., 2016).

The brainstorming was created in 1957 by Osborn, who realized that the generation of ideas stimulates creativity and is a critical part of the innovation process (KOHN et al, 2011).
In a brainstorming session, groups are encouraged to think and express their ideas, providing a basis for problem solving in organizations (COSKUN; YILMAZ, 2009).

According to RAWLINSON (2017), brainstorming can be performed in both structured and unstructured ways. When each participant expresses their opinion, one at a time, the application is done in a structured way. Already in the unstructured form, participants say more than once with ideas that arise in the head without a specific goal. According to HESLIN et al. (2009), in order to improve the quality and creative capacity of the group, brainstorming is divided into four norms as shown in table 9.

Table 10 - Standard do Brainstorming.

Standards	Description
1 Any criticism is ruled out	Expressing ideas without fear of judgment
2 The more creative the better the idea	All creative ideas are welcome
3 Quantity is more important than quality	The more ideas, the greater the likelihood that the

	objectives of the problem will be met
4 Improve ideas that have been suggested	Through the ideas explored by the group, try to combine them and try to improve them

Source: HESLIN (2009).

2.4.2 ISHIKAWA DIAGRAM (FISHBONE):

The Ishikawa diagram, also known as fishbone, was developed in 1943 by chemical engineer Kaoru Ishikawa at the University of Tokyo. It aims at visualizing the problem (cause) and its possible solution (effect) (FERNANDEZ et al., 2012).

For ROMERO (2016), the Ishikawa diagram is an important quality tool that aims to identify the problems and all their possible causes and determine corrective measures.

According to BASU (2014), to apply the Ishikawa diagram it is necessary to:

a) Summarize the relationship between causes and effects;

b) Obtain a global and structured vision to facilitate analysis of the causes;

c) To promote the improvement of the processes and to favor the human relations within the organizations;

d) All members should understand the problems and their possible causes.
It was structured in 6 known causes as 6M: labor, machine, method, raw material, measures and environment, according to Figure 2.3 (GWIAZDA, 2006; BEHNAM, 2011).

a) Machine: equipment and machinery;

b) Method: procedures, routines and techniques that may interfere in the process;

c) Material: raw materials, spare parts, spare parts etc .;

(d) Labor: includes all aspects of staff;

(e) Measures: gauging and calibration of measuring instruments;

f) Environment: conditions or environmental aspects that may affect the process.

Figure 1 shows a model of the Ishikawa Diagram.
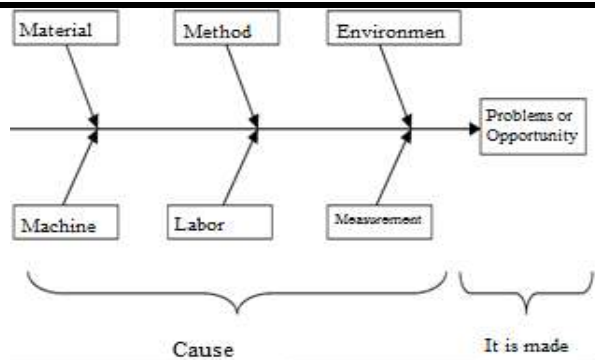
Fig.1: Modelo de Diagrama de Ishikawa.
Source: FERNANDEZ *et al;* (2012).

Pareto's chart:

According to ZASADZIEŃ (2014), the Pareto chart is a very useful tool in the identification and prioritization of the problems that impact the objectives of the organizations, helping in the decision making. It is used to set the priorities of the most problematic items of a company, based on the volumes of occurrences.

According to the principle that 20% of defects are responsible for 80% of the damage, it can be stated that 1/5 of the causes of problems can solve approximately 4/5 of all problems detected (GONZÁLEZ, 2014).

For PRÍSTAVKA (2016), the Pareto chart identifies and eliminates the most serious problems, studies in depth the causes of the problem, decides which elements should be improved and concentrates the analysis on the key problems to improve and facilitate improvement decisions. Figure 2 shows a Pareto Chart Example
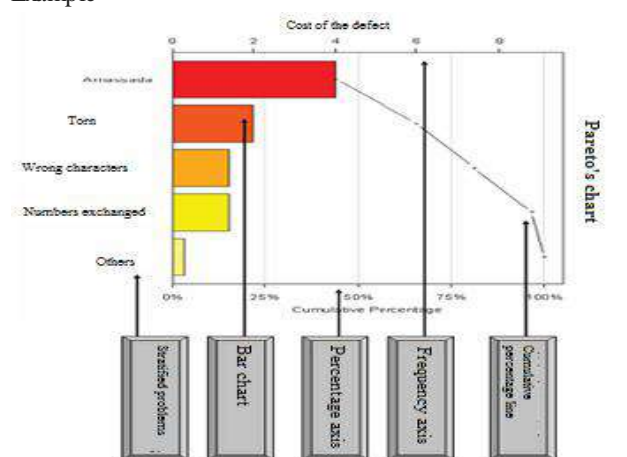
Fig.2 Shows a Pareto Chart Example
Source: GONZALEZ (2014).

Diagram 5W1H:

The 5W1H tool is an introductory method of analysis to clarify the root cause of the system failure, which aims to facilitate the implementation of corrective and preventive actions. The importance of this tool is in the checklist of activities that are developed in a clear and efficient way by all involved in the project (JIA et al., 2016).

For JIANG et al. (2015), the 5W1H diagram is a tool that assists in structuring action plans from key issues: What? (what); Who? (who); When? (when); At where? (Onde); Because? (why), and; As? (how).

According to LIN et al. (2016), explains the application of the questions as follows:

a) (What) - What will be done: defines the tasks that will be executed, through a plan of action;

b) (When) - When will be done: the schedule is established stating the deadline for the accomplishment of the task;

c) (Who) Who will perform: Who will be the person responsible for each task;

d) (Where) - Where it will be done: determines where the tasks should be performed;

e) (Why) - Why it will be done: shows why the tasks should be performed;

f) (How) - How it will be done: determines the economic and rational way in which the task should be performed.

PANORAMA OF MOBILE ENTERPRISES IN BRAZIL

With the impact of the economic instability generated mainly in the civil construction sector, the furniture industry faced major challenges in recent years. Many companies were closed and those that remained had to adapt to a process of repositioning the market. They needed to develop strategies that seek differential through innovation, cost reduction with greater efficiency in both management and processes, without giving up the production of products with quality and added value (ABIMOVEL, 2017).

Even in the face of the difficulties faced by the furniture industry in Brazil, Brazil ranks fifth in the world's furniture production and is the 32nd largest exporter (SEBRAE, 2017).   In the first two months of 2018, data published in the Quarterly and Foreign Trade Report showed a 12.4% increase in the volume of furniture production compared to the same period in 2017. In the twelve-month period (February 2017 to January 2018) there was growth of 5.9% (ABIMOVEL, 2018). In 2017, furniture companies generated 258,95 thousand direct and / or indirect jobs, with annual revenues of R $ 38 billion (ABIMOVEL, 2018). The vast

majority of establishments, around 80%, employ up to nine employees. The small establishments with 10 to 49 employees correspond to around 16.5%, while the medium-sized establishments of 50 to 249 employees, around 3% and large 0.5%, over 250 workers (BRAZIL, 2017). The largest concentrations of formal jobs are in the Southeast (São Paulo and Minas Gerais) and South (Rio Grande do Sul, Paraná and Santa Catarina) regions, representing around 77% in these five states, according to table 11.

The regions with the most representative number of companies are the south and southeast regions around 72.1% of the Brazilian market, according to table 10.

Table 11 - Furniture Jobs.

States	Jobs	%
São Paulo	53687	22,91%
Rio Grande do sul	35414	15,11%
Paraná	34561	14,75%
Minas Gerais	30839	13,16%
Santa catarina	27378	11,68%
Other states	52464	22,39%
TOTAL	234.343	100,00%

Source: BRASIL (2017).

Table 12- Mobile establishments

States	Establishments	%
São Paulo	4036	9,26%
Rio Grande do sul	2916	6,69%
Paraná	3024	6,94%
Minas Gerais	3000	6,88%
Santa Catarina	2744	6,29%
Others states	6077	13,94%
Brasil	21797	50,00%
TOTAL	43.594	100,00%

Source: BRASIL, (2017).

In relation to the trade balance of the furniture industry, Brazilian exports were US $ 625.9 million between January and December / 2017, up 5.1% over the same period of 2016. Historically the country's furniture trade balance is surplus. Santa Catarina ranks first in the ranking in relation to exporting federal units, around 34.6% of the total, followed by Rio Grande do Sul of 30% (MOVERGS, 2018).

The main exported items are bedroom furniture, about 40% of the total exported value followed by wooden kitchens and others such as dining room, office. According to statistics from the United Nations Trade Database (COMTRADE), in 2016, the furniture sector ranked 9th among the leading exporters of wooden

furniture in the dormitory category, while in the category cuisines Brazil was in the 20th position. The main destinations for Brazilian exports are the United States, United Kingdom, Peru and Uruguay, according to table 11. In relation to the trade balance of the furniture industry, Brazilian exports were US $ 625.9 million between January and December / 2017, up 5.1% over the same period of 2016. Historically the country's furniture trade balance is surplus. Santa Catarina ranks first in the ranking in relation to exporting federal units, around 34.6% of the total, followed by Rio Grande do Sul of 30% (MOVERGS, 2018). The main exported items are bedroom furniture, about 40% of the total exported value followed by wooden kitchens and others such as dining room, office. According to statistics from the United Nations Trade Database (COMTRADE), in 2016, the furniture sector ranked 9th among the leading exporters of wooden furniture in the dormitory category, while in the category cuisines Brazil was in the 20th position. The main destinations for Brazilian exports are the United States, United Kingdom, Peru and Uruguay, according to Table 12.

Table 12 – Main destinations of furniture exports in Brazil.

Main destinations of furniture exports in Brazil			
Millions			
Ranking	Destiny	Value US$ 2016	Value US$ 2017
1	United States	10.360	13.124
2	United Kingdom	6.442	6.826
3	Peru	3.129	3.174
4	Uruguay	2.142	2.364
5	Chile	1.727	2.087
6	Paraguay	1.178	1.591
7	France	915	1.514
8	Argentina	666	1.483
9	Spain	505	774
10	Bolivia	99	722

Source: MOVERGS, (2018).

As for imports, about one-third originate in China. In 2017, the country's participation generated around 39.4%. Next, the United States (8.3%), Mexico (6.2%), South Korea (6.1%), Germany (5.3%) and Italy (5.1%). On average 80% of imports are in the seat and upholstery segment, basically plastic and metal components (MOVERGS, 2018).

Regarding investments, according to IEMI (2016), the Brazilian furniture sector invested around 1.1 billion. Of this amount, 30% of these resources were used to purchase machinery and equipment imported from Italy (29.3%), Germany (22.5%) and China (18.7%) as a sawing and bending machine, that is, they are machines for nailing, stapling, gluing or assembling parts applied to hardwood, cork, rubber or plastics. The remainder of this amount was destined to the manufacture of furniture and production of mattresses. Nevertheless, these investments do not match the reality of most furniture companies in Brazil. Innovations in the Brazilian furniture industry are technologically low. Modernization occurs most of the time in some stages of production, once in the same factory environment one observes modern machines operating alongside obsolete equipment. In addition, large portions of the Brazilian manufacturers can not keep up with the technological pace applied to the sector. Therefore, this makes it difficult to standardize parts and pieces, preventing the standardization of these items in new projects, especially those of diversification of the final product (COSTA; HENKIN, 2012; SPEROTTO, 2016).

Most of the manufactured parts are intended for dormitory residences, around 67.7%. The other representative categories in numbers of pieces are office furniture, 13.7% and others, such as furniture for kitchen, dining room and upholstery, all three with participation of 18.6%, according to figure 2.4 (IBGE 2017).
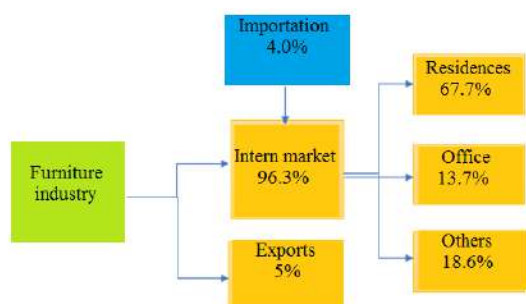
Fig.3 - Furniture industries in 2017.
Source: IBGE (2017).

In the region of Manaus, the object of this study, the furniture sector is characterized by the predominance of small and medium enterprises, inherited in the great majority of past generations. Most of them have 3 to 8 employees who still work artisanally. They face great difficulties because of the lagged technological structure, disqualified labor with low added value in comparison to other sectors, furniture decapitalized and the use of wood without certification. This scenario reflects in low competitiveness in the Brazilian market (AIMAZON, 2017),

The data recorded on the number of companies in the furniture branch of plans that operate in the city of Manaus, are obsolete and incomplete. It is believed that there are 170 to 180 planned furniture companies in Manaus, the majority being informal. According to SEPLAN data (2017), around 50 formal establishments operate in Manaus.

As possíveis explicações para esse pequeno número são as seguintes:

a) Small planned furniture companies open and close in the same year;

b) Illegalities of the planned furniture sector, dominated by micro-enterprises and informality of them;

c) There is no way to separate furniture factories from backyard workshops;

d) Small companies when registered in the SEFAZ-AM register, are registered in the register for many years, even if they have been inactivated.

III. MATERIALS E METHODS
3.1 METHOD OF ANALYSIS AND TROUBLESHOOTING (MASP)

Through literature review, it was sought to find studies that prove the effectiveness of MASP in reducing or eliminating occurrences of failures and the losses caused by them. Ten recent papers have been identified, but none of the articles are intended for the planned furniture industry. Table 4.1 shows the studies identified.

PIECHNICKI et al. (2011) applied MASP to combat volume losses produced by a sanitation company. The losses and the application of quality tools were analyzed and the root causes of the anomalies were discovered and it was possible to propose solutions for the reduction and elimination of water losses. Thus, the authors concluded that the method is linked to the process of continuous improvement and proved to be an effective tool in the fight against water losses in the Sanitation Company.

According to a study conducted by GABILLAUD (2011), in the 2nd largest retail chain in the North-Northeast, the MASP method was effective in its purposes. As a result, maintenance information restructuring was implemented through the implementation of a computerized management system that enabled an adequate registration of equipment, quick access to reports and more efficient decision-making capacity, contributing to the reduction of losses in the retail context. CORREA et al. (2011), in research conducted at a food company in Valle del Cauca in

Colombia, managed through QC Story (MASP) to identify the machines that were working below their productive capacity and to correct the factors that were generating errors and leading increase in the number of stops. The method improved the reliability of the information generated by the production control system of these machines.

For MOTA and MARINS (2012), the MASP method was used in one of the largest companies in the steel industry in the country to reduce divergences in inventory that reached 30% of total inventoried equipment. These divergences caused a number of disadvantages for the company, such as the loss of service level to the customer, difficulty to resupply, planning in unrealistic data and possible production stoppage. It was possible to reduce divergences through the tools Brainstorming, Pareto Diagram, and 5W2H, which detected that the failures were related to the human factor and that needed training of the personnel involved in the process. Another study in one of the largest glassmaking industry in Brazil sought to improve production that was below standard and much variation over a period of 24 h. With the application of the MASP method, the process improved in relation to the past, not only in the increase of its yield, which was 98.03%, and became 98.831%, but also in relation to its variation that became more stable (SANTOS et al., 2012). Another work that demonstrates the feasibility of applying MASP was developed by CANO and NOÉL (2013), which evaluated the application of the method in a poultry slaughtering industry in Lima-Peru, minimizing the cost of the sector with the improvement of the quality of poultry feeds both in the nutritional part and in the shelf-life of the product. With the application of MASP, there was an improvement in the quality of food produced in the industry, reflecting in the shortest time the development of poultry for slaughter without compromising the quality of the meat and the clients' side, the certainty of the purchase of good quality poultry and with weight right. SINI (2013), proposed a workflow management model in organizations based on the MASP method. The study was conducted in France and it was possible through the application of Masp to formalize a workflow application, which allowed productivity improvement and process optimization in companies.

Already, CORRAL et al. (2014) studied the application of QC Story (MASP) to train workers on the assembly line at a cable factory in Mexico, in order to reduce the index of defective products. After application of the method, there was reduction of defects in the final product and as a consequence the reduction of costs around 964 pesos per defective product (whips) and manufacturing time where the reduction reached 5s in the average time of manufacture of the product. In the TADDESE study (2017), the method was used in an empirical exploratory research in 14 companies from Japan, India and Thailand. The research results indicated that the method facilitates the ability to innovate in organizations through customer-focused management practices and the human resources of companies. This innovation brings organizational transformation in several areas of the companies and the improvement in the productive process. ANDRADE and RODRIGUES (2017) used MASP in a manufacturing industry to solve problems with defective parts from their suppliers. He used the tools: Brainstorming, Check Sheet, Cause and Effect Diagram, Pareto Chart and Flow Chart. The results showed the need to control suppliers. With the application of MASP it ended up reducing the lead time of the company's production and consequently a reduction in the rate of parts with defects and reduction of costs. Therefore, the survey of works with the application of MASP, in other areas, showed efficient and positive results, in which they were able to eliminate process failures, reduce costs and improve the productive capacity of equipment and operators.

Table 13 - Studies identified.

Reference	Study	Results
Piechnicki et al (2011)	Use of the methodology of analysis and solution of problems in the reduction of water losses: A case study	It has proven to be an effective tool in combating water losses in the sanitation
Gabillaud (2011)	Method of analysis and solution of problems (MASP) - application in the management of maintenance of a retail network in the state of Sergipe.	Restructuring of maintenance information through the implementation of a computerized management system.
Correa et al (2011)	Identification and elimination of low reliability of the data capture system M.E.S. em a food company in Valle del Cauca.	Improved reliability of the information generated by the production control system of production control system of the
Mota e Marins (2012)	Analysis of the application of the masp tool in the inventory control of a steel mill.	Reduced the divergences found in the stock by 30%.
Santos et al (2012)	The implementation of the MASP tool for continuous improvement in a vine industry.	It improved the yield of production that before was of 98.03% and happened to be 98.83%. Becoming more stable.
Cano e Noél (2013)	Improvement of quality in pelleted balanced feed for birds, through the quality route method.	Improved quality in poultry feed reflecting the shorter development time of poultry for slaughter without compromising quality of
Sini (2013)	Méthodes et outils pour la gestion des workflow -modélisation ontologique des processus pour l'analyse.	Formalized a workflow application and allowed for improved productivity and optimization of business processes.
Corral et al. (2014)	Implementation of visual aids for the manufacturing area. Avancos engineering research in the state of Sonora.	Reduction of failures in the final product, as a consequence of the reduction of costs around 964 pesos per defective product.
Taddese (2017)	Application of TQM for innovation: na exploratory Research of japonese, Indian na Thailand companies.	Organizational transformation in various areas of the company and improvement of the productive process.
Andrade e Rodrigues (2017)	Implementation of the methodology of analysis and solution of problems (MASP) to reduce losses in manufacturing companies.	Reduction of the production lead time of the company.

IV. APPLICATION OF THE CASE STUDY - RESULTS AND DISCUSSIONS

COMPANY PROFILE

The study was carried out in a furniture industry located in the southern part of the city of Manaus, in the production and after-sales sectors (technical assistance).

The plant has about 20 years, employs 50 employees in four sectors: sales (projects), administrative, operational and after-sales (technical assistance). The sales and after-sales sectors are located at the point of sale of the brand and are headed by a director who is responsible for the department and staff. The other sectors are located in the factory and are headed by a production manager and an administrator.

The sales industry is responsible for the projects and sales. The aftermarket, also called technical assistance, is responsible for the logistics, installation, maintenance and correction of the products. The administrative sector is responsible for the processes related to HR and financial and operational is responsible for the costs, purchases and execution of production. The industry currently counts on the production of furniture with high technology machines and with an annual manufacturing capacity of around 13000 items. In 2011 it made new investments in equipment and human resources in which it increased its production capacity. In 2016 with the crisis in the area of civil construction had to remodel its factory park to ensure its brand in the market Manauara. In terms of strategic business management, it has made available a comprehensive and innovative portfolio to meet the diverse needs of its customers, in a culture based on the ethics, quality and safety of its products. It is recognized in Manaus for producing furniture rich in detail, with quality raw material and high added value.
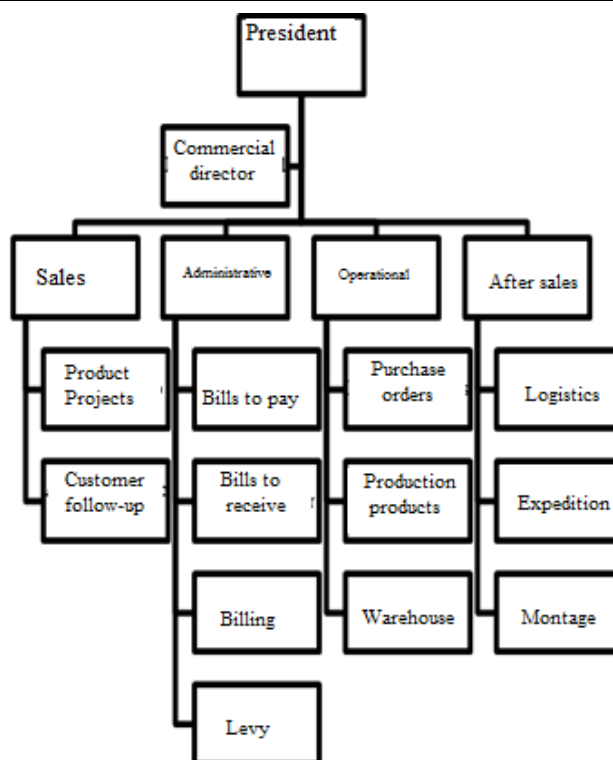
Fig.4 - Company organization chart.

5.2 SCENÁRIO

The information provided by the management, through the technical assistance sheets, there was no period from June to October 2017, 268 requests for technical assistance occurred. During this same period 3600 items were manufactured. The accumulated cost for the sector was calculated around R $ 40,000.00.

Based on data, 7.44% of what was manufactured is not in compliance, ie manufacturing failures, adding a cost to the factory. This cost has mainly been due to repairs, such as the demonstration of failures in Table 5.1, which can be controlled in the production line.

Table 14 - Description of faults

Types of failures / June to October 2017	Description
Finishing	Damaged paint with bubbles, pen scratches, blemishes, edges taking off.
Mounting error	Holes out of measure, feet off, doors uneven.
Damaged components	Defective puller, loose slides, and defective bulbs.
Incorrect shipment of components	Mounting hardware, small handles.
Transport failure	Risks, crunches, broken glass and broken components, broken lamps.
Missing pieces	Impossibility to complete the project on schedule.
Generated by customer	Glass broken, small beats, scratches, handle break, infiltration of water.
Wrong order	Incorrect color and design measurements
Pests	Changing of closet, ballast of bed.
Environmental	Moisture

5.3 PROCESS IN THE FABRICATION OF FURNITURE

According to HARRINGTON (2007), a process is "the specification of work activities in time and space with a beginning and end, with inputs and outputs, identified and defining a structure for action." The process in a furniture factory is characterized by producing a large variety of parts in a small quantity and by requiring a longer time in the production of the products and in the planning of the production in relation to the time of manufacture (AZEVEDO and NOLASCO, 2009). The process involves various machines and equipment such as planer, circular saw, sectioning machine, sander, drill and border collator. The main products manufactured by the furniture factory planned in the case study are listed according to table 15:

Table 15 - Main products manufactured.

Main products manufactured	
Products	**%manufactured**
Bedrooms (beds, wardrobes)	39%
Kitchens planned	33%
Bathrooms (cabinets)	12%
Home Theaters (shelves and racks)	7%
Home Offices (tables, shelves and cupboards)	6%
Closets	3%

Source: Adapted by the authors, (2017).

5.3.1 Stages of the product development process

Currently the process of manufacturing the company obey three steps:

First step:

Firstly, the client requests the technician's visit to the property for the measurements and already informs the type of service that will be realized. These measurements are carried out millimetrically in the environment obeying setbacks, beams, recesses and points of water and energy and sent to the designers who use a *computer-aided design* (CAD) to generate drawings.

The project with the specifications of the furniture is carried out at the point of sale of the brand and transferred to the factory, so that the quotation and the list of materials and the deadline of the products are elaborated. The 3D design is presented to the customer with the specifications of the furniture and the final price of the project in order to get approval for the beginning of the manufacturing. After approval of the client, the project returns to the factory and starts programming the furniture manufacturing by the production management sector.

Second stage: The second stage of the production process is on the factory floor. Cutting is the first process. The production scheduling sends the list for cutting the MDF sheets. The sectioner operators perform the programming instructions, part by piece, without the need for project interpretation. The pieces are cut into the machine and deposited in an intermediate place. There are no issues missing in this process. The batch is transferred to the next laminating machine. The mill operating team performs the blade application instruction, as per the part label. Then the pieces are sent to the drilling process, where they are screwed together and receive the so-called edge tape, material that protects and finishes the sides of the plates. Sometimes carpenters perform trimming cuts. When they reach the specifications the pieces are sent to the paint sector for the final finish.

Third stage: When ready, the parts are sent for conference according to design and packed in a way to facilitate the assembly process in the customer's environment. The last process is the output of production parts. Parts are hipped to the off-site warehouse. Parts are tagged, ensuring exact delivery of the design.

5.3.2 Flow chart of the product development process - current and proposed.
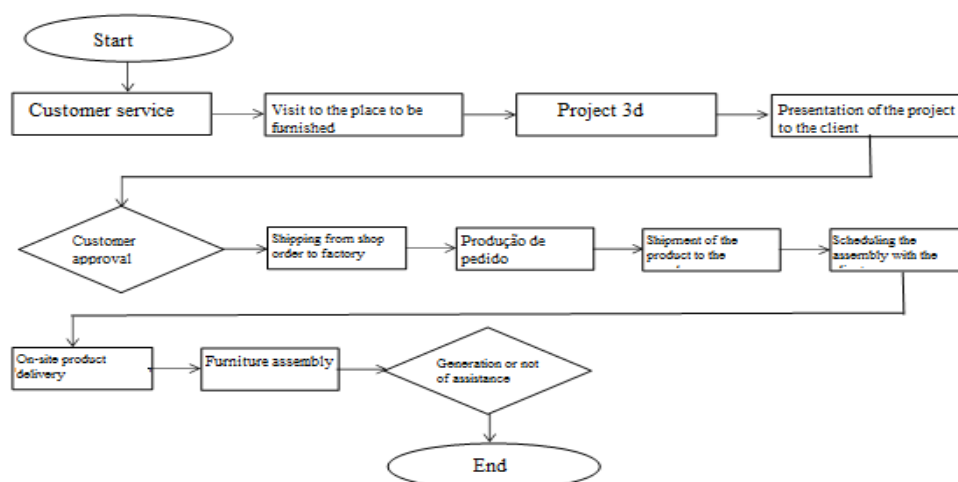
Figure 5 - Current flowchart of the product development process.
Source: Adapted by the authors, (2017).
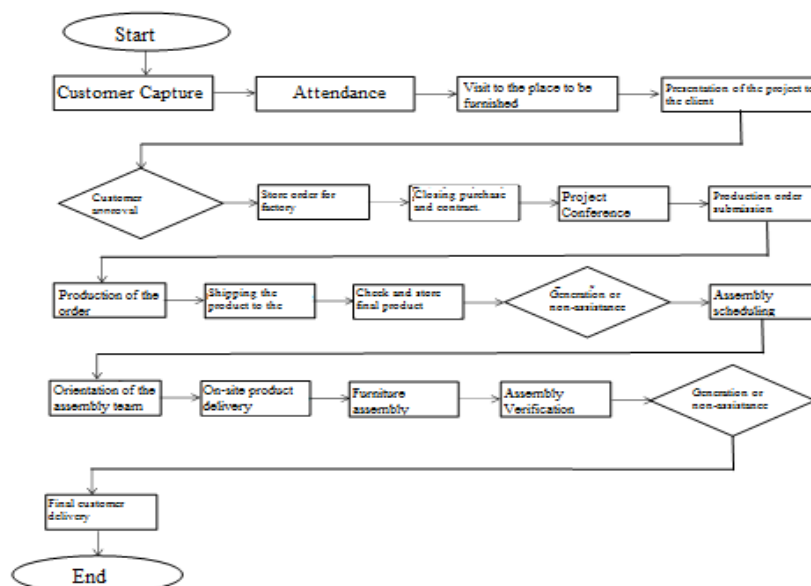
Fig.6 - Proposed flowchart of the product development process
Source: Adapted by the authors (2017).

5.4 APPLICATION OF MASP

In this section we will present the application of MASP in the productive sector with the purpose of eliminating / reducing the failures in the process and will be transcribed here the eight steps that comprise the method, and quality tools such as the Pareto chart, Ishikawa diagram, brainstorming, 5W1H, as well as their analyzes, identifying the root causes and the circumstances in which the failures happen and proposing actions to correct them as well as the verification and conclusion of the process.

5.4.1 Step 1 - Problem identification

The industry studied had an average of 53.6 calls per month of technical assistance caused by failures in the production process during the period from June to October 2017. This problem always bothered the industry. The Board of Directors' dissatisfaction is justified by the fact that these flaws in the process tarnish their image vis-à-vis customers, in addition to taking on all expenses causing loss and reduction of their profit, not counting the loss of a day worked by the assemblers. The verification of this problem was carried out quantitatively, through information in the technical assistance sheet according to the period of study mentioned above. The Pareto chart, represented by the Graph of Figure 8,

illustrates the respective failures noted by the information on the service chart. As the purpose of the Pareto Chart is to identify the most influential cause and focus on solving the problem, we can identify that the finishing that corresponds to 33% of the requests received in the period is the task where there is a greater number of failures, stage to be prioritized for the study. This is not to say that not all the problems listed in the Pareto chart are important, but rather that some need to be solved more urgently.

Graphic 5.1 - Identification of the problem.

Fig.7 – Graphic 5.1 - Identification of the problem.
Source: Authors, (2017).

5.4.2 Step 2 - Watching for the problem

Meetings were held with the purpose of tracing negative points that were affecting the final quality of the product. The following members took part in the meetings: 01 production leader, 01 person in charge of the after-sales department (technical assistance) and the general director. It was clearly defined the problem to be debated and listed a number of potential problems with care not to criticize suggestions not to inhibit membership participation. The director participated as moderator, noting all the suggestions discussed and the meeting lasted about 45 minutes and coordinated by the researcher. In this stage it was established that the problem should be solved in the period from November 2017 to January 2018. By the end of January 2018 the 10% goal in reducing the failures in the production process should be achieved. This goal was established at the meeting with the members of MASP and the researcher. The Ishikawa Diagram tool was used through the data obtained by the brainstorming methodology, and it was identified the causes that could be affecting the finishing of the pieces, according to Figure 9.

Fig.8 - Cause and Effect diagram for process and product failures.
Source: Authors, (2017).

5.4.3 Step 3 - Problem analysis

To analyze the problem, a chart was created with the causes responsible for the occurrence of the problem under study, according to the Ishikawa diagram. This scenario enabled the author of the project to go further, questioning the members why the causes listed above are happening, thus generating a branch of

secondary causes. The main causes raised by the members, named by Toledo (2014) of secondary causes (second level), are listed in table 14. Each member listed through note (1 to 10) the main causes for the failures in the finish of the final product. It is worth mentioning that the score was based on the data verified in projects, the information in the reports of requests for technical

assistance and also in the lived experiences of the members in the furniture factory.

The causes that scored above 20 points, that is, the most influential ones for the process losses, were taken as classification criterion. They were: disqualification of labor, machines with defects, scratches in painting and painting without adhesion. Table 5.3 shows the secondary causes identified in the final product from the primary causes of the Ishikawa Diagram and the scores assigned by the members.

Table 16 - Secondary causes identified in the final product from the primary causes of the Ishikawa Diagram.

Identified Cause / Product Finish	Total score assigned by members
Disqualification of labor	21
Accumulation of functions	10
Defective Machines	22
Scratches in paint	20
Paint without adhesion	25
Fissure in wood	18
Out of measure	16

With regard to disqualified labor the causes involved refer to unsatisfactory training, leading the employee to inappropriate attitudes such as: recklessness, sloppiness, hurry leading to errors in both the production of the final product and its installation.

For defective machines, there is a lack of regular maintenance and improper operation. For the case study the causes related to lack of maintenance are included. In this case, the maintenance of the measuring equipment for the preparation of the ink.

With regard to scratches in painting and painting without adhesion, the problem is linked to the standardization of procedures and quality standards. In this stage, the causes related to the preparation of the product of the varnish, as well as its application and the minimum curing time, that according to the norms established by the company are of the minimum of 6 hours and the inadequate storage of the wood.

In the graph of figure 10 are presented in percentages the alleged causes in relation to the problematic evaluated.
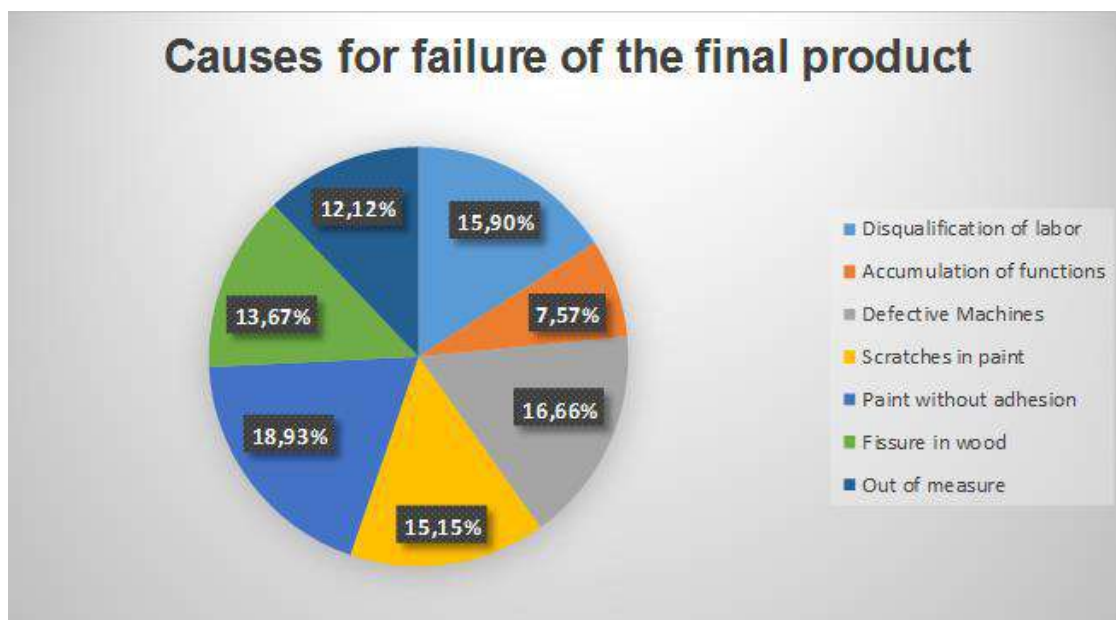
Fig.9 - Graph - Percentage of causes identified in the final product.
Source: Authors, (2017).

5.4.4 Step 4 - Action Plan

After analyzing the main causes of failure of the final product, an action plan was elaborated using the 5W1H quality tool. The objective of the action plan is to define preventive and corrective actions on the identified causes. This plan of action was made jointly with the

members through a meeting, where it disseminated the plan to all the people involved in the process, taking into account the daily experiences in the store and on the factory floor, defining the counter measures to be performed , informing those responsible for the actions, why it should be executed, the deadline for execution, the location and the manner in which the proposed action will be executed, as shown in Table 3.

Table 17 - 5W1H action plan.

	ACTION PLAN				
General objective	Reduce requests for technical assistance services in a Furniture Industry in Manaus applying the MASP (Analysis and Problem Solving Methodology).				
Area:	Production	Responsible	Andrea Claudia		
	PLANNING				
Origin of the Action (Why?)	What to do / Objective (What?)	How - Method (How?)	When - Deadline (When?)	Who - Responsible (Who?)	Where - Location (Where?)
Avoid improper preparation of the product	Cleaning the ink preparation equipment	Cleaning nozzles and needles	At the end of each month	Sector of painting	In charge of the painting sector
Damage the painting	Replacement of measuring equipment for ink preparation due to wear	Running Product Review	6 months	Sector of painting	In charge of the painting sector
Due curing time does varnish	Packaging of furniture	Wait 6 hours after painting	daily	Packaging Sector	Warehouse
Avoid paint and take-off problem	Cleaning in the glue reservoir	Cleaning the applicator waste	daily	Sector of cutting	In charge of the sector of cut
Standardization of MDF sheets	Timber monitoring (MDF) in the warehouse	Check that the timber is cracked	When receive the goods	Storage of materials	Warehouse
Avoid painting and disruption problem	Verification moisture woods in	Visual analysis of the MDF board	Before cutting the MDF board	Production sector	In charge of production
Generates imbalance in the plate and Empenamento	Wood Storage	Away from sources of heat and moisture	When receiving the supplier's woods	Storage of materials	Warehouse
Improvement of the productive process	Training of employees, standardization of procedures and quality standards	Course improvement after the record.	Every 6 months and new Employees - immediately	Sector of production / sector and after-sales / sales	Board of Directors

The trainings of the employees of the production sector were carried out during the month of October. It was perceived a greater commitment of the employees since the failures in the final product began to be fought. Regarding the sectors, such as after-sales and sales, the deadline for starting the training is for January / 2018.

The action plan made it possible to better monitor the members, especially the management (director) who did not have to open several documents to monitor the activity.

5.4.5 Etapa 5 – Ação

After the action plan, the next step of MASP is action, ie if the action plan is already being implemented by the relevant sector. The implementation of this plan had a follow-up through the director and researcher. Due to the commitment of all members, the planned actions had a low cost, since those responsible used internal resources of the company itself, respecting the deadlines and tasks defined. In this stage, a table containing the tasks, the sector responsible and how much has already been done was implemented, under the supervision of the board of directors, as shown in table 15.

Table 18 - Execution of tasks of the action plan.

Tasks	Responsible sector	%conclusion
Cleaning of painting measuring equipment	Painting	100%
Cleaning the glue reservoir	Lamination	80%
Replacement of measuring equipment for ink preparation due to wear	Painting	100%
Follow-up of MDF sheets	Warehouse	100%
Wood humidity checking	Production	70%
Training contributors	Board of Directors	40%
Furniture packaging	Warehouse	98%
Wood Storage	Warehouse	55%

5.4.6 Step 6 - Verification

Nesta etapa foram coletados dados de números de solicitações de assistência técnica de novembro de 2017 a janeiro de 2018 depois da implantação do MASP, estabelecidas pelo plano de ação e posteriormente comparadas com o período de junho a outubro de 2017.

Os resultados correspondentes aos 3 meses citados acima, houve uma redução do número de solicitações de assistência técnica em torno de 58% (cinquenta e oito por cento), conforme gráfico da figura 11.
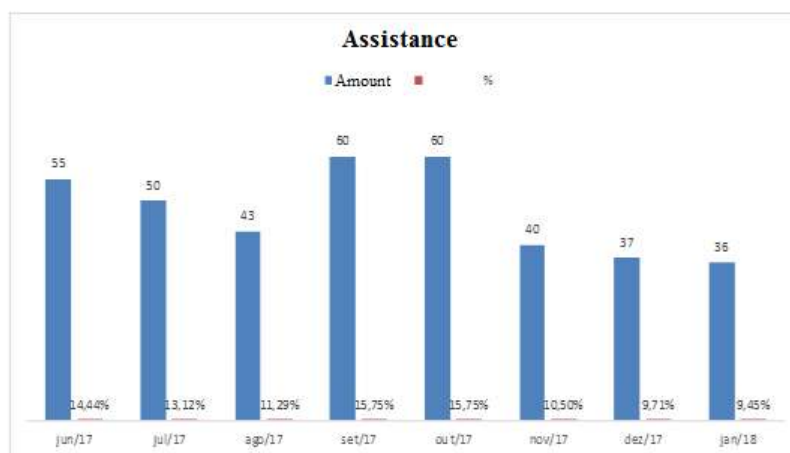
Fig.10 - Assistance Chart.

Regarding the finishing, the cause studied, the number of requests was 90 in the period from June to October 2017. After application of MASP, in the period from November 2017 to January 2018 reached 29, a

reduction of 68% in the number of requests, according to the graph of figure 12.
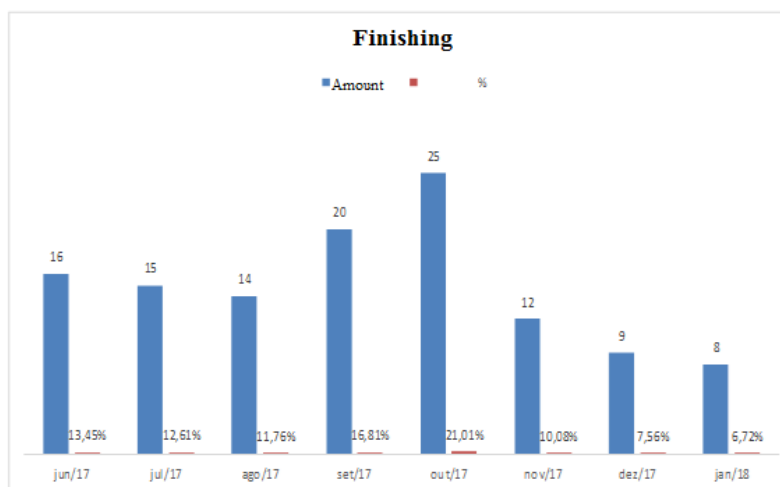
Fig.11 - Finishing Chart.

The costs and quantity of fabricated items were tabulated based on the information provided by the person in charge of the company. The graph of Figure 13

Fig.12 - Graph - Costs.
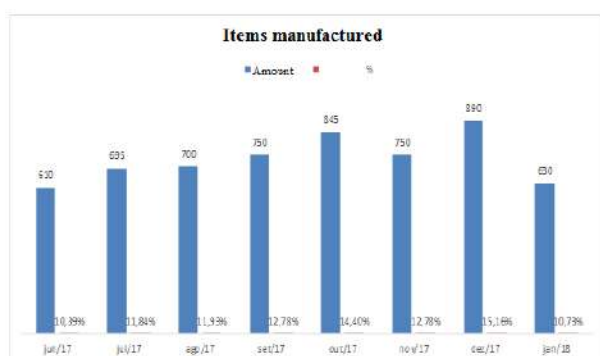
Fig.13 - Graphic - Items manufactured.

The results presented demonstrated the effectiveness of MASP and not forgetting the commitment of the team involved, who began to worry

shows the period from June 2017 to January 2018, with a 49% decrease in costs and the graph of Figure 14 shows the items manufactured in the same period.

more about the quality of the final product and paid more attention to their daily activities.

5.4.7 Step 7 - Standardization

As the company did not use quality tools, there were difficulties in the application of MASP by the members. However, the difficulties were diminishing with the good results obtained by the method in the months of its implantation and with that the activities identified in the action plan were standardized and each employee was trained before starting their activities. In order to achieve a positive result in the achievement of the goals, it was also necessary to standardize the documents such as: MASP file, training manual, final product assembly manual, which was still being discussed by the board and the actions follow-up form. Finally, after application of the method, the members of the MASP Group personally followed and monitored the tasks to remedy any doubts of the collaborators.

5.4.8 Step 8 - Conclusion

The last stage of MASP allowed the factory to create a fertile ground for change by correcting problems detected in its operations, making adjustments to the processes of existing products and systems.

5.5 ANALYSIS, RESULTS AND DISCUSSIONS

Production failures are always arising in any productive process in factories, and they need to be

flexible in order to identify the presumed causes of the problems and try to reduce or eliminate them, thus guaranteeing the improvement of the quality of their processes (JAGER, 2004).

The validation of MASP applied in the furniture industry occurred based on the reduction in the number of requests for technical assistance in the period from November 2017 to January 2018 compared to the months of June to October 2017.

In the period from June to October 2017 the company under study received 268 requests for technical assistance and 3600 items were manufactured, generating failures of 7.44% of the final product. In the period from November 2017 to January 2018, after application of the MASP model, it received 113 requests for technical assistance and 2270 manufactured items, generating failures in the final product of 4.97%. The value of the percentage demonstrated was based on the number of requests for technical assistance divided by the number of products produced in the month.

The results obtained showed that the actions performed through the MASP methodology were effective, obtaining a reduction of 33% in the number of failures of the final product, achieving the target set by the members of the reduction group of 10% and consequently a reduction around 58% of the number of requests for technical assistance. In relation to the main root cause, the finishing, from November 2017 to January 2018 were 29 requests, a monthly average of 9.66 requests, a reduction of 68% compared to the period in which MASP was not applied.

The technical assistance generated a cost in the period in which MASP was applied (November 2017 to January 2018), of R $ 20,300.00 compared to the period from June to October 2017, which was around R $ 40,000.00 resulted in a reduction of 49%. The results achieved in the study were similar to the main national and international studies using the MASP cited in the dissertation, such as the reduction of failures and the resulting losses, continuous improvement of the productive process, improvement in final product quality, reduction of rework and the cultural change in relation to quality in the internal environment of the factory and the store.

These results have only been achieved with the creation of a MASP form, the implementation of the training manual for employees, the final product assembly manual and a new flowchart in the product development process with a checklist before the product is delivered to the customer and after assembling the furniture, giving the delivery of the final product with quality. The MASP form was created to prevent process steps from being skipped or forgotten and could compromise the efficiency of the method. The form was created prior to the application of MASP in the company and presented to members in a self-explanatory and simple to use form and can be viewed in Appendix D. In the employee training manual, it was studied by the board and implemented in November 2017. The company realized its importance and the need to provide the employee with a fast understanding, interaction and explicit duties and rights before the company. It was proposed to update it annually and deliver the copy for both the old and the new employees. The items included in the manual are: Mission, Vision and Values of the Company, Organization Chart, Company History, Main Products Manufactured, Human Resources Processes, Rights and Duties of Employees.

For Manville (2003); Oliveira (2009), the employee integration manual aims to socialize the employee and make him feel motivated and an integral part of the organization, becoming a disseminating element of the organizational culture. As for the manual for assembly of the final product, it is being elaborated by the board, waiting for some items related to the best procedures. However, the assemblers are already using a checklist, where customers sign up at the end of the product installation.

Thus, as the method was applied in the company, involving people from different departments, the members of the MASP group were able to perceive the effect of the interaction in the company. The progress of the work was constantly communicated to all to be aware of the problem and to make contributions. With this, there was a transmission of knowledge both from the members who learned about the details of the furniture production line, and from the operators who knew and learned about MASP and the importance of a quality product.

It should be noted, however, that the company does not have a quality management system in place, but it is already reaping the benefits of MASP. As evidence of this, the board intends to continue the method, involving more employees to constantly seek to improve the company.

V. CONCLUSIONS

The search for the dream of home ownership, the reduced spaces of the current housing configuration in Brazil, and technological advances in machinery and equipment have driven the growth of the national furniture industry in the last decade. In this context, quality in products and services in furniture companies appears as a basic need for business maintenance and a means to gain competitive advantage. A product made

with zero defect reduces rework, decreases the number of non-conformities and returns, waste, costs, increased productivity and profit and as consequence generates customer satisfaction. In addition, the quality management within a furniture factory improves its productive processes and the valorization of its clients, thus promoting the organizational improvement and therefore increasing its competitiveness. In this way the quality has become a basic strategic to ensure the survival of the furniture companies and make the production of products more diversified and high value-added and aligned the needs of customers. In this respect, quality tools and methods are highly important for organizational differentiation, since they allow the identification and solution of the main problems and continuous improvement in order to meet and exceed the expectations of the consumer taking the competitive advantages. However, the use of quality methods still faces difficulties in its implementation due to several factors such as the financial problems faced by medium and small companies, disqualification of labor and low value wages in comparison with other sectors and companies managed by relatives. This work is part of this theme by making use of the MASP method together with the quality tools in order to identify the factors that lead to the increase of technical assistance requests as a consequence of the increased cost in a planned furniture company. Based on this method, we analyzed the collected data prioritizing which problems were affecting the production process generating failures and impacting the final product. Finishing, delivery failure, damaged components, incorrect shipment of components, transportation failure, customer-generated parts failure, incorrect ordering and plagues were listed, but the finishing was most evidenced by the Pareto chart tool, arriving around 33% of requests received. After this step, the Ishikawa Diagram was analyzed, analyzing the possible causes of the failures in the final finishing of the products in each of the 6Ms suggested as methodology, identifying the failures in the final product, with emphasis on disqualified labor, machines with defects and the lack of standardization of procedures and quality standards. The action plan (5W1H) was then formulated together with the members of the company, with proposals for improvements in the production processes.

At the end of this study, satisfactory and positive results were obtained, as there was a 58% reduction in the number of requests for technical assistance. In relation to the costs generated by the occurrence of failures, the reduction reached 49%, causing financial gains for the company surveyed. It is important to emphasize that the use of methodologies such as MASP are very helpful tools to determine the root causes of an organization's problem and only with constant use in a problem solving routine can the quality of the services desired be guaranteed.

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Articulation and Negotiation in the Rural Territorial Council of Ilha Grande Bay for Productive inclusion

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Abstract— *In order to understand the dynamics of the relations between the actors of the Rural Territorial Council of the Ilha Grande Bay (BIG) in search of productive inclusion based on sustainable rural development, the objective of this article, their actions are analyzed from the network shaped by these actors after three and a half years of research. It is a case study with participant observation, action research, bibliographical and documentary; and semi-structured interviews. The said Council became a space of articulation and negotiation of strategies of public interest with protagonism of the civil society. This arena has been strengthening as it has been presenting positive results regarding the productive inclusion of rural communities. The BIG Council has promoted the approach among the institutions widening its opportunities. And it has advanced in the conquest of distribution and commercialization spaces in the market.*
Keywords— Civil Society, Network, Productive Inclusion, Social Management, Sustainable Rural Territorial Development.

I. INTRODUCTION

The Territorial Council of Sustainable Rural Development (Codeter) of Ilha Grande Bay (BIG), the BIG Collegiate as it's known among the members and partners, as well as the other Councils of the 164 rural territories distributed throughout Brazil, were created in the institutional design of the Programa de Desenvolvimento Sustentável dos Territórios Rurais (PDSTR) of Brazil, situated in the Ministério de Desenvolvimento Agrário (MDA) and implemented by the Secretaria de Desenvolvimento Territorial (SDT). The program guidelines indicated a concern in strengthening the participation of civil society through the creation of these spaces under the bases of social management. The program guidelines indicated a concern in strengthening the participation of civil society through the creation of these spaces under the bases of social management.

The PDSTR started in 2003 but was only regulated in 2005. The Codeters were the central axis of the PDSTR implementation as a space where local actors would participate, negotiate and settle on local actions, plan actions sustainable territorial development; and would still exercise social control in the territory. In this way the governmental actions would be legitimized through agreements signed after deliberation in these participatory spaces[1].

The rural territory of Ilha Grande Bay (BIG) is located in the federative state of Rio de Janeiro, Brazil and consists of five municipalities: Seropédica, Itaguaí, Mangaratiba, Angra dos Reis and Paraty. In the BIG Council, both the ordinary meetings and the other activities defined by it are advised by the team of the Programa de Ensino, Pesquisa e Extensão em Desenvolvimento Territorial e Políticas Públicas (PEPEDT) of the Federal Rural University of Rio de Janeiro (UFRRJ) since 2016, assuming the role of the BIG's Núcleo de Extensão em Desenvolvimento Territorial (NEDET), which the same UFRRJ team has been following since 2015. The NEDETs would not only provide technical advice to the Codeter, would also assume the role of disseminator of knowledge and methods for a participative action of productive inclusion in the Rural Territories [2].

The Codeter remained under the aegis of the MDA until May 2016, when President Dilma Rousseff suffered withdrawal and then impeachment. From then on, there was an immediate interruption of the PDSTR, at the same time that the bureaucratic structures that supported it were dismantled. Six months later, the financial contribution that was passed on by the federal government to support the Codeter also ended.

However, the BIG Collegiate is still active in promoting the development of the territory and in facing the external threats imposed on rural communities, counting on the fundamental support of PEPEDT/ UFRRJ. Large industrial, port, residential, including high-

standard, logistic and extractive enterprises, provoke, under different scales and forms, harmful effects to those who live on small rural property in the BIG territory. Rise in land prices, gentrification, environmental degradation and expulsion, veiled or expressed; loss of quality of life are examples of these effects. This prevents or creates difficulty for the rural population to exercise their productive activity and way of life in their space of reference where their identities are built [3].

The objective of this paper is to analyze the dynamics of the relations between the actors of the BIG Council, space of negotiation and articulation, to think about strategies of productive inclusion considering the sustainable development [4] of the rural territory of BIG as a form of resistance to remain in the territory. This paper may stimulate other territories to strengthen their networks when they realize that their maintenance and possible articulations through it are favorable to productive inclusion actions of rural communities.

The article is divided into five sections, including this introduction. The second part discusses the theoretical framework of social management that guided the PDSTR and the management of the BIG Council, as well as the theoretical framework of the relational approach, which proposes to explain the territorial development based on the fact that it depends on the social and political relations that extrapolated the structure proposed by the PDSTR [5]. The section three discusses the methodology and techniques applied in the research. In the fourth section the results are presented considering the new structure of the network shaped by the actors between 2016 and 2018, whose expansion and strengthening led the BIG Council to become a space of negotiation of public interest. In the last section the conclusions are presented.

II. THEORETICAL FRAMEWORK

Social management is based on communicative action and dialogue among actors in the public sphere that discuss issues of collective interest. When affirming that a space of discussion in the public sphere acts under the bases of social management, it means that it is practiced (or should practice) deliberative citizenship, [6] where the process of discussion is revealed in a communicative action between individuals consciousness and the decisions are taken from the understanding of the actors involved.

The principles of inclusion, pluralism, participatory equality, autonomy and the common good are guiding the practice of social management in participatory spaces that seek to respect the leading role of civil society. Civil society, in this context, is that opinion-maker that resounds in the public sphere and, therefore, capable of

deciding its destiny for the positive results that its political participation can bring to the private sphere. It is strengthened by forms of contemporary organizations: social movements, organizations and associations etc. [7].

In summary, inclusion presupposes that all actors who may be affected or benefited from a topic under discussion must be inserted in the public space that proposes it. Pluralism must encompass the tripod: public power, market and civil society be observed in these spaces so that the discussion can have concrete results, although not tangible, given the density of the network formed. Pluralism is effective when there is participatory equality, that is, isonomy among subjects so that they can express themselves without coercion [8]. Autonomy refers to the real potentiality of representative actors of institutions to make decisions in a public space of discussion. The common good reflects not only the results of the actions of a public space, but the capacity of the actors to suppress their particular interests to the benefit of the collective.

Business relations mix with social ones, because there is no market where agents never meet; in contrast, they behave and make decisions in a given social context [9] [10]. From these relationships arise networks, that is, structures of interpersonal relations shaped by the actors, considering economic and social interests, collective or private. The recurrence of the transactions and the social conviviality result in mutual trust between actors to act jointly, forming a coalition in the economic life.

In this context, the BIG Council network is defined as the set of actors that interact in it or through it, that is, members of the plenary and not members that have ties with the Council. The network is an expression used to verify the quality of interpersonal relations from the investigation of a case, while it is a tool to understand the articulations between actors to reach an end [11]. Social networks in the relational approach also enable to know the field of forces and the institutional potentialities in the territory, considering the actors involved and what type of relationship connects them [5].

III. METHODOLOGY

Through the exploratory research carried out during the activities of the researchers in the BIG Council, social facts that could be investigated were observed. Based on a theoretical basis, based on the social management of public spaces of discussion [6](TENÓRIO, 2008) and relational approach [9] [12](GRANOVETTER, 2000, 2007), these social facts were scientifically analyzed according to the inductive method. The assumption raised is that the existence of a network shaped by the actors themselves in the BIG Territory and the articulations

established therein may result in alliances between private and public institutions from different spheres of government to promote actions for productive inclusion based on sustainable development.

As a field method, the case study was used, since it contributes to the understanding of contemporary organizational, social and political phenomena [13]. This is a unique case study because, although it is only one more council among 164 other rural territories, the Council continued its activities, even with the closure of the public policy that created it, the PDSTR. His actions as well as his results are deeply linked to the actors that make up the Council. In addition, there are no scientific publications dealing with the continuity of other Codeter activities.

To base the research and confirm the data collected, a bibliographical and documentary research was done. The following were consulted: norms, regulations, regiments, minutes of the ordinary meetings of the BIG Collegiate and research diary. In the field, data collection included participant observation [14], action research [15], and semi-structured interviews between 2015 and 2018. For this, he counted on the support of the members of PEPEDT / UFRRJ , of which the researchers are part. An important facilitator of the research was also the fact that one of the researchers is a member of the BIG Council, representing UFRRJ.

The actors involved in the survey are all those who were present in at least one of the 15 regular meetings of the BIG Council. This is composed by: civil society, represented collectively or individually; (representatives of municipalities, the nucleus of technical assistance, teaching, research and extension, the state and federal spheres); the PEPEDT and market representatives.

IV. ANALYSIS AND DISCUSSION OF RESULTS

The dynamics of the relations between the actors of the BIG Council allowed the conformation of a network shaped by them. The result of this interaction is measured by: the performance of its members during the decision-making process in this political arena (assiduity and propositional statements); the actors' actions to provide the productive inclusion of rural communities; and by the joints that break the boundaries of the BIG Council in events promoted by this space.

The BIG Council network was formal until May 2016, as it was based on a bureaucratic consultative structure under administrative rules [16]. Today it could be classified as semi-formal.

Fig. 1: BIG Council Composition in December 2018.

SOCIEDADE CIVIL
Associação de Prod. Rurais Unidos de Assentados da Fazenda (Batatal)
Associação de Pescadores e Maricultores da Ilha da Marambaia - APMIM)
Associação da Comunidade dos Remanescentes de Quilombos da Ilha da Marambaia (AQUIMAR)
Associação dos Agricultores Familiares das Glebas Coletivo e Santa Alice (AACSA)
Associação dos Agricultores da Agroindústria de Doces de Mangaratiba (AAADM)
Associação de Moradores e Amigos de São João Marcos - Serra do Piloto (AMA-SERRA)
Associação de Pequenos Produtores Orgânicos de Seropédica (SERORGANICO)
Associação de Maricultores de Paraty (AMAPAR)
Associação de Produtores Rurais do Vale Mambucaba - Angra dos Reis (ASPR)
Associação Rural Agrícola Pecuarista - Assentamento União, Terra e Trabalho (AATT)
Associação de Pequenos Agricultores do Vale do Rio Sahy (APAVRS)
Associação Comunitária Indígena Guarani (ACIGUA)
Associação Comunitária Indígena do Bracuí (ACIBRA)
Associação dos Trabalhadores Rurais da Serra do Piloto (ATRSP)
Cooperativa dos Produtores Rurais de Paraty (PACOVA)
Cooperativa de Trabalho, Consultoria, Projetos e Serviços em Sustentabilidade (CEDRO)
Colônia de Pescadores de Paraty - Z18
Conselho Comunitário de Mazombinha e Rio Preto
Conselho das Associações da População e Povos Tradicionais Paraty (CONAP)
Sindicato dos Trabalhadores Rurais de Angra dos Reis
Sindicato Rural de Itaguaí
Sindicato dos Trabalhadores Rurais de Paraty
Sindicato dos Trabalhadores Rurais de Mangaratiba
União das Associações e Cooperativas de Pequenos Produtores Rurais do Estado do RJ (UNACOOP)
PODER PÚBLICO
Empresa de Assistência Técnica e Extensão Rural do Rio de Janeiro (EMATER-Rio)
Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) - Agrobiologia
Empresa de Pesquisa Agropecuária do Estado do Rio de Janeiro (PESAGRO)
Fundação Instituto de Pesca do Estado do Rio de Janeiro (FIPERJ)
Fundação Nacional do Índio (FUNAI)

Fundação Oswaldo Cruz - Observatório dos Territórios Sustentáveis e Saudáveis da Bocaina (OTSS)

Parque Estadual Cunhambebe (PEC)/Instituto Estadual do Ambiente (INEA)

Instituto Chico Mendes de Conservação da Biodiversidade (ICM-Bio) - Parque Nacional da Serra da Bocaina (PNSB)

Instituto de Terras e Cartografia do Estado do Rio de Janeiro (ITERJ)

Programa Luz para Todos/RJ (PLT)

Secretaria de Agricultura, Aquicultura e Pesca de Angra dos Reis (SAAP)

Secretaria Municipal de Meio Ambiente e Agricultura - Itaguaí (SEMAAP)

Secretaria Municipal de Meio Ambiente Agricultura e Pesca de Mangaratiba (SEMAP)

Secretaria de Pesca e Agricultura de Paraty (SEPA)

Secretaria de Ambiente e Agronegócios de Seropédica (SEMAMA)

Universidade Federal Rural do Rio de Janeiro (UFRRJ)

The same formal structure remains to be regimented and much of the rules of conduct established by the late MDA are maintained. On the other hand, there is currently nothing bureaucratic to control, unless the

decision of the plenary, which is sovereign. That is why it is a network of complicity, based on trust between actors.

The relationships established between the institutions seek to support rural communities through sustainable proposals that promote productive inclusion and social control actions in the territory. Fig. 1 lists the members of the BIG Collegiate.

The network shaped by the actors of BIG Council promotes a bridge with other actors in the same network or outside. In the latter case, approaching the actors when they do not have previous links. The expansion of the network occurs even if the BIG Council is not a bridge because it is not the only possible way, but the network is used because it is a shorter route so that there is an approximation among the actors.

As shown in Fig. 2 the actors of the BIG Council were organized in a network - molded by the actors after the end of the PDSTR - according to the arrangements that made up the nuclei of each municipality. The nuclei of "technical assistance", "new partnerships" and "market" were allocated separately because they are supra-municipal.
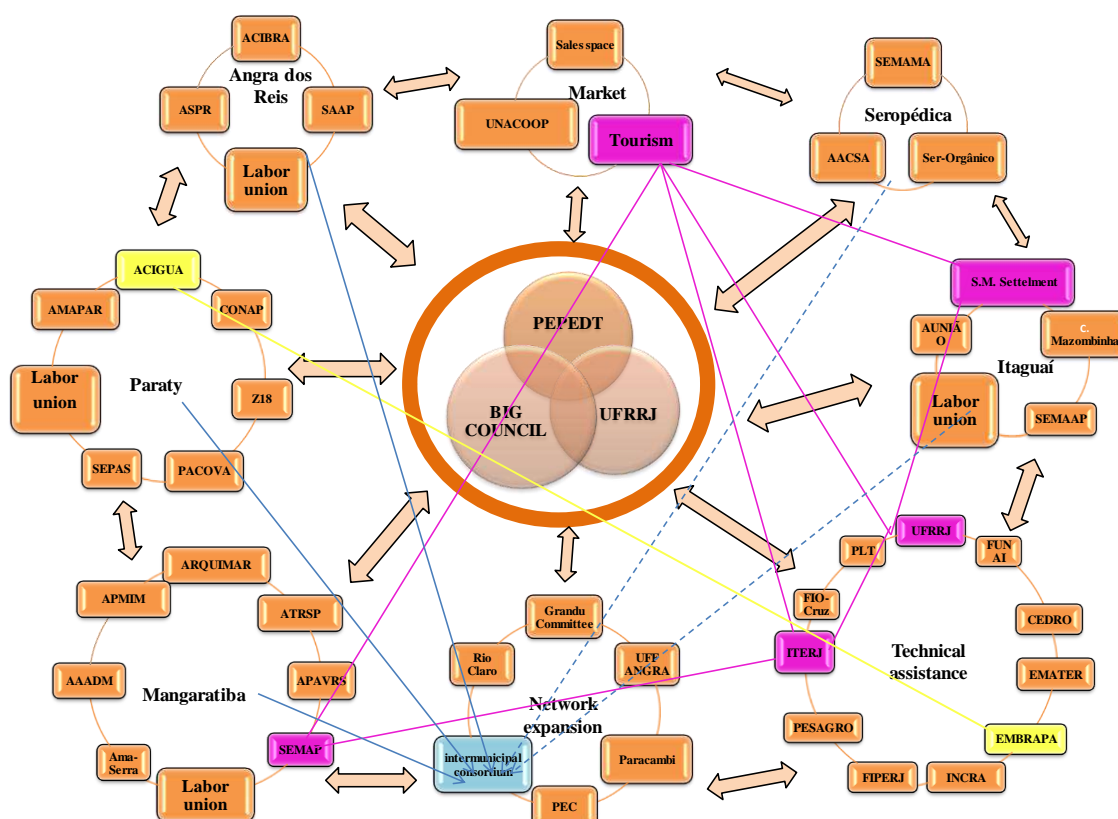
Fig. 2: BIG Council Network

The positioning of the nucleus of the network in the center of Fig. 2 symbolizes the immersion of the PEPEDT in the BIG Territory as a non-hierarchical network, because in the BIG Council space, the social management is practiced. The PEPEDT seeks to stimulate interlocution between the nuclei.

In order to evaluate how the dynamics of relations in the BIG Council stimulated the greater integration of technical assistance, research and extension agencies with municipal governments in order to productively include rural communities, it was asked to the representatives of the most frequent and/or participatory institutions of public power at ordinary meetings, whether they observed developments and actions in favor of these communities from their participation in the meetings of this Council.

The respondent from the Municipal Government of Angra dos Reis/RJ stressed that the maintenance of the BIG Council WhatsApp Group as a channel for disseminating information is now one of its two main contacts with other representatives of technical assistance and extension. In this way, he is kept informed of his actions, interests and opportunities to work with rural communities.

The ITERJ representative stated that some accomplishments in his work came from his interlocution with the BIG Council. He considers that this space is a creative field of exchange of ideas, where it observes and reaches the means and the specialists that can take subjects capable of solving the needs in the communities of the field with which it works, especially in the settlement Rubião in Mangaratiba/RJ. As an accomplishment, he highlights the technical skills offered by a UFRRJ's professor and intermediated by PEPEDT regarding good milk production practices in that locality.

The PEPEDT also established contact with professors of the UFRRJ' Bachelor of Hospitality Course to provide knowledge transfer in the community-based tourism area. The representative of ITERJ also mentions the BIG Collegiate as mediator of the articulations for the realization of tourist projects in the mountains of Piloto and Matoso, in Mangaratiba/RJ and Itaguaí/RJ, respectively. Community-based rural tourism has been supported by the Council as a way to promote sustainable development and the inclusion of rural communities in the market.

The EMBRAPA member highlighted as a result of his participation his approach with the FUNAI representative, enabling him to join the Associação Comunitária Indígena Guarani (ACIGUA) situated in Paraty/RJ, for technical assistance purposes. He worked with FUNAI to deepen the concepts of agroforestry. From this work he obtained the donation of 1,500 seedlings of the "Caixeta"

tree, whose wood is used in the handicrafts of the Indigenous. Part of their craft is marketed.

The member representing the PEC/INEA affirms that their participation in the Council allowed a perception of the demands of the communities and an approximation with the users of the Park. It did increase the connection of the park with the local community. It facilitated the dialogue of the family farmers with the Environmental Protection Area of Mangaratiba/RJ to mitigate the problems within the legality. In this sense, the research revealed that the Guandu Committee sees in the Council the possibility of getting closer and better acquainted with the demands of rural communities and increasing the participation of civil society in their discussion forums.

Both representatives of the municipal government of Angra dos Reis/RJ and Mangaratiba/RJ mentioned the importance of their participation in the dissemination of information and motivation for the rural communities to win the SEAD's Public Call for the acquisition of the fair kit. In Mangaratiba/RJ, it was also noticed by its representative that the talk about productive inclusion and direct sales; as well as exposure of some traditional communities in the Central Pavilion of UFRRJ at the 8th Ordinary Meeting of the BIG Collegiate helped municipal managers to understand the potential that the fairs have as a channel of a direct sale, especially when well structured and supported by municipalities, impelling a project that has been working since 2014. Reinforcing the speech of the respondent of the municipal public power of Mangaratiba/RJ, the representative of ITERJ states that the idea of the fair opened doors for the participation of the Rubião settlers at this municipal fair.

A very specific case that the BIG Council became a network that shortens the way for access to other actors or networks was that this network facilitated the approximation between the municipalities, in the figure of the municipal secretaries of agriculture with the rectory of UFRRJ, both newly sworn in. It is recalled here the importance of the strength of weak ties [12], since they can provide the approximation between actors with the potential to contribute to the objectives of the BIG Council.

A second example of the potential for negotiation of this discussion space is the fact that it has enabled a rapid rapprochement between UFRRJ and SEAD. This approach redeemed the University a Financial Execution Term (TED) in the amount of approximately 150 thousand dollars for the implementation of the project for the training of young family farmers in agroecology, where part of this resources was transformed into 60 scholarships for young knowledge multipliers . The project ended in January 2019 and involved different

research centers, including PEPEDT, which gained visibility, credibility and institutional support at UFRRJ, including a place in the House of Family Agriculture, Sustainability, Territories and Popular Education (CASTE), created to be a center of research and extension involving the theme.

The third example is revealed in the fact that the SEAD delegate in Rio de Janeiro used the BIG Council as a way to meet and contact the BIG collegiate actors at the time of the government transition, especially the Municipal Agriculture's Departments.

The market's nucleus is still a challenge to be worked on in the Council to promote the productive inclusion of tangible or non-tangible products of rural communities. For the first time, at the 15th Ordinary Meeting, two market representatives were present to discuss the tourism project together.

The UNACOOP Cooperative did not reach the expectation regarding the establishment or extension of the approach of the rural producers with the market in a strategic territorial and collective perspective transforming the capacity to organize the productivity and the quality of the production able to close agreements with groups of consumers that sympathize with the way of being and doing of the rural communities of the territory. However, the importance of this Cooperative, which assists in the distribution of production and in the insertion of producers in the institutional markets, is acknowledged.

PESAGRO's response was the only negative among respondents. Although there was a frequency of the respondent in the discussion space, his performance was considered weak and not profitable in the two moments of reference. Often, to have actions and results with the institutions, the actor's capacity for action in the sense of autonomy is very important [17] [18]. No proposal came from this member considering the competences of this institution that involves: transferring knowledge and technologies to society, from issues such as product quality and environmental issues for rural development in the federative State of Rio de Janeiro.

As important as the institutional arrangement involving a political project, is the institutional capacity to effect it [19]. In this context, it was found in this research that the ties established between institutions also depend on the profile of the occupant of the position. But one can't ignore the fact that it is a state body and that its activity depends on the structure, resources and equipment intended for the institution.

In addition to the results already mentioned, they also reflect the achievements of productive inclusion articulated by the BIG Council: the mediation for the inclusion of family farmers in the UFRRJ fair, who were motivated to innovate and diversify the products offered; access to the UFRRJ Food Acquisition Program (in this case the municipalities of Itaguaí/RJ and Seropédica/RJ benefited), dissemination of information that encouraged the submission of projects to compete for SEAD's public Calls, which included the municipalities of Mangaratiba / RJ, Angra dos Reis / RJ and Paraty / RJ; articulation with the Guandu Committee; this approach may bring resources to finance the Collegiate meetings in 2019; articulation for the establishment of cooperation agreement of the city of Mangaratiba / RJ with UFRRJ; and finally, the articulation for the creation of the territorial consortium.

V. CONCLUSION

Field research has shown that the links between BIG Collegiate actors are affected by: empathy, trust, actors' autonomy, existence of political culture and interests (individual or collective, institutional or private). The alliances established from the new structure made it possible to achieve productive inclusion actions that contribute to the sustainable development of the rural territory and the strengthening of the space itself, since it was a network dense enough to attract strategic players to use as a bridge or shorten the way to establish connection between actors.

The current absence of sustainable rural territorial development policies at the national level should not mean the halting of initiatives to promote it. Therefore, the importance of the protagonism of civil society and the plurality of actors in spaces such as the BIG Council for the development of the territory is even more striking. Just as it is fundamental that institutions such as the UFRRJ shelter this type of organization of civil society in the public sphere.

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Epidemiological Profile of the Hypertensions

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Abstract— Hypertension is a chronic pathology that needs care because it is considered as risk factors for the appearance of other cardiovascular diseases. The objective of this study was to analyze the epidemiological profile of hypertensive residents in the urban area of Vitória da Conquista. The research is transversal in nature with a quantitative approach. To collect the data were used questionnaires composed of questions that belonged to the study. The study involved 306 people who were diagnosed with hypertension of both genders, 75 male and 231 female, where 63.4% of hypertensive patients did not work and most were of social class D, most of the schooling was low being 44% and most had only elementary education incomplete and 90.3% studied in the public education network, 53.2% were married. This research provided a controlled health-disease profile in which a very low number of people with conditions associated with hypertension were verified, this means that blood pressure control is being effective. This research has provided a controlled health-disease profile in which a very low number of people with pathologies associated with hypertension have been verified, this means that the monitoring of the pressure is being effective. However, it was possible to notice that hypertensive patients do not use continuous medication, being a point of alert in our study. It was observed in the study a high number of patients make use of natural medicines, often because they think that it has fewer side effects.

Keywords— Hypertension, risk factors and cardiovascular diseases.

I. INTRODUCTION

Hypertension is a chronic disease of high prevalence that reaches about 1 billion individuals worldwide and is classified among the major diseases contributing to a large worldwide increase in diseases and deaths, accounting for approximately 9.4 million deaths a year (Akinluaet al., 2015; Guwatuddeet al., 2015).In today, the prevalence of hypertension is 32.3%, where low- and middle-income hardest hit with a higher burden of disease (Sarkiet al., 2015).

There are several risk factors that can cause the appearance of hypertension are age, race, gender, overweight or obesity, excessive consumption of alcoholic beverages, sedentary lifestyle, dyslipidemias, diabetes mellitus, smoking and high-sodium diet (Motteret al., 2015; et al., 2016). Thehigh blood pressure can also lead to cardiovascular diseases such as stroke, peripheral artery disease, heart failure, chronic kidney disease, acute myocardial infarction and coronary artery disease (Nobreet al., 2013).

According to the 7th Brazilian Guidelines for Arterial Hypertension, conceptualize arterial hypertension as a multifactorial disease which is defined by the increase in pressure levels, where the values are greater than or equal tommHg140/90(Mvbet al., 2016). In the year 2013 the prevalence of hypertension in Brazil was 21.4%, being 24.2% in women and 18.3% in men, where it was possible to perceive that this prevalence increased with the passing of the years, being higher in sex women and in people with lower schooling(Anderson et al.,., 2015).

The main measures to avoidis pathology is making lifestyle modification, reducing weight, avoiding alcoholic beverages, controlling psychosocial stress, practicing physical activity, avoiding foods with high salt content, smoking cessation, diet rich in fruits, vegetables, reduce saturated fat and cholesterol (Nobreet al., 2013).

The objective of this project is to analyze the epidemiological profile of Conquest's hypertensive patients, verify the socioeconomic factors and lifestyle of

hypertensive patients, present pre-existing diseases, classify the level of physical activity, and verify the weight of the patient according to their conception, analyze the habit of smoking, alcohol, illicit drugs and stress level.

II. METHODOLOGY

The study is part of the Nucleus of Extension and Research and Study of Chronic Diseases (NEPEDC) (David, et al., 2019). The research is transversal in nature with a quantitative approach. The research was carried out in the health units of Vitória da Conquista - Bahia, Brazil, which has a population of 320,129 inhabitants, with a latitude of -14 ° 51 '58', longitude of -40 ° 50 '22 and Altitude 923 meters on the stairs of the main church. The study population consisted of individuals previously diagnosed with arterial hypertension, using blood pressure monitoring results following the ATP III protocol and also using the questionnaire of pre-existing diseases, adults of both genders, living in the urban area of Victory of the Conquest.

The data were collected through the use of five questionnaires to the research participants. The first instrument evaluated the socioeconomic profile (gender, income, age range, schooling, marital status, etc.), and health conditions to know if there were diseases, drug therapy used by the elderly and consultations / hospitalizations in the last 12 months (PEREIRA, et al., 2015). The second instrument was the ABUEL questionnaire that investigated living conditions, eating habits, behavioral, physical and mental health and social relations between people and the elderly (David, et al.,., 2019).

The next questionnaire was that of adult stress symptoms (LIPP), which is a questionnaire that contains several questions, in order to identify if the patient has any symptoms of stress. To complete the collection, the BECK depression inventory was used as an instrument to measure depressive episodes, in which these questionnaires are composed of 21 groups of affirmations. Having intuited to describe how the patient has felt in the last week (Silva, et al., 2018).

The study included individuals previously diagnosed with hypertension, and who were individuals who were 60 years of age or older, and the individuals were of the sex (female / male) and patients who had no difficulty in communicating and withdrawing from the study persons without conditions reasoned, hearing-impaired, bedridden, wheelchair-bound, or who had difficulty communicating when they were not accompanied by a helper to assist him in the interview.

The socioeconomic variables that were taken into account were age (expressed in years), sex (male or female), race / color (white, brown and black), schooling (expressed in years of study), marital status , separated, divorced and widowed), number of residents at home and per capita income in wages.

III. RESULTS AND DISCUSSION

The study included 306 people previously diagnosed with arterial hypertension of both sexes, being 75 men and 231 women. Some people have failed to answer some parts of the questionnaires, so some variables are not complete. Most of the hypertensive students studied did not work (63.4%), formed by social class D, mostly majority schooling was low, 44% had only incomplete fundamental and 90.3% studied in the teaching network 53.2% were married. More details of the sample in table 1, soon after.

Table.1: Characterization of the hypertensive sample.

		n	%	Total
Gender	Male	75	24.5	306
	Female	231	75.5	
Work	Yes	112	36.6	306
	No	194	63.4	
Social Class	A	1	0,3	289
	B	6	2,1	
	C	39	13,5	
	D	155	53,6	
	And	88	30.4	
Education	Incomplete Elementary	107	44.0	243
	Elementary Full	10	4.1	
	Incomplete Middle	10	4.1	
	East Full	58	23.9	
	Some college	18	7.4	
	Complete Higher	26	10.7	

	Education No	14	5.8	
State Civil	Single	46	15.4	299
	Married	159	53.2	
	Divorced	30	10.0	
	Widowed	64	21.4	
Type ofTeaching	Public	204	90.3	226
	Private	22	9.7	

Source: own research, 2018.

The number of women who participated in the Data collection was superior to that of men, since they are more interested in knowing their health condition and monitoring their health-disease profile. However, when the sample of both sexes is equal, the tendency of the male gender to be hypertensive is much higher than the women (Ghoeshet al., 2016).

The great majority of the studied public denied not to work, where it can take into consideration and analysis that the arterial hypertension and its morbidity has removed the worker from his condition of exercising his daily working conditions, preventing him from being able to do his work activities, either by drug use and / or complications of disease out-of-control (Lenget al.,., 2015).

The effectiveness of drug treatment is related to the level of schooling and the understanding of the positive effects of daily and controlled drug use. Our sample of hypertensive individuals, the level of schooling was very low, thus demonstrating that the level of schooling has a strong influence on the health status of patients who have hypertension or who do not have which does not have (Lunstadet al., 2016).

With the factors cited above, of course most people are allocated into a lower social class. Being the majority of class D and E, which can be a barrier to the adoption of good habits of life and prevention of chronic diseases(Ruilopeet al., 2016; Mistrettaet al., 2017). Many authors have shown that social class has an important influence on changes in the individual's health-disease profile. The impact of public policies on health improvement must take into account the important findings regarding risk factors, and prophylactic treatment, not only being the treatment curative (Lenget al., 2015, Duncanet al., 2012).

The results showed that large parts of hypertension had normal weight, 54.35 and 68.6% said they had good body satisfaction. However, it is worth mentioning that a large number of people were overweight and obese, which can progress to the accumulation of chronic diseases, and should invest in health improvements and encourage healthy eating and high physical exercise that is practiced all days (Davis et al., 2016, Sodermanet al., 2013, Szwarcwaldet al., 2015).

Table.2: Hypertensive Health-Disease Profile.

		n	%	Total
Body Mass Index	Low weight	38	13.8	276
	Normal weight	150	54.3	
	Overweight	70	25.4	
	Obesity	18	6.5	
Hyperlipidemia	Yes	23	7.9	291
	No	267	91.8	
Hypertriglyceridemia	Yes	35	13.1	268
	No	226	84.3	
Obesity	Yes	22	7.5	293
	No	271	92.5	
Diabetes	Yes	53	18.4	288
	No	235	81.6	
Cardiopathy	Yes	23	7.9	291
	No	269	92.4	
Renal Disease	Yes	22	7.5	293
	No	271	92.5	
Anxiety	Yes	78	27.4	285

	No	207	72.6	
Depression	Yes	59	19.7	300
	No	241	80.3	
Stress	Yes	177	62.8	282
	No	105	37.2	
Body Satisfaction	Content	208	68.6	303
	not Satisfied	95	31.4	
Autonomy	Independent	90	48.1	187
	Dependent	97	51.9	

Source: own research, 2018.

In heart medication, 93 people with hypertension were seen to use daily. Pain medications, 176 hypertensives claimed to use daily and regularly. More information regarding the use of drugs by hypertensive patients are described in table 3.

Table.3: Medications used by hypertensive patients

		n	%	Total
Natural Medicines	Daily	14	4.8	
	Regularly	111	37.7	294
	Never	169	57.5	
Diabetes Drug	Daily	48	16. 2	
	Regularly	4	1.3	297
	Never	245	82.5	
Heart Medication	Daily	93	30.8	
	Regularly	10	3.3	302
	Never	199	65.9	
Medication for Asthma	Daily	5	1.7	
	Regularly	4	1.3	295
	Never	286	96 .9	
Anxiety Medication	Daily	17	5.7	
	Regularly	10	3.3	298
	Never	271	90.3	
Medication for Depression	Daily	13	4.4	
	Regularly	4	1.3	298
	Never	281	94.3	
Sleeping	daily Daily	18	6.1	
	Regularly	19	6.4	297
	Never	260	87.5	
Medication for Pain	Daily	35	11.7	
	Regularly	141	47.3	298
	Never	122	40.9	

Source: own research, 2018.

Regularly - 1 to 3 times a week.

In our sample it was found that there is a high number of hypertensive patients who use drugs for the heart, in which 103 people were declared. This fact can be justified by the fact that high blood pressure is a disease that carries many risk factors for the appearance of cardiovascular complications, where 40 to 50% of patients with hypertension will present problems in the heart or even serious vascular accidents if not control blood pressure levels(Oparilet al., 2018; Jakovljevicet al., 2015). Therapeutic adherence on the part of hypertensive patients was not very good, as it can be perceived both by the use of drugs for the heart including the hypotensive drugs and for the drugs directed to the control, as shown in chart 1 below (Lanet al., 2015).

The use of pain medications was considered high, since they are mostly medications without the need

for medical prescription and used intentionally. Because they do not have contraindications, only in cases of dengue, their use does not follow the same guidelines as other medicines such as those with black stripes. It can then be justified by rooted cultural issues of self-medication without prior consultation.

IV. FINAL CONSIDERATIONS

This research has provided a controlled health-disease profile in which a very low number of people with pathologies associated with hypertension have been verified, this means that the monitoring of the pressure is being effective. However, it was possible to notice that hypertensive patients do not use continuous medication, being a point of alert in our study. It was observed in the study a high number of patients make use of natural medicines, often because they think that it has fewer side effects.

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Evaluation of Medicinal therapy in the Presence of Psychological factors in Individuals from 45 to 60 Years

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Abstract— *The psychological factors encompass a vast consumption of prolonged and continuous use drugs, whose purpose is to soften the clinical manifestations that comorbidities present. The concomitant use of more than five drugs may lead to a reduction in adherence to treatment and therefore the unsatisfactory drug effectiveness. The present article aims to evaluate individuals aged 45 to 60 years with some of these psychological factors: anxiety, depression and / or stress, as well as adherence to drug therapy. This is a descriptive, cross-sectional and quantitative approach, performed in the city of Vitória da Conquista, Bahia, Brazil. For obtaining the results, it was adopted the socioeconomic questionnaires, BAI, BDI, ISSL and Abuel. The sample was composed by 389 individuals of both genders. Individuals with anxiety reported a greater intake of natural drugs for pain, sleeping, and depression. Individuals with depression reported a higher intake of the drugs described above, plus anxiety. Individuals with stress reported a greater intake of the same drugs than those ones described by anxiety, plus the drug for anxiety.*
Keywords— Anxiety, chronic conditions, medication adherence, pharmacological treatment and quality of life.

I. INTRODUCTION

Drug adherence is a behavior that is difficult to comprehension and shows a connection with the processes of globalization that has been increasing the psychosocial suffering of the population due to its association with the decrease of mental health, physical and well-being, on the same proportion that generates the increase of socioeconomic inequalities, cultural disturbances, urbanization, substance abuse, conflicting coexistence, displacement of individual and collective identities. (FREDDO et al, 2018). These are factors that in balance are essential for enjoying quality health. Being lacking end up by causing serious disorders, because these factors cause changes in the way how the individual expresses himself (LABONTÉ, Ronald, 2018).

The use of polypharmacy in the therapy of various medical conditions has shown as a contribution marker in the increase of Problems Related to Medications (PRM) (MASNOON et al, 2017). Thus, it should be emphasize that patients who attend with the presence of psychological factors and use polypharmacy, trivially defined by the frequent use of at least five drugs, end up being exposed to the occurrence of PRMs. Studies show that the number of PRM per patient increases linearly with the increase in the number of drugs used (YIMAMA et al, 2018).

Prolonged consumption of drugs and even continuous / permanent by patients with chronic diseases tends to achieve beneficial results in relation to the survival of the individuals (FRITZEN et al, 2017). By making pleasant the damages caused by the incorrect intake of the drugs by the individuals, concomitantly increases the life quality of these ones (BASU et al, 2019) (PAGÈS-UIGDEMONT, N. et al, 2016).

Vitamin B_{12} is soluble in water and it is extremely important for the maintenance of the neuronal health and hematopoiesis (ABDULKHALEQ et al, 2018). The appearance of oxidative stress and diseases correlated with age have simultaneity with the deficiency of the same one, since there is a connection between Vit. B_{12} and markers of peripheral neuronal function and

increasing of oxidative stress, all of which are indispensable for prevention of the appearance of age related diseases (LAGEMAAT et al, 2019).

Anxiety disorder is one of the examples of these dysfunctions of the nervous system. The same one can be diagnosed through somatic and cognitive clinical manifestations (WILSON et al, 2018). The characteristic symptoms are increasing blood pressure, exacerbated worry of thoughts, feelings tension, derealization, perspiration and anticipation of future threats (CARLUTTI et al, 2018). Depression also fits on these neuronal changes, and it is characterized as a state where the human being is strenuous. In this context, there is an enormous difficulty for the individual to control his or her life due to mental and physical weakness (BALSAMO et al, 2018). Exacerbated worry, hypochondria, persistent sadness, melancholia, and insomnia are the personification of a depressive individual, considered a patron status, in which the individual becomes incapacitated (PARK et al, 2017). The exacerbated consumption of drugs with the consequent reduction of vitamin B_{12} levels, for example, may also increase stress levels, in which after a physical or psychological exhaustive stimulus, the organism starts producing a reaction against the object identified as a stressor (BITO et al, 2017) (PELUSO et al, 2018). From this, the brain processes the stimulus produced by the stressor, and it generates the answer that may result in psychological and / or physiological changes in the human being. This reaction can be diagnosed through signs and symptoms, such as tissue injury and increasing oxidative stress (KULLMANN et al, 2018). Knowing about the repercussions of polypharmacy use in the therapy of the individuals with anxiety, depression and stress and its effects in the long run, it is necessary to evaluate the use of medication, non adhesion and correlation with the presence of psychological factors in patients with the pathologies mentioned above.

II. METHODOLOGY

This is a descriptive, profile and quantitative approach, performed in the city of Vitória da Conquista, Bahia, Brazil (Latitude: 14 ° 51 '58 "S; Longitude: 40 ° 50' 22" W), located on 518.8 km from the capital. The study is a fraction of a project entitled "Systemic Evaluation of Chronic Diseases in the population of southwestern Bahia" and this one has as objective to evaluate drug therapy in the presence of psychological factors in individuals of both genders, from 45 to 60 years old. It is worth noting that the age range was chosen due to the hormonal constancy in the individuals who belong to the same one and that the sample was composed by

389 individuals. For obtaining the results, the participants were invited to answer the following questionnaires:

a) Socioeconomic Questionnaire: it aims to evaluate the socioeconomic profile of individuals that are, on several times, associated with the appearance of diseases. The sociodemographic variables (age, schooling, marital status, family arrangement, employment status, family income, contribution in family income) were collected through an own questionaire, by following the standards of the Brazilian Institute of Geography and Statistics (IBGE) (DUARTE, S. F. P. et al, 2019).

b) BAI (Beck AnxietyInventory) - Beck Anxiety Inventory: Self-report scale, constituted by 21 items, that measures the intensity of anxiety and contains descriptive affirmations of anxiety symptoms. The items must be evaluated by the subject with reference to themselves, in a scale of 4 points, by according to the Portuguese Manual of the Beck Scales, that reflect severity levels of each symptom as: 1) "Absolutely not"; 2) "Lightly: it did not bother me so much"; 3 "Moderately: It was very unpleasant, but I could afford it"; 4) "Severely: I could hardly afford it" (DUARTE, S. F. P. et al, 2019).

c) BDI (Beck Depression Inventory): a self-report scale by 21 items, each one with four alternatives, by implying increasing degrees of severity depression, with scores ranging from 0 to 3. Items were selected based on observations and reports of symptoms and attitudes more frequent in psychiatric patients with depressive disorders, and they were not chosen to reflect any theory of depression in particular (DUARTE et al, 2019).

d) Lipp Adult Stress Symptom Inventory (ISSL): The symptoms listed on ISSL are typical of each stage. In the first chart, composed by twelve physical and three psychological symptoms, the patient signals with F1 or P1 the physical or psychological symptoms that they have experienced in the last twenty four hours. The second chart is composed by ten physical and five psychological symptoms, the patient scores with F2 or P2 the symptoms that they have experienced in the last week. The last chart is composed by twelve physical and eleven psychological symptoms, in which the patient must signal with F3 or P3 the symptoms that he has experienced in the last month. In total, the ISSL presents 37 somatic nature items and 19 psychological items, with symptoms often repeated (DUARTE et al, 2019). e) ABUEL: It is a multidimensional instrument that provides indicators of pre-existing diseases degree, whose questions aim to evaluate the cognitive capacity of the interviewees, personal relationships, well-being, eating habits, mental health and their behavior and after indicates the pathological profile, quantifies the use of medications, in

order to verify if the same one makes use of polypharmacy and the regularity intake of the same one (SOUZA, 2014).

After obtaining the data, these ones were tabulated and processed by the Excel program and after imported into the SPSS scientific software in version 20.0. The analysis was performed by considering a level of significance of $p < 0.05$, in which the Chi-square test was applied. The project was approved by the Ethics and Research Committee (CEP) of Esau Matos Hospital. The participants were clarified about the methods to be used and signed the Free and Informed Consent Term (TCLE), according to Resolution 466/2012.

III.   RESULTS AND DISCUSSION

In this study 389 individuals of both genders were integrated, 280 of the female gender (72.0%) and 109 of the male gender (28.0%). Some individuals chose to hide information as answering items during the application of the questionnaires, therefore, the study presents some incomplete variables. Most of the interviewees were classified in a significant way in class D, and composed in its majority by working class (76.9%) the schooling of these ones is medium in its totality, with 29.6% presenting the complete high degree, 22.4% have complete higher education, and only 5.4% are illiterate, of which 15.2% studied in a private education network and 78.7% studied in the public education network, 67.1% were married. The other particularities of the sample are described in table 1, below.

Table 1 – Description of the samples of the participants of the stufy in question.

		n	%	Total
Gender	Female	280	72	389
	Male	109	28	
Social Class	A	1	0,3	329
	B	23	7	
	C	88	26,7	
	D	154	46,8	
	E	63	19,1	
Work	Yes	112	36,6	306
	No	194	63,4	
Schooling	Incomplete elementary school	89	22,9	381
	Complete primary education	20	5,1	
	Incomplete high school	21	5,4	
	Complete high school	115	29,6	
	Incomplete higher education	28	7,2	
	Complete higher education	87	22,4	
	No schooling	21	5,4	
Marital Status	Single	73	18,8	386
	Married	261	67,1	
	Divorced	43	11,1	
	Widow	9	2,3	
Type of Education	Public	306	78,7	365
	Private	59	15,2	

Own Research, 2018.

Self-perception of health differs between genders, since most men, even after receiving a diagnostic of a chronic disease, they strive in a decelerated manner for seeking medical attention, possibly due to the lack of severe symptoms or more difficulty by accessing health services than women, due to the greater care taken with their health condition, they make with higher frequency their health / disease. This fact, the calculation of the chronic diseases diagnosis and complications in the female genus are presented as super (ROSSANÉIS et al., 2016.)

The social factors affect health and well-being, especially in low socioeconomic environments, because it is a multifactorial mechanism that may be on the basis of unfavorable health outcomes. In this study, there is a greater number of people allocated to social classes C and D, and it can finally prevent that the individual could have adequate life habits for the purpose of preventing comorbidities (HILL et al, 2019).

The ingestion of diabetes medications in anxious, depressed, and stressed individuals was low, since only 17 interviewed reported to intake daily, compared with non-anxious, non-depressed, and non-stressed individuals. Stressors ones were more likely to report diabetes medication intake, since stress is a biological marker in the development of diabetes, and the answer generated through it is an indispensable factor for in order that the patient understand the process of adaptation and adherence to the medication use (VICTORIO, 2016).

It is important to emphasize that patients who present with the clinical condition of diabetes associated with anxiety or depression adhere in a low proportion to the drug therapy, lifestyle, by generating an unsatisfactory prognosis for the presented comorbidities (KNYCHALA et al, 2015) (ELAMOSHY et al. al, 2018).

There are several factors that correlate so that the individual can follow with the correct drug therapy, among these ones the professional counseling so that the patient can know the disease and understand the need of the following appropriate therapeutic against their situation, easy access to the medication and favorable social factors (CARDOSO et al, 2019).

The description of the drug therapy related to the anxious, depressed and stressed patients of the study sample are detailed in table 2.

Table 2. Description of the drug therapy of the study of participants based on anxiety, depression and stress.

Variables	Use	Anxiety				Depression				Stress			
		Without	With	Total	p - value	Without	With	Total	p - value	With	Without	Total	p – value
Med. For Diabets	Daily	9	3			11	3			5	8		
	Weekly	0	1	272	0,208	1	1	297	0,323	1	1	286	0,953
	Never	197	62			239	42			108	163		
Med. Naturals	Daily	11	3			11	3			2	12		
	Regurlarly	17	5	272	0,907	22	2	297	0.329	8	14	287	0,083
	Weekly	24	10			29	9			12	27		
	Never	153	49			189	32			93	119		
Med. For pain	Daily	9	8			9	8			3	14		
	Regurlarly	27	12	275	0	35	7	299	0,001	13	26	290	0,003
	Weekly	74	33			92	18			37	74		
	Never	99	13			117	13			64	59		
Med. For Sleeping	Daily	4	6			5	5			1	9		
	Regularly	1	2	275	0,011	2	1	300	0,013	0	3	289	0.044
	Weekly	8	1			8	2			2	8		
	Never	196	57			239	38			113	153		
Med. For Depression	Daily	6	7			8	4			4	9		
	Regularly	0	1	274	0,006	1	0	299	0,331	0	1	288	0,447
	Weekly	-	-			1	0			1	0		
	Never	203	57			243	42			111	162		
Med. For Anxiety	Daily	6	6			11	3			2	12		
	Regularly	2	0	272	0,164	22	2	46	0,005	8	14	287	0,796
	Weekly	3	1			20	9			12	27		
	Never	195	59			189	32			93	119		

Source: Own Research, 2018

Significance Level on p<0,95.

In the described findings, it was verified that the anxious individuals were more likely to report higher intakes of natural drugs for pain, sleep and depression, but the consumption of these drugs by non-anxious occurred more significantly. Depressants individuals were more likely to report higher intakes of natural drugs for pain, sleep and anxiety, but the consumption of non-depressants occurred more significantly. Stressed individuals were more likely to report higher intakes of drugs for diabetes, natural, pain, sleep, depression and anxiety compared to non-stressed individuals. The use of several drugs is a risk factor for intensifying the effects caused by therapy, and such conduct is justified due to the multiple complications caused by the diseases and the need of treating these ones. Polypharmacy has high probability of increasing the risk factors associated with pharmacological interactions (SANTANA et al, 2017). Our results indicated that 18 anxious, 14 depressed and 53 stressed claimed to accomplish the intake of natural medicines. Natural medicines can be used through a combination of existing drugs against a specific chronic disease, whose behavioral intervention is specific and so that pre-clinical studies prove their efficacy and safety of the same ones, by aiming to improve the clinical results of the patients, since there is an expressive decline in adherence by industrialized drugs (BULAJ, G. et al, 2016).

Our results indicated that 53 anxious, 33 depressed and 114 stressed subjects reported on realizing to intake pain medication. Chronic pain is subjective, since the same one belongs to the individual consciousness domains and it varies according to cognitive factors (SOUZA et al, 2017). The anxious ones are selective to the painful stimuli due to their of hypervigilance state, by propitiating a considerable decrease on the distraction against the stimulus and consequently the perception of the pain is increased, by having the potential to chain the anticipation of this one (CHAYADE et al, 20190) (BURSTON et al, 2019).

Depressive individuals have a two-way association with chronic pain due to take the stricken for the social isolation, by aggravating the symptoms of this comorbidity. In this case the drug therapy shows a marked ineffectiveness, due to the complaints of physical pain predominate the diagnosis. The pain symptom usually presents with more frequency in individuals who simultaneously cope with anxiety and depression, since the pain is capable of generating anxiety feelings, increasing the perception of pain, possibly it will bring on the pain catastrophization (HUNG et al, 2018) (HEER et al, 2014).

Stressed individuals generate a physiological answer to chronic pain, that is able to increase respiration, heart rate and blood pressure, triggered by the release of catecholamines and glucocorticoids. Pain may be triggered by stress, just as stress may be triggered by pain, however, pain sensitivity is an individual adaptive and physiological process, a virtue of adapting of the situation in which the individual is allocated (TIMMERS et al, 2018). It was investigated that 9 anxious, 8 depressed and 20 stressed claimed to realize the intake of medicines for sleeping. It is indispensable that the human being enjoy a quality sleep for maintaining a vigil adequate to the necessary and essential standards (GAO et al, 2018). Insomnia is viscerally linked to anxiety, the same one causes an abrupt decrease in sleep quality, since anxious arouses with more frequency during the night and morning rest. The drugs prescribed to induce sleep cause a significant decrease in the cognition of the anxious due to its sedative effect, thus increasing the risk of adverse effects in these patients (HARRIS et al, 2017). Insomnia is a source for triggering the signs and symptoms of depression, the depressed person maintains a waking state and stays awake all night and stays sleepy by yourself during the day, so it becomes necessary the drug therapy for helping the patient who suffers with the suppression effect caused on a large scale by medications to treat comorbidity (STEIGER, 2019). Insomnia is related to the stress against some causative agent, usually caused by negative events. The stressed individual presents a decrease on the overcoming capacity, and be able to negatively influence on the regulation of excitation and emotion, by maintaining insomnia (PALAGINI et al, 2018) (DRAKE et al, 2014). Our results indicated that 7 anxious, 4 depressed and 10 stressed patients claimed to take medication for depression. For anxiety and stress patients who suffers with anxiety and stress, the intake of medication for depression was greater compared to patients who did not present the psychological factors, as for depressive patients, the use of this medication was lower compared to patients who did not attend with psychological factors. Anxiety patients are commonly treated with benzodiazepine and antidepressants medications because of the effective answer that the same one produces, but these drugs cause side effects that are similar to the anxiety symptoms, and thus anxious people interrupt their medication intake, by increasing their non-adherence to the treatment and consequently the worsening of the anxiety condition (GOMEZ et al, 2018).

It was noted that depressives do not adhere to drug therapy for depression, by causing to non-efficacy of the treatment. There are evidences that patients who go on

with depression in a maintaining state of the improvement of condition is the stage in which more patients withdraw from the treatment, in view of the side effects caused by the drugs, and this is correlated with the decrease on beneficial effects and its correlation with non-adherence (PINO-SEDEÑO et al, 2019). Patients with chronic stress are more likely to trigger the depressive condition, because a stressed individual is considered as an imminent factor for developing depression, to the detriment of the exacerbated release of noradrenaline due to the exhaustive neurons activity, soon arises a greater need to use drugs to treat the depression (SEKI et al, 2018).

Our results indicated that 7 anxious, 8 depressed and 13 stressed individuals claimed to realize the intake of medication for anxiety. For anxiety and depression patients who make the intake of medications for anxiety was lower compared to patients who did not present psychological factors, while patients who were stressed the use of these medications was greater compared to patients who did not attend with the psychological factors.

IV. FINAL CONSIDERATIONS

The present study performed by the Nucleus of Extension and Research of Chronic Diseases (NEPEdc) has made viable a superior comprehension of the theoretical-practical character, so that it would allow the interpretation of therapy and drug adherence in patients with the anxiety psychological factors, depression and stress, as well as the characteristics of the sample in what refers to the gender, social class, work, schooling, marital status and kind of education.

Moreover, it was identified that the patients use several medicines and in their great majority have difficulties in following the prescribed therapy correctly, therefore it is necessary to perform following up pharmacotherapeutic with these patients, by intending to increase the quality of life and health, so that the therapy becomes accessible, safe, effective, and correct.

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Implantation Process of Medicine Suppliers Qualification Used in a Domiciliary Assistance Service

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Abstract— *The Hospital Pharmacy, is subjectively known as a "clinical care, technical and administrative unit, in which the activities performed are directed to pharmaceutical assistance, by constituting the organizational structure of the hospital and functionally integrated with the other administrative units and patient care," by having as responsible the pharmacist. The present study is about a descriptive research, using quantitative methods, in which the drugs suppliers of the Pharmaceutical Supply Center (PSC) of a Home Care in the city of Vitória da Conquista were evaluated in the period from February to April of 2019. The research field is an establishment classified as Home Care, that is a care service with patients in home care and urgency and emergency removals, specialized in the care from low to high complexity, with a spread of municipal care, regional and in some cities of the south, southwest and west of Bahia. It was identified in our results that a large number of drug suppliers had their own delivery, delivered the drug by the deadline, maintained the integrity of the drug, and all the ones had the lot equal to the electronic invoice (NFE). However, some suppliers did not have the vehicle suitability for transporting the medicines, the validity of the drug supplied was less than 12 months. It is perceived the importance of the pharmaceutical professional, both in storage as well as in transportation so that everything is done within the established standards by the health agencies. The handling of the medicines so that be prevented all kind of adverse events, be it contamination, expiration date, fake lots, damaged boxes must be taken into consideration all the aspects of safety.*

I.   INTRODUCTION

The Hospital Pharmacy, is subjectively known as a "clinical care, technical and administrative unit, in which activities are conducted for pharmaceutical assistance, by constituting the organizational structure of the hospital and functionally integrated with other administrative units and patient care," having as responsible the pharmacist (1-3).

Encountered the usual need for financial means and seen by most of health organizations, it is important that the same ones can make that suppliers not only present to them profitable and advantageous conditions, but also the warranty of being able to count on an agile and vertiginous service, reliable and of quality, besides a wide range in the line of products and hospital drugs (4, 5).   The increase in spending on medicine purchases in the last years has increased in a frightening way, as a result of different conditions, in which, among them, there is the growth of the search for health care subsequent to the aging of the people, the chronicity of different disorders, consumption of new therapeutic possibilities of high cost and application of therapeutic resources more and more implemented (2,6, 7)

The third age stage hinders so much the processes of absorption, distribution, metabolism and excretion of the drugs and leading to changes in the pharmacotherapeutic treatment, however one of the factors that hinder is the pharmaceutical form and the administration routes. A series of events may occur

during the phases of absorption, distribution, metabolism, and excretion of the drug (ADME), that may lead to an increase or decrease of concentration of the same one, and for potentially toxic or underdose effects (8-10).

In the midst of every problem analyzed so far. The understanding and importance of the pharmacist in the hospital setting is perceptible and that his / her functions are very broad. Given that the main role of the hospital pharmacist is in the improvement of the use of medicines where it is going on the intervention by identifying the problems related to medications, and thus contributing for reducing this problem (2, 11, 12).

II. METHODOLOGY

The present study is a descriptive research, with the use of quantitative methods, in which the medications suppliers of the Pharmaceutical Supply Center (PSC) of a Home Care in the city of Vitória da Conquista were evaluated in the period from February to April of 2019. The research field is an establishment classified as Home Care, that is a care service with patients in home care and emergency and urgency removals, specialized in the care from low to high complexity, with a range of municipal care, regional and in some cities of the south, southwest and west of Bahia.

The service has a physical structure for the Pharmaceutical Supply Center, destined for the storage and stock of medicines and medical hospital materials, and a specific area for the hospital pharmacy that counts on the technical and administrative sector and an area destined to the storage of medicines and materials for dispensing to the homes of the patients of home hospitalization and treatment in the ambulance.

The transport is constituted by a logistic where the receiving medication is realized that are delivered by the suppliers and the merchandise is checked through the purchase order and the invoice of the medicines, in this process the medicines are designated to a quarantine method until the invoice entry be made in the stock via online system.

As the research field did not have an evaluation routine of suppliers, the study was conducted on the steps of supplier selection, purchase evaluation, document evaluation and evaluation of the product received. It was included since the establishment of the flux activity, definition of the evaluation of standards, preparation of the evaluation instrument (nonconformities form), data collection and evaluation of results. After the planning steps, the work team was trained in order to systematize the filling process of the nonconformities form (Figure 1).
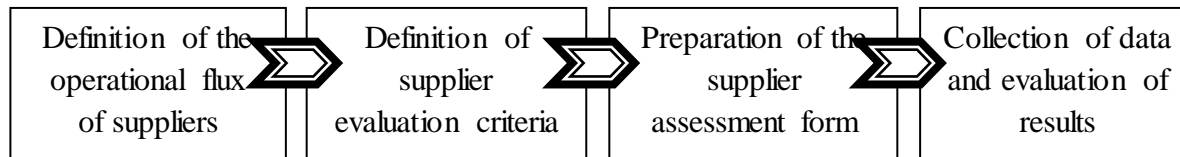
Fig.1: Stages of the methodological process of the evaluation study of drug suppliers, Vitória da Conquista (BA), Brazil, from February to April 2019.

The operation flux activities was default through agreement of the pharmacy team together with the responsible pharmacist and a pharmacy student in order to introduce on the logistic period of receiving suppliers. In such a way, that at the moment that the supplier appeared in the PSC receiving area, the conformity between the invoice and purchase order (PO) was evaluated.

Then, the invoice, the technical report and the products were evaluated, with subsequent registration of the data on the non-conformities form. Being analyzed the existence of some divergency the logistic officer was oriented to consult the pharmacist, who opted for the receiving or returning of the products according to the criticality analysis of the drugs received. Posteriorly, it was realized the storage of products and the filling of the worksheets regarding the data collected.

The nonconformities form was prepared based on ABNT and RDC norms 44/2009. It was included the following information: discrepancies in the invoices in relation to the purchase order (absence of the OC number, NRLE - National Registry of Legal Entity, delivery different from that requested in the purchase and nature of the transaction); delivery conditions and packaging integrity (temperature, identification, validity of less than a year); unidentified packaging (name of product, number of units, validity, lot); Quantity of product different from that identified (in the package and invoice) and delay on delivery of the request.

Suppliers were categorized as to their legal nature (distributors); locality (region) and category of product delivered (plain medicine, psychotropic and antimicrobial). The suppliers who performed at least one delivery in the three months evaluated were included in

the research. The data collected were computed by the Excel 2007 program of Microsoft Office, with a posteriorly simple descriptive statistical analysis.

III. RESULTS AND DISCUSSION

It was identified in our results that a large number of drug suppliers had their own delivery, they delivered the drug on the deadline, maintained the integrity of the drug, and all the ones had the lot equal to the electronic invoice (EI). However, some suppliers did not have the suitability of the vehicle for transporting the

medicines, the validity of the supplied drug was less than 12 months. Detailed information can be observed in the description of table 1.

Medications are vital components of patient care all over the world. The World Health Organization (WHO) defines essential medicines (EMs) as products that satisfies the priority health needs of the population, that must be available on health units at all the times in appropriate quantities at an affordable price by the community (13).

Table 1.

		n	%
Delivery	Own of the Supplier	11	55
	Transporter	9	45
Suitable of the vehicle	Yes	9	45
	No	11	55
Delivery on Deadline	Yes	16	80
	No	4	20
Order EI	Yes	1	5
	No	19	95
Integrity of Medication	Yes	19	95
	No	1	5
Validity Less Than 12 Months	Yes	9	45
	No	11	55
Lote Equal the EI	Yes	20	100
	No	0	0

Source: Own Research, 2019.
EI – Electronic Invoice.

All medicines must be packaged safely and transported by safely way and secure. This should be shown if requested by a client or by any other person who has reason to verify the identity of the drug (14,15). The medicine transport is a very important point to be raised, since all the integrity of the product, durability, reliable use, is not only defined by the manufacturer, since the route that the medicine travels until reaching the final recipients are also of extremely importance for their quality (16,17).

The transport of medicines between health services is realized by companies contracted for the circulation of pharmaceuticals and other miscellaneous articles. Medicines may go along a patient from one unit to another one in an ambulance or transport authorized by the hospital or by taxi. The person who transports the medicines is responsible for their safety until they have been delivered to an authorized person and acknowledged delivery (18, 19).

Refrigerated storage for medicines that require this support is another important factor for quality,

whether it is stored in refrigerators at health centers or even on refrigerated trucks for transport, the temperature must be keeping constant so that the medicines do not have their quality compromised (20,21).

In relation to the stock of medicines its management of is vital for the pharmaceutical supply system, that involves the management of the routine pharmaceutical order process (14, 22). It helps to maintain a constant supply for the patients, thus avoiding that the stock of products and minimizing the costs of maintaining the stock. Accurate and up-to-date inventory records are crucial for proper inventory management, since they are used to calculate future needs (13, 23, 24).

IV. FINAL CONSIDERATIONS

It is perceived the importance of the pharmaceutical professional, both in storage as well as in transportation so that everything is done within the standards established by the health agencies. The handling of medicines to prevent all the types of adverse events, be it contamination, expiration date, fake lots,

damaged boxes must be taken into account all aspects of safety.

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Evaluation of Adhesion to Pharmacological Treatment in Elderly with Systemic Arterial Hypertension

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Abstract— *Systemic arterial hypertension (SAH) is a chronic, asymptomatic and multifactorial disease, characterized by elevated and sustained pressure levels. SAH is the main risk factor for serious cardiovascular complications, such as acute myocardial infarction, chronic renal failure, stroke and heart failure. The objective of this study is to evaluate the adherence to the pharmacological treatment of systemic arterial hypertension in a pharmacy network in a city in the interior of Bahia. This is a descriptive and exploratory quantitative study, performed with 40 elderly patients with systemic arterial hypertension (SAH) in a network pharmacy in Vitória da Conquista, the pharmacy network has three establishments located in different locations in the city, thus covering several carrier profiles. As an instrument for evaluotioning adherence, a structured questionnaire was applied with socioeconomic variables, based on the adherence scales according to the Morisky and Green Test. The prevalence occurred in female representatives, who represented 52.5% of the total sample, the most important age group was among the elderly from 60 to 70 years old, by corresponding to 55% of the 40 hypertensive elderly interviewed, 45% have studied until the current fifth year. In reference to the monthly income of the family group, 65% of the interviewed affirmed that they receive from one to three minimum wages. According to the obtaining of the medicines, 33% of the participants purchase in public pharmacy, 35% in private network and 32% acquires in both parts. The approaching elements demonstrated the importance of implementing health care models that incorporate diverse individual and collective strategies in order to improve the quality of care and adherence to treatment.*

Keywords— *Chronic diseases. Arterial hypertension. Public health.*

I. INTRODUCTION

Systemic arterial hypertension (SAH) is a chronic no communicable disease (CDN) of multifactorial origin and is considered a serious public health problem, as it affects many people around the world. It is estimated that a part of the population with arterial hypertension is unaware of its pathology because they are asymptomatic, constituting an important group of risk for other diseases (Araújo et al., 2016; Bonadiman et al., 2012; Gomes et al., 2017).

SAH is the most frequent morbidity in Brazil and is considered a risk factor for the development of serious health complications, such as cardiovascular, cerebrovascular and renal diseases. Approximately 250,000 deaths per year are due to CD in Brazil, about 40% of deaths due to stroke are caused by hypertension, and 25% of deaths due to coronary artery disease are also due to this condition (Lade, Lima, 2014).

The main characteristic of SAH is the elevation of pressure and supporting of pressure values. Currently, established values for hypertension is greater than or equal to 140/90 mmHg for the general population and greater than or equal to 130/80 mmHg for patients who have advanced age associated with cardiovascular risk or underlying disease such as diabetes and chronic kidney disease (Jardim, 2017).

In general, hypertension is asymptomatic, and often its carriers are misdiagnosed or only discover when

they have some chronic complication (Miller et al., 2016, Costa et al., 2016).

The elderly are the main carriers of hypertension. This fact can be justified according to the physiological changes of the organism that evidences a decrease in the normal functioning of normal systems, making the patient vulnerable to these chronic diseases (Medeiros et al., 2014; Campolina et al., 2013, Veras, 2011).

Several variables contribute to the development of SAH, such as smoking, alcoholism, stress, family history, obesity, among others (DeVechio et al., 2017). Thus, antihypertensive drugs are used to treat hypertension. The primary objective of this therapy is to reduce the morbidity and mortality of patients who have a high predisposition for CD and other complications resulting from this clinical condition (Corrêaet al., 2005).

Beyond that, no pharmacological treatment should be integral to drug therapy so that the carrier has benefit effects. As a result of this fact, it is of the utmost importance that the patient makes the correct adhesion of the medications to control the blood pressure, in order to avoid possible complications, and the biggest obstacle for health professionals is the lack of blood pressure control (PA) (Freitas, Nielson, Porto, 2015).

The Therapeutic adherence (TA) consists of the commitment and responsibility adopted by the patient in relation to their treatment, established by a qualified health professional. Thus, AT expresses to the carrier the reality and the science of the therapy used to treat its clinical condition. The phenomenon of adhesion comprises several areas that warranty improvements to the health of the patient, such as drug adherence (Rocha et al., 2008).

Therefore, several factors may interfere in TA, among them, the lack acknowledge the patient about the disease and his / her behavior towards drug taking. The difficulty of access to the health system, cost, quantity of drugs and number of daily doses of prescribed medication, besides adverse effects and resistance to treatment, are variables that may impair the course of the treatment established (Freitas; Nielson; Porto 2015).

According to these information, many people carrier with SAH may be resistant to pharmacological treatment and therefore do not adhere to the prescribed therapy. It is estimated that approximately 40 to 60% of patients with this disease do not adhere correctly to therapy. Another essential factor is also important to note that many elderly people are non-adherent, since they have physiological limitations that impede the proper use of the drug (Vancini-Campanharoet al., 2006; Rocha et al., 2008). In this context, the objective of this article is to evaluate adherence to the pharmacological treatment of

systemic arterial hypertension in a pharmacy network in a municipality in the interior of Bahia.

II.   MATERIALS AND METHODS

This is a descriptive and exploratory quantitative study. The scenario of the study was the city of Vitória da Conquista, that is represented as the third largest city in Bahia. It has a population of 320,129 inhabitants and is a distance of 509 km from Salvador, its capital. The economy of the region is mainly focused on agriculture, livestock and health. And the city as a center of reference in health for more than 70 municipalities (Kochergin; Proietti; César, 2014; Cardoso; Melo; Cesar, 2015). Vitória da Conquista has a local Regional Pharmacy Council (CRF) and according to the information collected by the author, approximately 108 pharmacies are registered. The present research was performed in a pharmacy network that has three establishments located in different locations in the city, thus covering various profiles of carriers. On average, approximately 18,000 people are treated per month in all these three units.

The study population was the elderly carrier with systemic arterial hypertension (SAH) in the city. The classification for the elderly, according to the World Health Organization (WHO), in developing countries focuses on 60 years.

The sample used for developing of the work was configured in 40 elderly people. This number was established according to the flow of the elderly who entered in the pharmacy network between August and October 2018. The elderly included in this research were those ones who were aged 60 years or older and of both sexes, randomly chosen and who are under pharmacological treatment for SAH.

Data collected occurred through a direct interview with the participants. The research instrument was developed based on the work of Elias (2011) that uses adhesion scales according to Moriskt and Green test. The procedure was performed in a reserved place in order to avoid unnecessary exposure of the wearer.

Data obtained were tabulated and organized into spreadsheets, graphs and tables in Microsoft Excel® 2010. Univariate analysis was performed based on absolute frequencies and percentage frequency distribution. In addition, the project was submitted to the Ethics Committee of the Faculdade Independente do Nordeste - FAINOR, and it was authorized through Ordinance no. 2,769,959. The participants involved in the research signed the Informed Consent Term (TCLE).

III.   RESULTS AND DISCUSSION

In the sample studied, a higher prevalence was observed in females, that represented 52.5% (n = 21) of the total sample. This data was similar to the one found by Tavares and contributors. (2016), when they evaluated the quality of life and adherence to the pharmacological treatment among hypertensive elderly, so that the predominance was also female.

Corroborating with Oliveira et al. (2008), the biological factors and the divergence of exposure to the risk factors of mortality, contribute to this increase be justified in women. David and collaborators (2013) complement this assertion when they approach the climacteric and its consequences in women, especially weight gain and obesity, which are factors that interfere in the emergence of several chronic diseases, such as hypertension.

As to the feminization of old age, it contributes much for obtaining this result, and we can still observe that women are more concerned with health than men, self-care and the search for health services for monitoring, diagnosis and control of certain pathologies, facilitate the identification of SAH in this public (Dias et al., 2019).

In relation to the age group, the highest percentage was in the range of 60 to 70 years, corresponding to 55% (n = 22). The result, however, differed from the study by Aiolfie et al. (2015), since most of the hypertensive elderly present on the study of the authors were older than 71 years (n = 69). The work by Andrade et al. (2014) also had a different result from the present research, and the interval with the highest concentration was between 70 and 79 years (30%). This data may demonstrate that HBP has been increasing by affecting the younger population, requiring medication to control the risk factors associated with the disease.

The relation between the age of the patient and hypertension is quite considerable, since over the years there is a decrease in the integrity of physiological systems and, in contrast, the vascular system is most affected, especially the renin-angiotensin-aldosterone system (RAA), that can suffer a modification and overload the entire organism, by maintaining the systemic blood pressure higher (Barbosa et al., 2016; Magalhães, 2012; Bhattacharya; Alper, 2014).

In case of physiology, there is still a rigidity in the blood vessels with advancing age, mainly due to the normal dysregulation of the vasodilator and vasoconstricting substances, associated with the genetic factors and the lifestyle of the bearer over the years, which may influence directly into the bloodstream (Barbosa et al., 2016).

Given the above, the physical vulnerability of the elderly and the limitations that arise in this phase of life,

interfere directly to the occurrence of chronic diseases. Some examples of these limitations are difficulty for locomotion, the lack of regular physical exercises and the prescription of restricted and specific diets, which can result in a compromising of the quality of life and, consequently, the clinical picture of the individual becomes worse (Campolina; Dini; Ciconelli, 2011).

Concerning to the ethnicity of the interviewees, 57.5% (n = 23) they declared themselves to be of a brown color. However, Massa and collaborators (2016), when they analyze hypertensive elderly in their research, they found a predominance of black skin color. Although this relative difference had been found, the miscegenation is a strong coefficient in Brazil. Thus, self-reported brown individuals are influenced by black skin color, because they are result of mixed breed (Iser, et al., 2015).

Therefore, the work of Serra et al. (2015), this category can be divided into whites and nonwhites (in which it covers brown and black individuals). According to Tavares et al. (2018), THE black race is a risk factor for the development of hypertension and it elucidate the high mortality rates in black individuals who have some cardiovascular disease, in comparison with populations of other races, for example.

Religion was another variable evaluated and the finding was extremely relevant, in which 70% (n = 28) of the elderly say they are Catholic. According to Abdala and contributors. (2015); Silva et al. (2016), older people tend to be more religious as they are compared with individuals of different age groups, by adding that religion provides greater benefits to the quality of life, since this public shows to be more active in religious activities and keep remains the optimistic in relation to the treatment and illness, through prayers.

In relation to schooling, 45% (n = 18) of the 40 hypertensive elderly interviewed studied until the current ATUAL fifth year (formerly known as primary, from the first to fourth grade of primary education). Similar results were found in the work of Aiolfi et al. (2015), in what they evaluated adherence to the medication use among elderly hypertensive patients and they found that the majority of the studied researched population (76%) had low educational level, with some degree of instruction.

The authors Lobo et al. (2017) and Andrade et al. (2015) bring data from the National Health Survey in their work and they describe the trends in the prevalence of SAH in Brazil. The preponderance of both studies revealed that the individuals with more advanced age and with less education, are more prone for developing the disease.

According to Zaitane et al. (2006) the level of schooling is linked to the risk factors that may contribute to the

development of hypertension, such as lifestyle. In addition, Pinheiro et al. (2018) elucidate that the lack of information can contribute t that the holders of SAH be prevented of performing an adequate follow up and they are unaware about the consequences of no adherence therapeutics.

It was also evaluated the place of residence of the elderly participants, and it identified that 95% (n = 38) reside LIVE in Vitória da Conquista, Bahia. This variant is important, since it can directly impact IN the adherence to the treatment of the patients, since the no displacement of the patient to acquire treatment in another place reflects in its comfort and quality of life (Rêgo et al., 2018).

The subsequent variable was the marital status of the elderly interviewed, and the most frequent data was concentrated around the elderly who were married or lived with a partner with a score of 57.5% (n = 23). Aquino et al. (2017) developed a survey of hypertensive elderly people and the percentile found in individuals who have married or who have lived in stable union were similar and it represented 58.17% (n = 145).

Accompanied by the marital situation, it was possible to analyze four other aspects that are complementary to this question: where he/she lives, with whom he/she lives, how many people live in his/her residence, the monthly income of the family group and occupation, which are shown in table 1.

Table 1. Social and housing characteristics of elderly patients with systemic arterial hypertension (SAH), interviewed in a pharmacy network in Vitória da Conquista, Bahia.

Variables	Frequency	
	n	**%**
Where do you live		
House or apartment with the family	34	85
House or apartment alone	6	15
Who do you live with		
Children	7	17,5
Husband and children	15	37,5
Husband or partner	8	20
Other relatives, friends or classmates	4	10
Live alone	6	15
How many people live in you household Including the interviewed		
Two people	9	22,5
Three people	10	25
Four people	6	15
Five people	6	15
Six people or more	1	2,5
Live alone	8	20
Monthly income of the family group		
Less than one minimum wage	13	32,5
From one to three minimum wage	26	65
From three to six minimum wage	1	2,5
Occupation		
Worker	5	12,5
Retired / Pensioner	26	65
Self employed	9	22,5
Total	40	100

Source: Data collected by the researcher (2018).

In agreement with Muniz and collaborators (2017) it is indispensable that the elderly live with their relatives, because this experience helps, mainly, in the adherence of drug therapy. Warneret al. (2015) supplement this statement as they present a study about aging in Germany and they point out that the social and family support network contributes positively to the quality of the elderly life, especially in mental, by reducing symptoms of anxiety and depression, for example.

In reference to monthly income of the family group, 65% (n = 26) of the interviewed stated that they receive from one to three minimum wages. Santos and Ferreira (2018) and Dias, Souza and Mishima (2016) presented a reality similar to the finding, as they report that the hypertensive elderly in their respective jobs are supported by up to two minimum wages.

Retirement wasthe most marked occupation among the interviewed 65% (n = 26). Similar to the work done by Dias et al. (2015) thatalsoobserved that the elderly hypertensive retired, represent a large part of the sample number used in their research, BY corresponding to 88.46% (n = 23). The income based on retirement provides to the elderly a better adherence to pharmacological treatment, because he can go to the private sector and buys the drug prescribed. While 33% of the elderly (n = 13) warranty the medicines through the public service. The result was directly similar to thatone found in the work of Alvese Ceballos (2018), that obtained a larger number of elderly hypertensive patients, who acquired drugs in the private sector.

The great obstacle that the elderly who buy medicines in the public sector can face is the complexity of the service and the lack of obtaining the medication, that impedes the therapeutic adherence and, consequently, the stability and improvement of the clinical condition (Ferreira et al., 2013 Santos et al., 2014).

According to Bonadiman et al. (2012), the majority of the elderly obtain their medicines in the public network and in the private network, since not all of them are available in public pharmacies. Therefore, it presents a difficulty in obtaining antihypertensive drugs. In another study proposed by Cunha et al. (2012) and Cintra et al. (2010), the elderly presented some difficulty in medication acquisition, by including the lack of medication in the unit, financial conditions and distance from the health unit.

The regarding information to the lifestyle of the bearer and habits adopted by them are shown in Table 2. These ones can be configured as modifiable risk factors for the progression of hypertension and possible development of other diseases of the cardiovascular system.

Table.2: Risk factors adopted for elderly patients with systemic arterial hypertension (SAH), interviewed in a pharmacy network in Vitória da Conquista, Bahia.

Variables	Frequency	
	n	%
Smoking		
No	38	95
Yes	2	5
Drinking (alcoholic drinks)		
No	36	90
Yes	4	10
Realiza atividade física (pelo menos 03 vezes na semana)?		
No	20	50
Yes	20	50
Faz dieta para controlar da pressão arterial?		
No	8	20
Yes	32	80
Total	40	100

Source: Data collected by the researcher (2018).

About smoking, 95% (n = 38) of the interviewees do not use tobacco, and 5% (n = 2) use tobacco. These data reveal that most of the elderly individuals interviewed do not use cigarettes or have ever done it in the past. Costa et al. (2007) verified that people who have already smoke have a higher prevalence of hypertension. Girottoet al. (2013), reports that the reduction of alcohol consumption and smoking cessation should be part of the management of the arterial hypertension.

As they evaluate the use of alcoholic beverages, 90% (n = 36) reported that they do not drink, and only 10% (n = 4) use alcoholic drinks. Result similar to those ones of Ramos et al. (2015) that 91.6% said they do not use beverages. It is verified that in this research a very low number of elderly people who consume alcoholic beverages, however the use of the drink can influence the adherence to the drug treatment.

According to the results found, half of the participants, 50% (n = 20) practice some type of physical activity. A different result verified by Martins et al. (2010) and Cunha et al. (2012) and Souza et al. (2014)

HAVE showed that most of the elderly have not practiced physical activities. According to Bonadimanet al. (2012) physical activities in general, practiced in a regular way, with lasting from 30 to 45 minutes, with a frequency from three to five sessions per week, have excellent efficacy as an adjunct to antihypertensive treatment. In view of this, it is essential the relation of interventions of the health team to raise awareness and clarify the importance of physical activity in antihypertensive treatment.

In relation to diet, 80% (n = 32) of the patients interviewed refer to follow diet. According to Freire (2016), THE excessive consumption of fats, salt and sedentarism are practices that favor the emergence of hypertension. Therefore, because that, an adequate diet, combined with physical activity, is able to delay the appearance of hypertension. According to Bonadimanet al. (2012) THE obesity is one of the main causes for the development of hypertension, as there is a high prevalence of patients with obesity, since this factor may be related to non-adherence to the antihypertensive treatment.

Table.3: Degree of adherence to the pharmacological treatment of the interviewees based on the Morisky and Green test.

Degreeofadhesion	Frequency	
	n	**%**
High degreeofadhesion	22	55
Lowdegreeofadhesion	18	45
Types of behavior related to the low degree of adhesion		
Low unintentional adhesion	9	22.5
Lowintentionaladhesion	3	7,5
Lowadherencewithboth	6	15
Total	**42**	**100**

Source: Data collected by the researcher (2018).

The Morisky and Green test evaluates the adherence to the drug treatment. In this test the answer "Yes" for at least one of the questions means nonadherence, the "No" answer for all the questions means adherence to the treatment. The test can still be used to describe the degree of adherence to the treatment, by classifying as high degree of adherence those people who had all the test answers negative, and with low degree of adherence those ones who had at least one affirmative answer. The delanterones can still be classified as to their behavior that can be intentional or unintentional, or both, as shown in Table 3.

It is noteworthy that in the study 70% (n = 28) administer adequately the drug. In the study, 35% (n =

14) of the participants HAVE reported that they neglected to take the medication, and 65% (n = 26)took the medication at the correct time. Ramos et al., (2015), in their study, 47% of the interviewees forgot to administer the drug, and 54.4% neglect about the time of administering the drug.

The main factors that interfere with adherence to the treatment are sex, old age, health beliefs, life habits, cultural aspects, difficulty to buy the medication, side effects, inadequate orientation of the professional, difficulty in administering the medication, this way a very important aspect for the treatment of SAH is the correct use of medicines (Ramos et al., 2015).

Regarding failing to take their medication when they feel better, 85% (n = 34) of the interview reported that they do not interrupt their treatment, and 90% (n = 36) do not stop administering the drug even when they felt ill. A similar result was proposed by Ramos et al. (2015). Meanwhile Bonadimanet al. (2012), report in THEIR study that patients discontinue the treatment because they do not feel anything and only return to use the medication when SOME symptoms reappear.

However, the results presented indicate that 55% (n = 22) of the patients in the study were classified as adherent to the drug treatment, that is, they answered "NO" to all the questions present in the Morisky and Green test. In contrast, 45% (n = 18) of the interviewed answered at least one affirmative question and thus, according to the Morisky and Green test, they have a low degree of adherence. There is also a greater index of "YES" answers in questions one and two of the test, regarding forgetting to take medication and carelessness with the schedule.

Result that differ from that of Ramos et al. (2015), indicate that the majority of the participants (67.3%) were classified as not adherent to the drug treatment. In another study by Dosseet al. (2009) with hypertensive patients who have participated in the Morisky-Green test, has showed that 86.93% of the patients have presented no adherence to the drug treatment.

It is important to draft the factors that may lead to this low adherence to the drug treatment, from the socioeconomic characteristics to the lifestyle of the patient. The majority of the elderly have a polypharmacy, and have a tendency forenoon adherence to the pharmacological treatment.

Most of the participants are over 12 years old with a diagnosis of hypertension, BY representing 37.5% of the sample. In this study, 95% of the participants have no difficulty in administering the medication, that means a positive aspect. Cintra et al. (2010) show that THE elderly patients consume several drugs daily, and may cause errors in their administration.in relation to the undesired symptom in administering the medicament, only 10% reported this discomfort, data similar to that one of Lima et al. (2010). Pharmacovigilance (2008) suggests that unwanted drug symptoms are any unfavorable occurrence or unintended effect while the patient is using the drug.

When evaluated the patients classified with low adherence degree, they may be classified as unintentional, intentional or low adherence with both adherences. Among the 18 patients classified as low adherence, 22.5% (n = 9) presented low unintended adherence, by indicating standards of forgetfulness or carelessness with the time of taking the medication, and 7.5% (n = 3) presented low intentional adherence, in which the patient decides to stop using the medication when he / she feels well, or when he / she feels bad about the use, it is emphasized that in 15% (n = 6) of the cases are classified as low adherence in both types.

Table.4: Drug Therapy Related Factors of the Research Participants

Variables	Frequency	
	n	%
Are medications enough for controlling hypertension?		
Never	1	2,5
Almostalways	8	20
Always	31	77,5
Do you believe in the positive effects of treatment for hypertension?		
Almostnever	2	5
Almostalways	3	7,5
Always	34	85
Não sei	1	2,5
Do you worry about gauging the pressure?		
Almostnever	11	27,5
Many times	3	7,5
Almostalways	6	15

Always	20	50
Do you have any disease other the hypertension?		
Yes	19	47,5
No	21	52,5
Total	40	100

Source: Data collected by the researcher (2018).

The interviewed reported that medications are essential for the control of hypertension, with succeeding 77.5% (n = 31), as indicated in Table 4, in agreement withheld of Lima et al. (2010) that 99% of patients reported that the drug is fundamental for controlling the blood pressure. Medications can be used in the prevention, diagnosis, treatment of diseases, their use should always be made with the advice of a specialized health professional, since the incorrect use can cause serious damage to the health. Thus 85% (n = 34) of the patients believe in the positive effects of treatment for hypertension.

It is worth noting that 50% (n = 20) of the participants said that "blood pressure always influences", and 27.5% (n = 11) "almost never" have this custom, a result different from that of Lima et al ., (2010), where 84% said they worry about gauging pressure regularly. This way, it is a worrying fact, since because the only way of knowing that there is an effective control of blood pressure is through gauging it , because it is a silent illness and does not usually present signs and symptoms.

In the variable "other diseases" in addition to HAS HBP, 47.5% (n = 19), most the individuals reported by having other health problems. The high level of comorbidity in the elderly population may contribute to poor adherence to the medication treatment of SAH. Freitas et al., (2015) point out that the association of hypertension with other health problems is one of the nonadherence factors.

It should be pointed out that individuals with diseases associated with hypertension suggest the need of taking other medications, which may intensify the side effects and drug interaction, by presenting greater difficulty in acquiring all medications and difficulties in taking care of the dose schedules (Ramos et al., 2015).

The most commonly used drug that was reported by elderly patients was Losartan with 72.5%, followed by Metformin with 27.5%, and Simvastatin and Hydrochlorothiazide with 22.5%. It is noticed that the patient uses on a large-scale Metformin, a medicine used to treat diabetes mellitus type 2, so that the arterial hypertension is most often accompanied with diabetes mellitus. This result is different from the tone found by

Lima et al., (2010), and by being that the most used drug was Captopril 34%, followed by Hydrochlorothiazide 29% and Methyldopa 13%. Therefore, this drug treatment is adequate according to the V Brazilian Guidelines for Hypertension.

IV. FINAL CONSIDERATIONS

Arterial hypertension is one of the major public health problems in Brazil and all over the world, with a high prevalence on the Brazilian adult population, especially the elderly. However, it is necessary to monitor all variables related to adherence to the treatment, in order to ensure the effectiveness and efficiency of health care services. By regarding about the pharmacological treatment, it can be affirmed that among the factors that interfere in adherence to the treatment are the symptomatology of the disease and the amount of medication administered daily.

It is able to be emphasized that it is important that the professional advises the ir patients by regarding to the factors involved in abandoning of the treatment or by not complying with therapeutic recommendations. Therefore, it is necessary to plan health promotion activities and disease prevention activities by considering the profile of the elderly hypertensive , such as walking, work gymnastics, educational activities to raise awareness the patient about their illness and the importance of complying with appropriate medical treatment. Beyond that, consultations and home visits should be organized and scheduled.

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Identification of elastic-plastic behavior in AHSS using the isotropic hardening model by the finite element method and EBSD

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Abstract— The aim of this work is to analyze the maximum potential for use of isotropic hardening model in the determination of elastoplastic behavior in an advanced high strength steel (AHSS) known as dual phase steel, with yield stress of 780 MPa. This material belongs to a class of steels currently used the feedstock in the production of vehicles. This material was chosen because it has a high elastic return or spring back effect, which commits the mass production of components, causing dimensional failures in projects. Consequently, it is a steel that presents a complex microstructural behavior during deformation. Mechanical properties of the material were evaluated by tensile tests. Mechanical characterization of spring back effect was carried out by means of sheet metal forming, called three-point air bending. These results were compared with results obtained by the Finite Element Analysis, using the isotropic hardening model. Microstructures were analyzed by means of EBSD technique and the structural fractions resulting from mechanical bending processes were identified, as well as, one of the main mechanisms of reorganization of the crystalline reticulum, measured by CSL boundaries, was identified. The 2D simulation and the isotropic hardening model used in ABAQUS was efficient to identify the mechanical response of steel in relation to its plastic deformation, concluding that it has a kinematic type hardening. However, such a model used in ABAQUS was not totally satisfactory to predict the degree of spring back, since such a model does not take into account reduction in the Young's modulus present in the AHSS.
Keywords— Spring back; AHSS; Sheet metal forming; finite element analysis; high strength steels, EBSD.

Resumo—El objetivo de este trabajo es analizar el potencial máximo para el uso del modelo de endurecimiento isotrópico en la determinación del comportamiento elastoplástico en un acero avanzado de alta resistencia (AHSS) conocido como acero de fase dual, con un rendimiento de 780 MPa. Este material pertenece a una clase de aceros utilizados actualmente como materia prima en la producción de vehículos. Se eligió este material porque tiene un alto efecto de retorno elástico o recuperación elástica, lo que compromete la producción en masa de componentes, lo que provoca fallas dimensionales en los proyectos. En consecuencia, es un acero que presenta un complejo comportamiento microestructural durante la deformación. Las propiedades mecánicas del material fueron evaluadas mediante ensayos de tracción. La caracterización mecánica del efecto springback se llevó a cabo mediante la conformación de chapa metálica, denominada flexión por aire de tres puntos. Estos resultados se compararon con los resultados obtenidos mediante el análisis de elementos finitos, utilizando el modelo de endurecimiento isotrópico. Las microestructuras se analizaron mediante la técnica de EBSD y se identificaron las fracciones estructurales resultantes de los procesos de flexión mecánica, y se identificó uno de los principales mecanismos de reorganización del retículo cristalino, medido por los límites de CSL. La simulación 2D y el modelo de endurecimiento isotrópico utilizado en ABAQUS fueron eficientes para identificar la respuesta mecánica del acero en relación con su deformación plástica, concluyendo que tiene un endurecimiento de tipo cinemático. Sin embargo, tal modelo utilizado en ABAQUS no fue totalmente satisfactorio para predecir el grado de recuperación, ya que dicho modelo no tiene en cuenta la reducción en el módulo de Young presente en el AHSS.
Palabras clave: Springback; AHSS; Conformado de chapa metálica; análisis de elementos finitos; Aceros de alta resistencia, EBSD.

I. INTRODUCTION

Due to the need for production of new materials for automotive industry with better performance coupled with concern for environmental issues, aiming at reducing the consumption of fossil fuels, emerged, from the 1990s, advanced high strength steels (AHSS), which reconcile a small sheet thickness and high mechanical strength [1].

Current issues in the automotive industry are closely related to environmental and energy issues, such as the emission of greenhouse gases (GHG emissions). Research shows a trend toward a reduction in GHG emissions by 2025 from the use of vehicles made with AHSS and new designs for fuel economy [2].

However, the mass production of structural components is limited due to the challenges in the formability and union of plates due to elastic return known as springback effect[3].

The springback can be identified as a change in shape of part subjected to unloading and after the withdrawal of the forming tool due to a redistribution of residual elastic stresses. This phenomenon is characteristic of the new steels with high resistance in relation to traditional steels of low resistance. Thus, the automobile industry has sought to use differentiated materials and modify manufacturing processes in an attempt to minimize problems with the springback effect [4].

Now, computational simulation by Finite Element Analysis (FEA) is one of the most used tools in projects for the evaluation of conformation processes. The main difficulty in the use of FEA is regarding AHSS due to the occurrence of several nonlinear phenomena during plastic deformation. The main factor that causes this nonlinearity in the behavior of these steels is the phenomenon of modulus of elasticity during discharging [3].

Several works [5-7] used the conventional isotropic hardening model to determine the degree of springback and resulted in an overestimation of those values, also realized that such results can be improved with inclusion of the Bauschinger effect, which affects the variation of Young's modulus.

Thus, the present work has chosen to use the 2D simulation, which presents a finite element superior mesh than 3D simulation. The model used for simulation was the isotropic hardening. The objective was to identify the behavior of elastoplasticity present in the DP780 steel with the aid of the study of microstructural parameters obtained by means of backscattered electron technique (EBSD). It is known that a greater knowledge about plasticity behavior of a material allows the development of new simulation models that improve the prediction of springback effect.

II. EXPERIMENTAL PROCEDURE

2.1. Tensile tests

Values for mechanical properties have been obtained by means of tensile tests, extracting specimens in the rolling direction of material, using the standard ASTM E8M-11. Tests have been carried out in a universal test machine, Instron.

2.2. Sheet metal forming

Test specimens were made from the same material as received and sectioned at dimensions following: 80 mm long by 30 mm wide. Such dimensions of specimens were made according to parameters defined for the unconstrained cylindrical bending test presented at the Numi sheet conference 2002 [8].The three-point air bending was carried out in accordance with the norms ASTM E290-09. The values selected for the internal angle bending were: 30 and 90 degrees, respectively, for each bend. The punch was removed from the material 20 seconds after reaching the bending angle and then the measurement was made of the new bend angle to determine whether there was springback. For this measurement, it was used the software ImageJ 1.45 for processing images photographed on LaserLevel 2.0.1 application, according to Figure 1. Such measurements continued to be made for a period of 12 h, 24 h, 48 h, 72 h and 96 h after forming. Completed the 96 h after mechanical bending, the angle bending resulting was subtracted from the initial angle of bending, which were 30º or 90º, and this subtraction resulted in total springback angle.

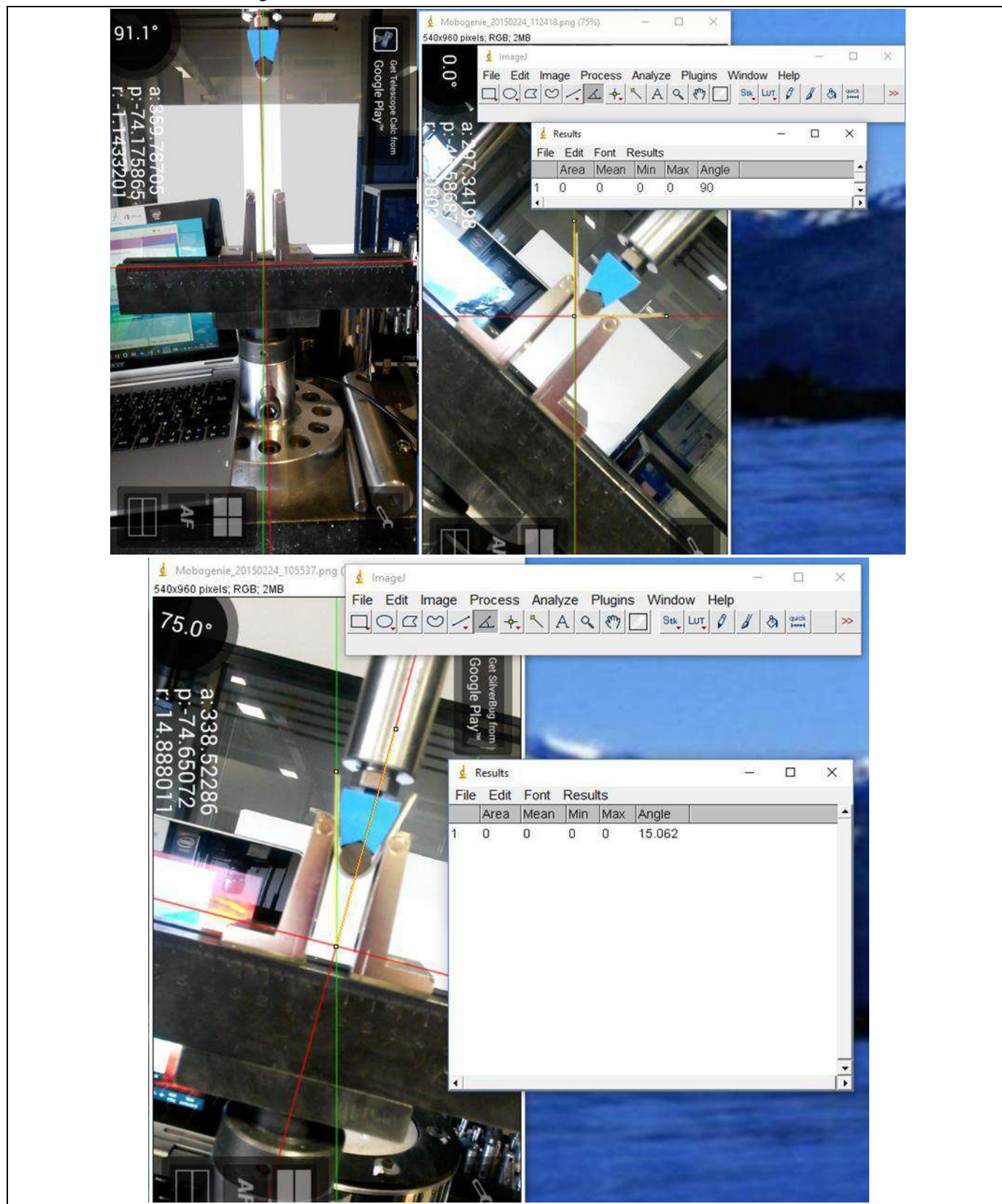Softwares: LaserLevel and ImageJ

Fig.1. (a) Android camera leveling in relation to the Instron bending device(b) and (c) Comparison between the angular value provided by LaserLevel and ImageJ for sheet metal forming at 90° and 30°, respectively.

2.3. Finite element analysis - FEA

Simulation of sheet metal forming and later springback effect was carried out using the software ABAQUS finite elements/CAE 6.13-2. The model used in all simulations carried out in this work was the model of isotropic hardening, taking into consideration the Young´s modulus of materials, its Poisson's coefficient, mass density, true stress and true strain.It was assumed a solid and homogeneous steel for composition of the die and the punction with a ratio of 0.03 between tension plan and deformation in the thickness. It was used a mesh size of 0.0002, with a control of curvature (H/L) in the value of 0.1, which is the same value as the fraction of total size used and with the analysis of 8 elements per cycle.

Software: Abaqus CAE 6.14
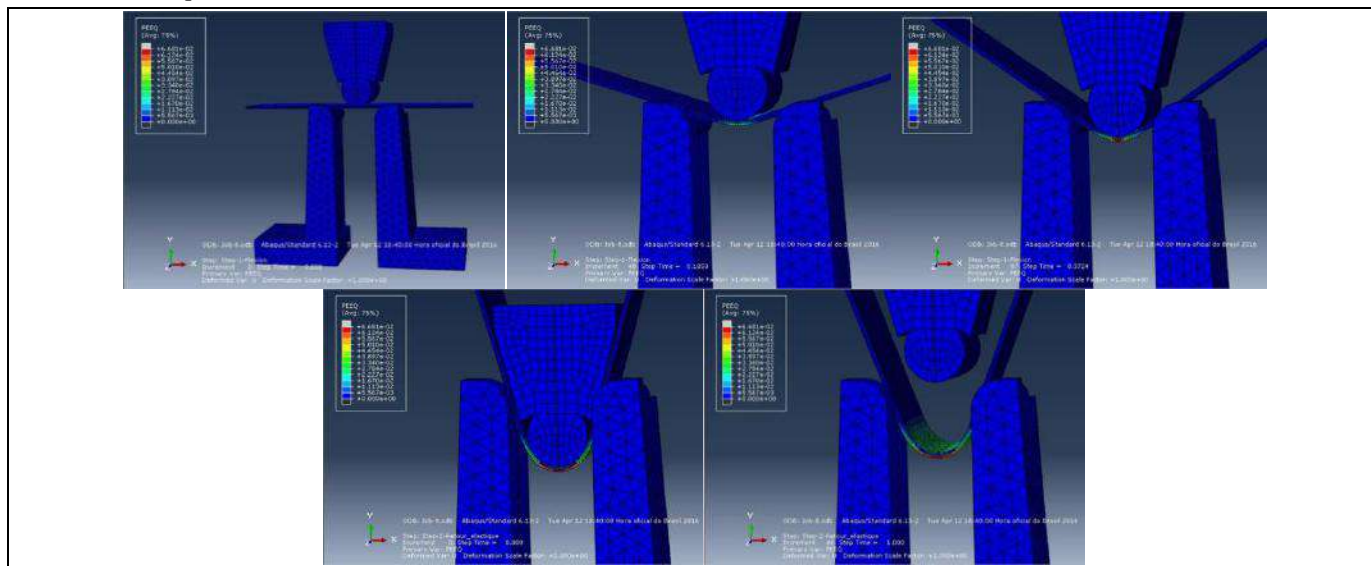
Fig.2. Stages of sheet metal forming in ascending order from left to right. Simulation carried out in the ABAQUS, isotropic model for the DP 780 steel folded at 30°.

2.4. Electron backscatter diffraction - EBSD

EBSD is a technique performed inside scanning electronic microscope when positioning a sample of perfectly flat surface by tilting it to 70 degrees with the incident of the electron beam [9]. It was used a scanning electronic microscope with field emission, model JSM-7000F, JEOL manufacturer, software Channel 5, Oxford Instruments HKL, equipped for analyzes of EBSD. In this step, the samples were analyzed in the dimensions of 15 mm length x 5 mm width on the two surfaces: external and along the thickness, following the rolling direction of sheets.

III. RESULTS AND DISCUSSION

Mechanical properties

Regarding mechanical properties, their values, shown in Table 1,were obtained by tensile tests. In Table 1, tensile strength is designed by RT in MPa, yield strength by LE in MPa, elongation by Elong in ε%, Young's modulus by E in GPa and modulus of resilience by Ur in KPa.

Table.1: Mechanical properties of DP780 steel.

Steel	RT (MPa)	LE (MPa)	ε%	E (GPa)	Ur (KPa)
DP780	864.43 ± 31	604.90 ± 1,9	23.73 ± 3.3	204.45 ± 1.02	894.83 ± 1.02

Sheet metal forming and FEA

Table 2 presents the final values of internal bending angles after finalization of the sheet metal forming, measured from 0 seconds to 96 hours after relief of tensions. Note that as expected according to the literature and in agreement with previous studies of the same research group, the values of these angles increase according to degree of resistance and resilience of materials.

Table.2: Internal bending angles from 0 seconds to 96 hours after the strain relief, from the initial angle of 30° and chosen their respective values of standard deviation.

	30°					
Steel	**0 s**	**20 s**	**24 h**	**48 h**	**72 h**	**96 h**
DP780	29.88 ± 0.73	47.14 ± 0,34	49.07 ± 0.88	50.34 ± 1.9	50.47 ± 1.84	50.65 ± 1.8
	90°					
DP780	88.62 ± 0.99	104.9 ± 0.29	105.02 ± 0.4	105.27 ± 0.45	105.29 ± 0.44	105.32 ± 0.44

Figure 3 below shows a comparison between experimental values of angles of springback obtained by the sheet metal forming and values obtained by FEA.

As expected (blue line), springback values were higher for treatments carried out at 30°, since a sheet metal forming performed in a more acute angle (30°) demands a greater tension amount, resulting in greater quantity of elastic residual tension and consequently greater springback effect. Therefore, the steel when bent at 30° obtained 2.236° more at its springback angle.

However, when observing the results from FEA (red line), it is noted that for the treatment at 90°, the springack value was overestimated at 1.756° and for the treatment at 30°, the springback value was underestimated at 2.127°. Although this difference is not so great, it is necessary to assert that the hardening model used is not ideal for predicting the degree of springback for this type of material.

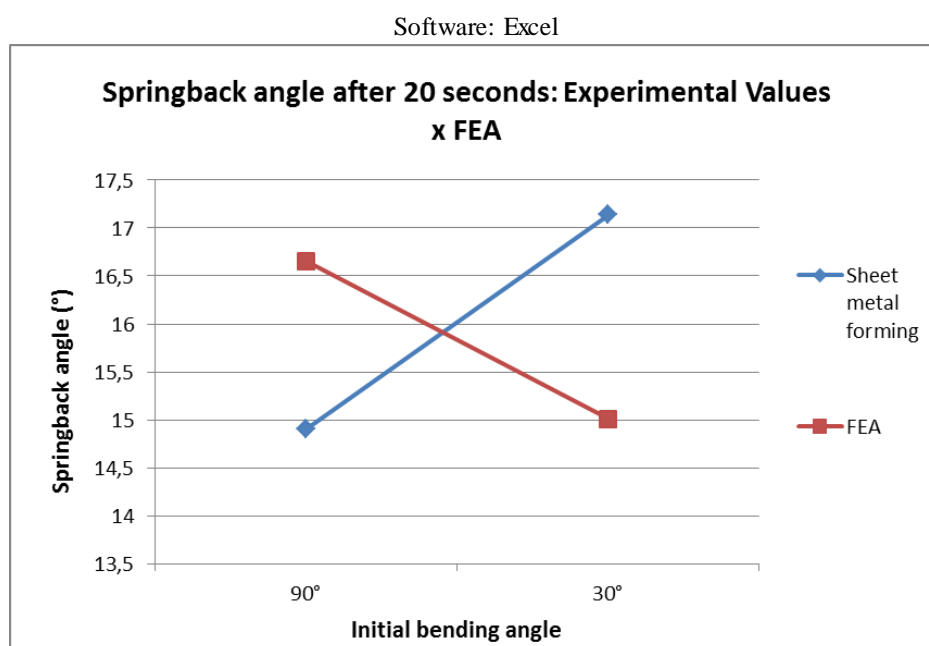Software: Excel

Fig.3: Comparison between experimental and calculated springback angles for the sheet metal forming in the 30° and 90° for DP780 steel.

In Figure 4, it is displayed results provided by ABAQUS for Von Mises Stress in Pa (S, Mises) and plastic deformation equivalent (PEEQ), after the effect springback, for sample submitted to sheet metal forming with initial internal angle of 30°.
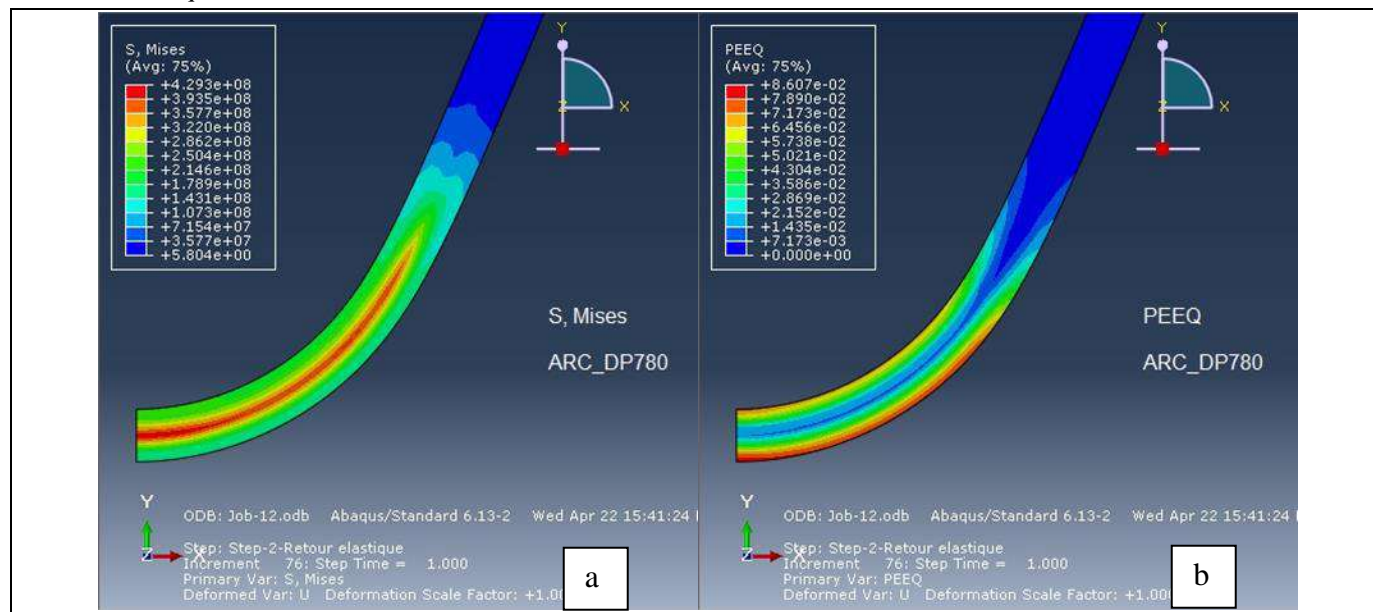
Software: Abaqus CAE 6.14

Fig.4.(a) Von Mises Stress; (b) Equivalent Plastic Deformation Values (PEEQ). DP780 steel after simulation of sheet metal forming at 30° and subsequent springback.

When looking at the region of neutral line, in Figure 4a, there is an orange-reddish solid line in this region, presenting a value of $4.293e^{+8}$ for Von Mises Stress and still in this region, in Figure 4b, it is possible to visualize a light blue color, presenting a value of $7.173e^{-3}$ for equivalent plastic deformation.

With respect to Figure 4b, this steel deformed intensely on surface, but in the region of nucleus (neutral line), it presented a minimal deformation, almost null, throughout the length of the sample. This may help explain the high springback effect, since the material has been shown to be virtually unchanged in the neutral region, due to a higher elastic return of grains during the relief of loads. In addition, it should be also considered that this material has a higher yield stress, and a greater amount of stress is required to cause plastic deformation during the start of sheet metal forming test, resulting in greater elastic residual energy and consequently, greater springback effect.

In addition, DP780 steel has a high resilience value (894,83 KPa) and consequently presents a high springback value, indicating that it absorbed more energy in the elastic deformation and released it after sheet metal forming, without deforming plastically in the region of neutral line. However, when analyzing the region of the outer surface, a higher plastic deformation is verified when compared to region of neutral line, presenting a value around $8.607e^{-2}$.

With respect to Von Mises Stress, it is necessary to know that its value represents the combination of the main tensions in the material pre-existent to the flow,

which starts when this combination reaches the value of the yield stress. Furthermore, it is known that this Von Mises Stress does not distinguish between compressive stress and tensile strength. Since such analysis is done after the elastic return, the Von Mises Stress seen in figure represents the combination of the resulting principal stresses in the material after its deformation and load relief. It is verified that the regions less affected by the plastic deformation, after mechanical folding, resulted in higher value of Von Mises Stress. This indicates that the higher the Von Mises Stress value on the neutral line of the material, the higher the flow should be on this material. Consequently, the release of residual elastic energy within the sample thickness was greater, as well as the plastic deformation on its surface. Thus, it can be said that in this region of neutral line, the higher value of Von Mises Stress represents the greater amount of elastic residual tension in this same region, which is responsible for the springback effect.

According to some authors [10-11], unlike isotropic hardening, the modulus of yield stress during reverse loading is lower than the initial loading. In this case, there is a decrease in flow resistance during reloading caused by this type of hardening. Plasticity for both initial and reverse loading is controlled by different mechanisms, resulting in kinematic type hardening. This confirms observation of the Von Mises Stress in neutral line region immediately after the sheet metal forming, which presented a high value of Mises indicating a greater proximity of yield stresstowards reverse deformation, so that the yield stress is reached quickly by having a smaller

modulus in the direction of unloading when considering the kinematic hardening. Since the hardening of kinematic type reaches a lower modulus of yield stress in the direction of unloading, which facilitates the total release of residual stresses during this step, resulting in the lowest possible value of plastic deformation (PEEQ) in this region of neutral line and consequently the discharge energy is transmitted to the surface resulting in a high plastic deformation (PEEQ) intensity in the regions closest to the surface, whose grains were rearranged by absorbing this energy.

EBSD analysis

A key parameter provided by the EBSD technique is the Coincidence Site Lattice (CSL). CSLs are interfaces in which a given wide angle orientation relationship between adjacent crystals produces a low interfacial energy value. The geometric model of CSLs is based on the formation of a network of sites belonging to the two adjacent networks when interpenetrated, having a relative disorientation between them well determined.

The symbol Σ is used to describe coincidence sites, always followed by odd numbers. The lower this value, the more ordered is the contour. Such a value can be interpreted as the ratio between the volume of the original unit cell of the lattice and the volume of the unit cell of the super-lattice formed by the occurrence of CSL, since the sites of coincidence give rise to a new lattice.

All the following analyzes of the CSLs can be confirmed in Table 3, from verification of degree of disorientation present in these microstructures. Figure 5a
Software: Tango (EBSD)

differs from the others because it has a higher intensity of low angle CSLs ($\Sigma 3$ and $\Sigma 7$), showing that the outer surface region presents a higher order of grains crystallographically (misorientation degree of 0.71°). The region along the thickness analyzed before the sheet metal forming in 5b shows an increase in intensity at sites $\Sigma 11$, $\Sigma 25b$, $\Sigma 35a$, $\Sigma 39a$ and $\Sigma 43a$, which are high angle sites, resulting in a greater crystallographic disorder of grains (misorientation degree is higher, 1.02°). It is verified that after folding, in this same region along the thickness, as shown in 5c, the intensity of the high angle sites remains high, but the low angle sites $\Sigma 3$ and $\Sigma 7$ suffer a slight increase, indicating that after the folding, the grains of this region presented a tendency to the greater ordering of their grains (misorientation degree of 0.95°).

Thus, it can be concluded that the mechanical bending process, for this steel, contributed to slightly increase the degree of crystallographic ordering of its grains.

Table.3: Degree of disorientation (misorientation) before and after sheet metal forming at 30° for DP780 steel.

Misorientation degree (°) before and after Sheet Metal Forming		
Steel		DP780
Before sheet metal forming	External surface	0.71 ± 0.41
	Thickness surface	1.02 ± 0.68
After sheet metal forming	Thickness surface	0.95 ± 0.65
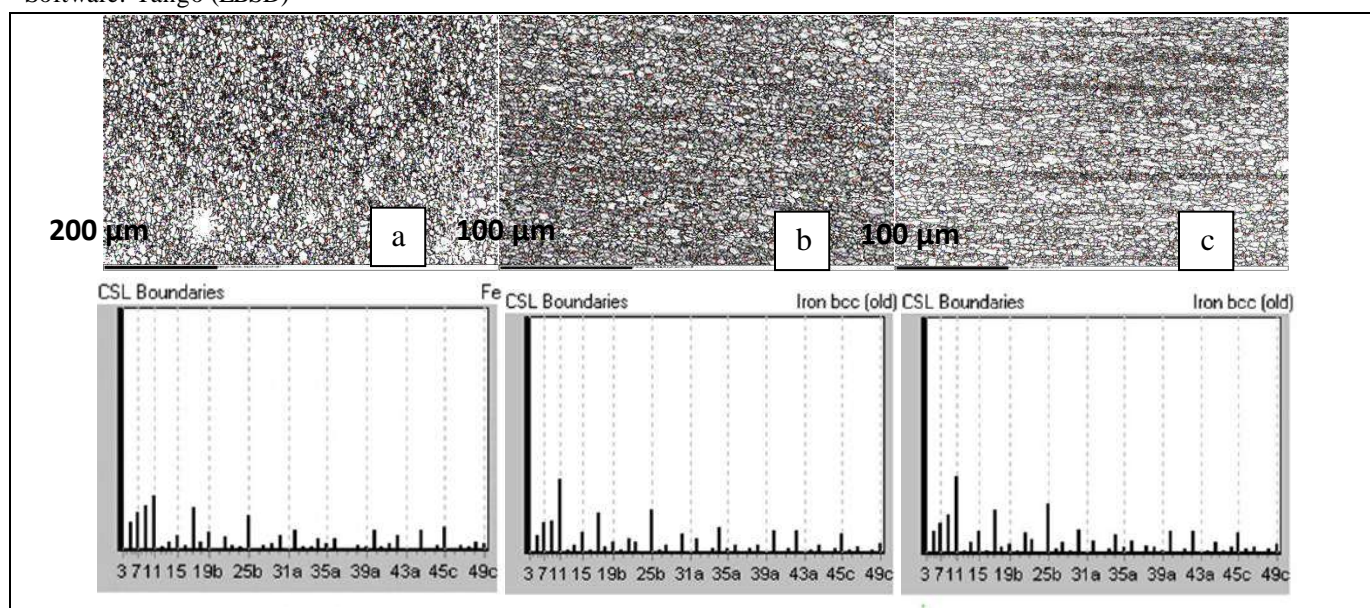
Fig.5: Occurrence of Coincident Site Lattices for DP780 steel. (a) region along the outer surface before the sheet metal forming (b) region along the thickness before the sheet metal forming (c) region along the thickness after the sheet metal forming.

When studying the fraction type predominant in each treatment step, it is verified, according to Figure 6, that a lower CSL value results predominantly in fraction of the recrystallized type (6a), a higher CSL value results predominantly in the fraction deformed fraction (6b) and an intermediate CSL value results predominantly in the substructured fraction (6c).

Therefore, it can be concluded that a high degree of crystallographic ordering of the grains is related to structure of the recrystallized type, and a medium and low degree of ordering are related to the substructured and deformed structures.

Software: Tango (EBSD)
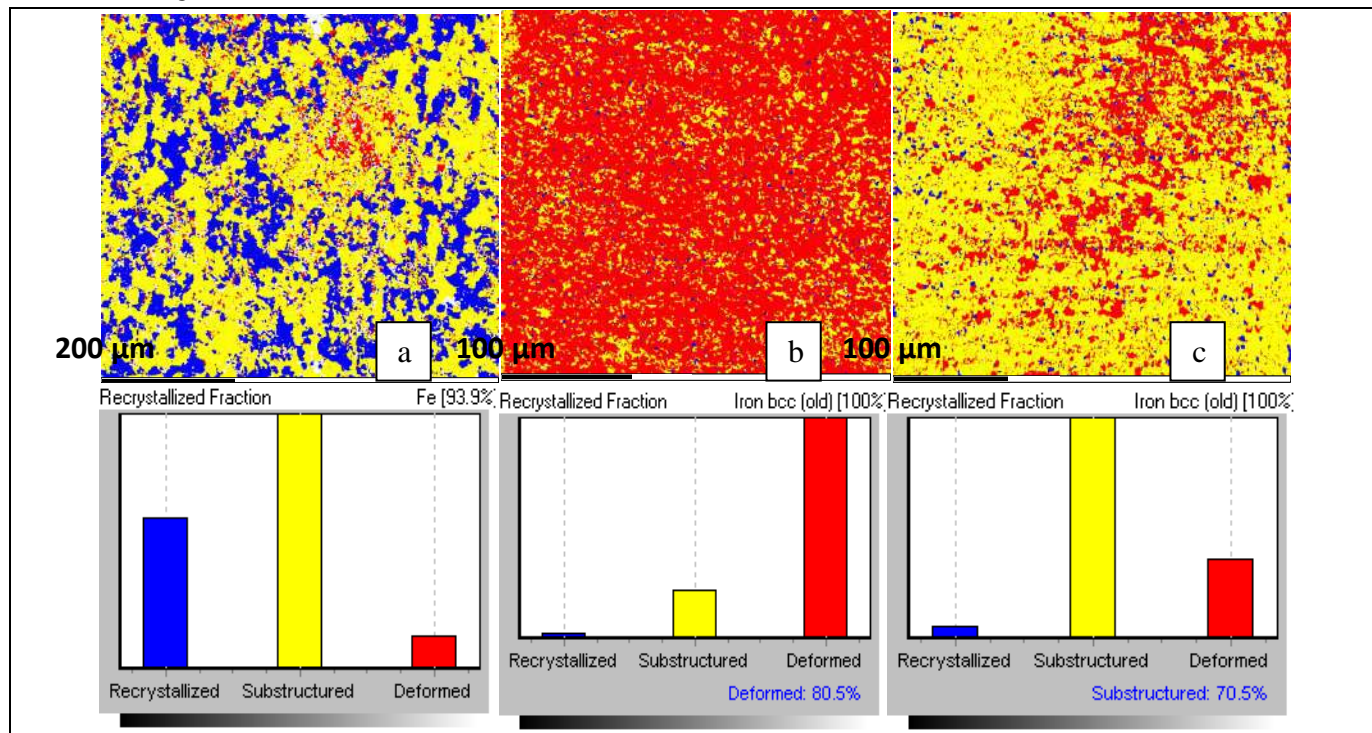
Fig.6: Types of structural fractions. (a) and (b) external surface and region along the thickness respectively before sheet metal forming. (c) region along the thickness after sheet metal forming at 30°.

Note that previously recrystallized or deformed grains present a large number of dislocations formed mainly as a result of the rolling process, and there is a tendency of these dislocations present in the area of grain contours to reorganize and give rise to a new subset of grains called substructured fraction. The driving force that makes this transformation possible is the elastic residual energy stored during the mechanical conformation process, which is trapped within the grains and through the energy gradient between the interstitial defects within the grains and the edge dislocations, this energy is released during the mechanical unloading, allowing the

grains near the surface of the sample to reorganize into new contours, thus forming the substructured fraction.

Software: Tango (EBSD)
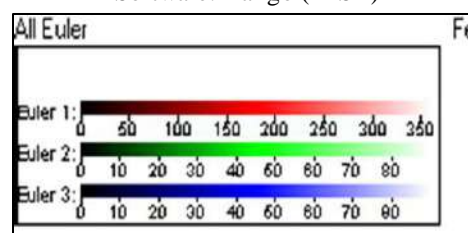
Fig.7: RGB color legend according to the intensity of the Euler angles.

Software: Tango (EBSD)
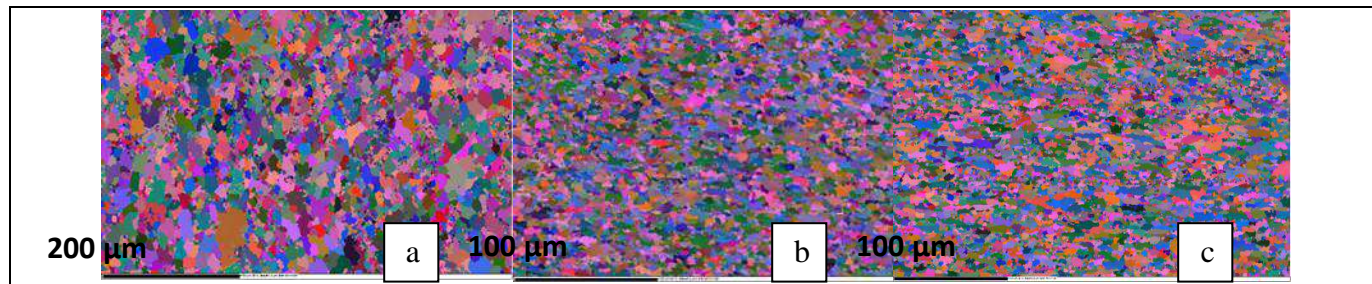
Fig.8: Preferential crystallographic direction map according to Euler angles for DP780 steel. (a) and (b): outer surface and region along the thickness prior to the bending test; (c): region along the thickness after the sheet metal forming.

According to Euler's map, different colors indicate different crystallographic orientations, so it is verified that for regions a and b of Figure 8, there is no preferential crystallographic orientation before mechanical bending. What exists is a great tangle of dislocations generated by this great variation in the crystallographic orientations and reinforced by the small size of grains, which, because they are smaller, increase the occurrence of dislocations. Therefore, within each of these regions, variation in crystallographic orientation is large. However, when comparing region *a* with region *b*, it is noted that there is not a great difference between the colorations of grains indicating a greater amount of grains oriented in similar crystallographic directions, thus producing similar mechanical responses between the regions *a* and *b*, with fewer obstacles between the outer surface and region along the thickness.

Thus, elastic residual tension finds easier in driving the movement of the dislocations, resulting in a high springback effect, characterized by a decrease in the yield stress during recharging, which constitutes the Bauschinger effect and this type of hardening is known as hardening kinematic. Since mechanical response of crystalline reticulum to the application of tension during loading is different from the response of the reloading step in which the reversal of the direction of deformation occurs, the hardening cannot be isotropic.

Figure 6 reinforces that observed in the Euler maps, since the presence of the three structural fractions in different percentages for each of regions *a* and *b* is verified. It is known that each structural fraction has a preferential crystallographic orientation, so the presence of the three structures at the same time and in considerable percentages results in a high crystallographic variation for region *a* and for region *b*.

These conclusions can be confirmed by the works of some authors [12-14], in which biphasic steels were studied that presented lower levels in the Young's modulus in the direction of the reverse deformation, characterizing the Bauschinger effect. Moreover, in these works it was observed that all the slip systems in this material were affected by the present dislocations giving rise to a hardening dependent of tangled dislocations or the density of discordances, known as forest hardening.

IV. CONCLUSION

It is possible to affirm that in region of neutral line, the higher value of Von Mises Stress represent the greater amount of elastic residual tension in this same region, which is responsible for the springback effect and then, it is concluded that the springback effect is directly related to the behavior of deformation in the region of neutral line of the material, since this region by deforming less than the regions of the internal and external surfaces, becomes responsible for the elastic deformation that the material presents after mechanical bending and therefore, responsible for the release of residual internal energies that are the driving force of the springback effect.

It is interesting to note that when an energy is supplied to these materials, it is used to decrease the degree of deformation and to decrease the high level of tension caused by the lamination, as a tendency to return to a condition of greater equilibrium, that is, a condition of lower residual tension between the grains.

Results from the FEA show a high value of Von Mises Stress, in the neutral line region, indicating a greater proximity of the yield stress in the direction of the reverse deformation, thus indicating that the discharge energy was transmitted throughout the elastic zone in the reverse direction, once the yield stress was reached. Then, the energy was transmitted the neutral line to surface. This resulted in the lowest possible value of plastic deformation (PEEQ) on neutral line and consequently in a high plastic deformation (PEEQ) intensity in regions closest to surface and a high degree of springback. And according to literature, this type of energy transmission refers to kinematic hardening.

The DP780 steel showed high intensity of coincident site lattices of high angle, predominant structural fraction of the deformed type, little discrepancy

between the percentages of structural fractions present in the external surface in comparison to the region along the thickness, which resulted in a high level of CSL interface. In addition, it presented small resistance to the flow due to the greater similarity in the crystallographic orientations generated by the tangle of dislocations with small discrepancy between the percentages of structural fractions. Thus, a high level of energy stored in the CSL interface coupled with a lower flow resistance resulted in the high elastic recovery in the neutral line region, which presented the lowest PEEQ value and high springback value, thus indicating a kinematic type hardening due to the forest hardening that leads to the Bauschinger effect.

Therefore, it is concluded that the use of isotropic hardening model, although it was not satisfactory to predict with good accuracy the degree of springback, was useful to identify the elasto-plastic behavior of biphasic steel, which was better understood by means of the parameters microstructures obtained with EBSD.

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Incidence of Congenital Toxoplasmosis in Newborn Infant in the Western Amazon, Brazil

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Abstract: Toxoplasmosis is a very common infection in our environment. The congenital form is the most worrisome, as it causes neurological and ocular lesions, leading to late sequelae, and may also cause abortions and death of the newborn. The objective of the study was to analyze the incidence of Congenital Toxoplasmosis in newborns in the State of Rondônia, Western Amazonia, in the period corresponding to 4 (four) years. The blood collection method was used on filter paper and the Elisa technique for the capture of Toxoplasmosis IgM. The results found in 102,963 newborns who underwent toxoplasmosis, 126 presented alterations. It is concluded that Congenital Toxoplasmosis in Rondônia is 1: 817 on newborns triates.
Keywords— Congenital Toxoplasmosis. Newborns. Rondônia. Western Amazon.

I. INTRODUCTION

T. gondii Congenital Toxoplasmosis is a result of an acute asymptomatic infection, which is acquired by the mother during pregnancy. Few cases of Congenital Toxoplasmosis are now known to have occurred in immunocompetent women when they acquired the infection six to eight weeks before conception, so it is understood that vertical infection occurs when infection occurs during pregnancy 1, [2]. Collaborating to the best understanding, they affirm that immunodeficient women with chronic infection, can transmit infection to the fetus [1], [2]. The risk of this occurring is difficult to quantify, it is probably low. The risk of the fetus is not correlated with the fact that it is the infection of the symptomatic or asymptomatic mother during pregnancy [3].

The severity and incidence of Congenital Toxoplasmosis are related to the quarter in which the infection was acquired by the mother. Children born to mothers who acquired the infection in the first and second trimesters often show severe Congenital Toxoplasmosis. In contrast, the majority of children born to women who acquire during the third trimester are born with the subclinical form of the infection. However, if untreated, 85% of these

children may develop symptoms and signs of this disease, in most cases, chorioretinitis and developmental delay [4], [5].

As the fetal infection occurs when a pregnant woman is infected, for the pregnant woman the disease is usually asymptomatic and may not manifest itself. Infection of the fetus, however, can cause serious problems, and if it occurs early in pregnancy, the severity is much greater. It is therefore seen that Congenital Toxoplasmosis is one of the most severe forms of the disease, in general, provoking varied symptoms, but commonly framed within the Sabin syndrome or tetrad. Thus characterized: chorioretinitis in 90% of the cases, cerebral calcifications in 69% of the cases, neurological disorders in 60% of the cases and alteration of the cranial volume in 50% of the cases [6].

Congenital Toxoplasmosis is transmitted by Toxoplasma gondii, a protozoan of worldwide distribution, with high serological prevalence. The most serious form of the disease is found in newborn infants, when the mother is initially infected, or during gestation through poorly baked meat, poorly washed fruits and vegetables, or by manipulating cat feces contaminated with the cyst. The transmission occurs when the pregnant woman during pregnancy, and, presenting the acute phase of the disease transmits Toxoplasma gondii to the fetus. Epidemiological studies have revealed that in most areas of the world the presence of cats is a primary factor of great importance in the transmission of the parasite. T. gondii infection has not been found where there is no presence of cats. Oocyst excretion occurs in approximately 1% of cats in different areas of the world [7].

Raw or undercooked meats containing viable cyst compared to oocyst ingestion do not change the frequency of infection. Studies conducted in France, where eating undercooked meat is common, the prevalence of infection is high, and meat may be an important cause of infection (it was in Paris in France that the hypothesis of propagation of T. gondii from meat to man has been proven). In contrast, Central American countries have a high prevalence of human infection, but meat intake is not common [8].

The most common clinical manifestation is asymptomatic, but there may also be a febrile syndrome, with complaints of fatigue, malaise, headache and muscle pain. Congenital Toxoplasmosis classically described by Sabin in 1942 is characterized by retinocoriditis, hydrocephalus, intracranial calcification in the form of disseminated nodulations and seizures, and microphthalmia may also occur. In these more severe forms, it is also usual to involve several organs, and

pneumonia, myocarditis, cholestasis, anemia, thrombocytopenia, meningoencephalitis and cerebrospinal fluid abnormalities may occur [9].

However, most infected newborns do not present clinical abnormalities at birth. This difficulty in the recognition of the congenital infection generates difficulties in the clinical diagnosis, therefore, the importance of exams such as neonatal screening (test of the foot) soon at the beginning of the birth, to obtain a therapeutic success, not leading to late, mainly visual sequelae and neurological disorders.

The manifestations of Congenital Toxoplasmosis are variable, depending greatly on the gestational age at which the mother was infected. The infection mainly involves the nervous system and the muscular and connective tissues. Among the main signs and symptoms are: intracranial calcifications, changes in the central nervous system, microcephaly, hemiplegia, abnormal muscular tonicity and active chorioretinitis (the most common sequel, being that the risks of new complications remain for some years). In most cases, toxoplasmosis occurs asymptomatically, or, with subtle manifestations like fever lymphadenopathies that regress spontaneously. However, when the infection occurs in the gestational period, the fetus may be affected with risks of serious ophthalmologic and neurological lesions, and definitive sequelae. In this way, the identification and early treatment of the disease in the pregnant woman, the fetus and the newborn are fundamental, since they avoid or attenuate the present and resulting lesions of the disease during pregnancy [6].

The consequences to the fetus of maternal toxoplasmosis will depend on the degree of exposure of the fetus to toxoplasms, strain virulence, the ability of maternal antibodies to protect the fetus, and, from the gestational period. It is known that 40% to 50% of infected fetuses die. The most common changes or fetal lesions are: 1st trimester of pregnancy: Abortion; 2nd trimester of pregnancy: Abortion or premature birth; 3rd trimester of gestation: the child can be born normal and present evidence of the disease some days, weeks or months after childbirth [10].

Toxoplasma gondii is a protozoan that parasites birds (chicken, pigeons), mammals, including man and primates [11]. T. gondii infection is a zoonosis of global dimension, this organism infects herbivorous, omnivorous and carnivorous animals, including birds [12].

It belongs to the Apicomplexa phylum that has as characteristic the presence of an apical complex visible only by electron microscopy. This complex is constituted of conóides, polar ring, subpeliculares microtubules, roptrias, micronemas and dense granules. Toxoplasma has

no host or host cell specificity, developing in almost all organic tissues [9]. It is an intracellular parasite, with tropism by cells of the reticuloendothelial system, muscle, nervous system and retina. Free forms are found circulating only for a short time [13].

The toxoplasmosis parasite has three forms, which are: the tachyzoites, the bradyzoites and the oocysts.

The tachyzoites are found during the acute phase of the infection, being characteristically a mobile form of rapid multiplication by endodiogenia. The parasites penetrate host cells actively, or by phagocytosis, and multiply within the cytoplasmic vacuole (vacuoles parasitophore) of several cells. This multiplication destroys the host cell, but the appearance of the lesions will depend on the ability of the cells to regenerate. These forms can be found in organic liquids, excretions and secretions, hepatic, pulmonary, nervous and muscular cells are little resistant to the actions of the gastric juice that destroys them in a short time. They are presented as a half-moon shape, with one end being tapered and the other rounded, measuring about 4-9x2-4μm, with a core in a more or less central position [9]. The survival of the tachyzoites is due to the formation of a vacuole that protects against the lysosomal function consequently the acidification does not occur. The active invasion of the macrophages by the tachyzoites is not an oxidative killing mechanism of the activator. An effective immune response significantly reduces the number of tachyzoites in all tissues [12], [14], [15].

Bradyzoites are forms of slow multiplication, characteristic of chronic infection. The bradyzoites found within the tissue cysts are known as cytozoites. These forms are thinner and less susceptible to peptic and tryptic destruction when compared to the tachyzoites. Tissue cysts develop within the cytoplasm of the host cell [9]. T. gondii multiplies intracellularly at the site of the invasion; bradizoites are released from the cysts or sporozoites are released from the oocyst they penetrate and multiply within the intestinal cellular epithelium [16], [17].

The nucleus of the cell remains outside the cyst and may degenerate after some time. The cysts grow and remain intracellular as the bradyzoites divide by endodiogeny. The cytoplasmic vacuole membrane becomes a capsule of the cyst. The tissue cyst wall is elastic and resistant, arginofilic, composed of parasite and host cell material [18]. The size of the cyst is variable and depends on the parasitized cell and the number of bradyzoites contained therein [19]. Younger cysts are small, 5μm in diameter and contain two bradyzoites in their interior, while older ones can reach 200μm containing hundreds or thousands of organisms. The most prevalent sites of cystic form of toxoplasma are skeletal and cardiac muscle tissues, nerve tissue and the retina. Finding cysts in visceral organs like lungs, liver and kidneys are rarer. Intact tissue cysts generally do not cause damage to the host and may persist throughout the life of the infected individual [18]. Oocysts are formed in the intestinal cells of felids and are eliminated as sporulated (immature), along with feces. They are spherical, measuring 12.5 to 11μm and sporulate in the environment where they contain two sporocysts, each with four sporozoites, which have a double wall that is very resistant to environmental conditions and resistant to the action of gastric juice [9].

Toxoplasma has a two-phase life cycle: an asexual phase, in the tissues of several animal and man hosts, and a sexuada, in the intestinal epithelial cells of young nonimmune cats, which are the largest eliminators of oocysts. The host susceptible to ingesting oocysts, tissue cysts and tachyzoites becomes infected. The tachyzoites are destroyed in the stomach for the most part, but may penetrate the oral mucosa or be inhaled, evolving in the same way as other forms. After ingestion the proteolytic enzymes cause degradation of the oocyst and tissue cysts wall, resulting in the release of bradizoites and sporozoites that will invade the host cell [9].

After a rapid passage through the intestine, the sporozoites and bradizoites will become tachyzoites and will parasitize various cell types, occurring to the formation of cytoplasmic vacuoles containing parasites. In these vacuoles, the tachyzoites are protected from the immune system of the host, multiplying asexually and causing rupture of the infected cell, with the release of new tachyzoites that will invade other cells, with greater tropism by the central nervous system and retina, restarting the cycle . The spread of the parasite in the organism occurs through the blood and lymph, leading to the involvement of multiple organs [19].

The sexuated phase occurs in the young and nonimmune cat that acquires the infection through the ingestion of oocysts, tissue cysts and tachyzoites. The sexual cycle occurs in the intestinal cells with formation and fertilization of the gametophytes and formation of zygote, this originates the immature oocyst that is later released after cell disruption, being eliminated in the feces after one or two weeks of infection 19. The immature, non-infectious oocysts under ideal conditions of temperature, humidity and oxygen, such as those occurring in regions of tropical climate, sporulate and can survive for 12 to 18 months in the soil as long as conditions are maintained [9]. The transmission of oocysts can occur through contaminated water, fruits or vegetables containing oocysts on their surface or by contact with soil or sand as a practice of gardening [20].

The only form of proven transmission of toxoplasmosis among humans to date is that which occurs through the passage of tachyzoites through the placenta [6]. The pregnant woman can transmit the disease to the fetus most often infected during pregnancy [9]. Toxoplasma can colonize the placenta that remains infected until the end of gestation. Thus, if the treatment is suspended, the placenta may behave like a reservoir, sending live microorganisms to the fetus throughout gestation [6].

Parasitemia characterizes the acute phase of the disease, when there is great cellular destruction and parasite proliferation. The severity of the disease will depend on factors such as the number of infective forms, the parasite strain and host susceptibility [9].

From the development of immunity, the extracellular parasites disappear from the blood and lymph, also occurring to decrease their multiplication in the intracellular environment. In this period there is the formation of tissue cysts in the host, characterizing the chronic form. Periodic rupture of these cysts may occur with cellular destruction and focal reactivation of the infection. However, with the exception of the retina, the parasites released into the tissues are rapidly destroyed by the immune system [10].

Cell destruction caused by parasites in the acute phase is more severe in the brain, eyes and muscles. The severity of the lesions depends on the ability of the tissue to replace the destroyed cells. In lymphatic, epithelial and connective tissues, in the liver and lungs no significant lesion is observed due to the greater recovery of these tissues. The inflammatory reaction consequent to these cell lesions is characterized by infiltration of lymphocytes, monocytes, macrophages and polymorphonuclear cells. Tissue repair is done by fibrosis and, in the brain, by glucose [9].

Due to the immaturity of the immune system, toxoplasma spreads to the fetus in various tissues, causing severe damage to the nervous system, including retina. In the cerebral cortex of an infant, the focal lesion may be so large that the calcified necrotic area is seen by the skull radiograph. Periaqueductal and periventricular necrosis reflects the great cerebral parasitism. Obstruction of the Sylvius aqueduct leads to dilation of the lateral ventricles and the third ventricle. Periventricular necrosis and necrosis due to infarction are characteristic of congenital toxoplasmosis [9].

In the eye, the parasite establishes a focus of infection that progresses from retinitis to a secondary choroid impairment. A conversion of the form tachyzoites to the bradyzoite encystoid appears apparently induced by the host immune system. The resolution of the lesion occurs with the control of the acute infection and the formation of scar tissue. The cyst may remain inactive in the healed lesion or adjacent to it for several years. During this period, there may be slow replication of the bradyzoite, which may result in rupture of the cyst wall, releasing the parasites in the adjacent retina and leading to recurrence of retinitis [21].

The reasons that lead to rupture of the cyst and reactivation of the disease are unknown, but immunosuppression may contribute to this phenomenon. It was thought that retinitis could occur due to a hypersensitivity reaction, but the occurrence of aggressive disease in immunocompromised hosts suggests that retinitis is a consequence of toxoplasma proliferation. Secondary lesions of vitreitis and uveitis may represent a hypersensitivity response [21].

In the retina, congenital infection may lead to the formation of white or unilateral necrotic focal retinocoroiditis areas located in the posterior pole, mainly in the macular region, which may be small or large and simple or multiple and with well defined limits between the areas involved by necrosis and without necrosis. The necrotic regions may exhibit dispersed melanocytic pigments derived from the retinal pigment epithelium. Adjacent active lesions and retinal cicatars may be observed, or in the area of necroses surrounded by retinal edema [21].

The intense inflammatory reaction of mononuclear nature consists of lymphocytes, macrophages and epithelioid cells with plasma cells grouped at the margins of the lesions. This reaction gives rise to the cell in the vitreous and exudation and, in the late stages, there is an increase in the glacial tissue that can invade the vitreous, leading to a vitreíte and subsequent formation of membranes [21]. The occurrence of retinal vasculitis may lead to local hemorrhage. Iridocyclitis is frequently seen in patients with toxoplasmic retinocoriditis. Another finding frequently associated with a previous granulomatous uveitis and, more rarely, panuveitis or optic neuritis may progress to optic atrophy. The cure of retinochoroiditis is associated with a decrease in the inflammatory reactions of the iris, ciliary body and vitreous [21].

Other ocular changes that can be found associated with retinocoriditis are microphthalmia, glaucoma, cystoid macular edema, cataracts, posterior synechia, retinal perivasculitis, chorioretinal vascular anastomosis, microcornea and retinal displacement. Strabismus and nystagmus may arise as a result of central retinocoriditis lesions [22].

The diagnosis of Congenital Toxoplasmosis can be made by means of the neonatal screening exam, already mentioned, by dosing with blood collected on special filter paper the fraction IgM, and in case of positivity

confirm with IgG and IgM serological test, using the ELISA methods [20]. Also by polymerase chain reaction (PCR) in the aminiotic fluid, which can be performed from the 12th week of pregnancy, with few complications [23]. This examination though not available throughout the public health network is less risk to the fetus and if positive one can begin intrauterine treatment.

The newborn with suspected toxoplasmosis should undergo a complete physical examination, including a thorough neurological examination. Other exams such as transfontanel ultrasound, ophthalmologic examination and serological examination may be performed to complement the diagnostic investigation [24].

Prenatal treatment can be done with the use of antibiotics, and the use of spiramycin in the initial treatment of the pregnant woman with toxoplasmosis is recommended until the confirmation of the fetal infection as it is devoid of important side effects and well tolerated. When fetal infection is proven, the association of sulfadiazine with pyrimethamine and folinic acid is recommended from the second trimester of pregnancy, as spiramycin does not treat fetal infection. The treatment of the pregnant woman throughout the pregnancy should be continued with alternating or continuous therapeutic regimens. For prudence, it is recommended to substitute sulfadiazine for spiramycin or clindamycin at the end of gestation to avoid the possibility of kernicterus caused by sulfadiazine in the newborn [6].

Treatment of infected newborns should be performed even in the absence of clinical manifestations, since most infected newborns are asymptomatic. The therapeutic regimen should be started as early as possible and maintained for one year with the association of sulfadiazine, pyrimethamine and folinic acid [6].

The prognosis depends on the severity of the clinical picture and the treatment. Cases with apparent clinical manifestations have a worse prognosis, with high mortality (12%) and patients who can survive have sequelae such as mental retardation (85%), seizures (75%) and visual injury (50%) [6].

In patients who have subclinical and undiagnosed infection early, there may be late visual, auditory, or other neurological changes. In these cases, 85% will present episodes of chorioretinitis, reports of hypocausia occur in 10 to 30% of cases and psychomotor retardation in 20 to 75% of these children. Fetal infection is less when the mother is treated during pregnancy. Similarly, treatment during pregnancy may modify the severity of fetal infection [6].

Ocular lesions are predominant in Congenital Toxoplasmosis, even in subclinical forms, and may lead to late sequelae that are responsible for many cases of subnormal vision. Thus, in order to ensure adequate prevention of injuries, it is important to emphasize the importance of effective prenatal care for the early detection of acute infection in the pregnant woman and the institution of early treatment. At the same time there should be coverage in the fetus for fetal detection and also at birth through neonatal screening, as treatment will avoid or attenuate future repercussions.

Currently, the detection of Toxoplasma gondii infection, DNA / RNA analysis of the parasite in the aminiotic fluid through the PCR technique and new serological techniques of high sensitivity and specificity, such as IgA, IgM, IgE, and avidity of IgG.

However, despite the advances in diagnostic techniques used in suspected toxoplasmosis, the certainty of infection remains a major challenge, since infection may be present even in cases where placental examination was negative, IgM was not found and that IgG showed a transient decrease in their levels [6].

Several investigations have shown that after inoculation of SHIV virus in monkeys the presence of opportunistic pathogens such as: pneumocystis, cytomegalovirus, cryptosporidium, toxoplasma and candidiasis. Other researchers found a prevalence of toxoplasmosis in 120 HIV-positive patients with retinal lesions compared to Mycobacterium avium [25]. They also observed that reinocoroiditis lesions had scars with less pigment than those found in immunocompetent patients. When analyzed 33 HIV positive children found ocular toxoplasmosis as the most common manifestation [26].

Johnson et al [27] diagnosed acute toxoplasmosis encephalitis in 10 (20.4%) of the 49 autopsied patients, concluding that the large number of CNS toxoplasmosis cases in AIDS patients shows the need for the disease to be included in the differential diagnoses and seven (7) immunocompetent patients in the 69-82 age group with an average age of 74 years. Although treatment with antiparasitic drugs was instituted early in the disease, treatment had to be longer than normal and that 4 (four) patients had reactivation of retinitis after drug withdrawal. There was a visual drop in most cases. Silveira, Belfort Jr, Burnier Jr [28] concluded that toxoplasmosis in elderly patients is more severe due to the low cellular immunity of these patients, they reported a case of Fuchs, associated with toxoplasmic reinocoroiditis and Desmont coefficient, positive. They considered it highly probable that the etiology of Fuchs's syndrome in this case was toxoplasmosis due to the high level of antitoxoplasma antibodies found in the aqueous humor.

Moraes Jr [29] demonstrated that toxoplasmosis can be located in the outer layers of the retina in patients with AIDS, and not only in immunocompetent patients as

previously demonstrated. Bosch-Driessen, Karimi, Stilma, Rothova [30] studied 150 patients with ocular toxoplasmosis who were examined between 1990 and 1997 and found 6% retinal displacement in patients with ocular toxoplasmosis. However, they concluded that a careful examination of the retina of patients with ocular toxoplasmosis should be done, especially those who have associated other risk factors such as myopia, and very severe intraocular inflammation.

The objective of the study is to analyze the incidence of Congenital Toxoplasmosis through the Elisa test in blood drops using the filter paper methodology in newborns in the Municipalities of the State of Rondônia, attended by the Neonatal Screening Program, in the period of 4 years.

II. MATERIALS AND METHODS

The present descriptive, quantitative character study will contribute to the knowledge of the incidence of Congenital Toxoplasmosis in newborns in the 4 year period in the State of Rondônia.

The material - The material used for the collection of blood in newborns was S & S 903 filter paper, which presents greater sensitivity in the analysis of the pathology by the Elisa method in the capture of IgM antibodies.

The collection of blood on filter paper - The collection was performed between 2 and 7 days after the first feeding, until the 30th day, and can be performed after this period, but classified as late collection, remembering that the earlier better collect the result of the work. In order to expedite the sending of blood samples on filter paper, postage-paid envelopes are available, which must be sent once or twice a week. These will be accompanied by a Listing, containing: RN / Mother's name, date of birth and date of collection of the Pezinho Test. When necessary, for any reasons (incorrect collection, improper handling of the collection card, insufficient material or Diagnostic Confirmation, etc.), a ricochet is requested through a document explaining the reason for the request.

The results of the analyzes - The results of the analyzes were issued individually, by computerized system, in an average term of fifteen days from the receipt, and immediately sent to the collection points from which they come. Any newborn suspected of being a carrier of one of the diseases will be recruited to perform the confirmatory tests. Suspected cases are confirmed by serum levels and, when positive, immediately reported to those responsible for the patient's location. Every live newborn identified / confirmed as having one of the pathologies has the right to adequate follow-up, guidance and treatment. The organization of the sample collection system for the National Neonatal Screening Program - PNTN requires special care in order to obtain desired results. All activities involved directly or indirectly are important, from the choice and training of the professional who will collect the sample transport system to the laboratory that will carry out the analyzes.

The collection point - The professional designated as responsible for the collection at each post is the person who will be activated by the Reference Service in neonatal screening whenever contact with the family becomes necessary. Generally, it is a nursing professional (nurse, nursing technician or nursing assistant), whose activity is regulated by specific legislation, and in the Collection Office has the responsibility to: guide the parents of the child regarding the procedure to take the child in a collection point of the network, in the case of the impossibility of performing the collection (early discharge) in the Hospital / Maternity; managing the storage and stock of filter paper, as well as request for replacement of material; administer the shipments collected to the Laboratory to which it is linked, as well as the receipt of results (Control of shipments sent / received); keeping records of the active search actions of those recruited: to locate the recalled children whose material has been returned for being inadequate, for requesting a new retake test, or for scheduling an appointment at the SRTN; administer and maintain record of delivery of normal or altered results to families; ensure the documentation and registration of information requested in Administrative Rule GM / MS nº. 822; file the proof of collection and delivery of results.

Collection environment - The collection room was a cozy place to quiet, suitable for the purpose. The use of refrigerated air is not recommended as cooling the baby's feet will make it difficult to absorb the blood. Before starting the collection, the professional should make sure that all necessary material, mentioned below, is available in the workbench that must be properly cleaned: procedure gloves (no surgical gloves are necessary); sterile disposable lancets with a triangular tip of approximately 2.0 mm; container (piss) with alcohol 70% for asepsis; cotton and / or small, sterile gauze; PNTN filter paper. In the stand, a small shelf or other device must be available to allow the distribution of already collected filter papers until the samples are completely dry.

Data recording on filter paper - All information requested on filter paper is important and necessary to achieve the desired results of the National Neonatal Screening Program. The collection card must fill out all the information. Incorrect, changed or illegible data delay or impede the examination, delay the diagnosis, harming the child. Only clear and well-readable information has

allowed the rapid localization of children whose examination results have changed, requiring urgent medical attention. The activities at the Collection Station, although considered very simple, are of fundamental importance for the Neonatal Screening Program. The collection point is the gateway to the program. Your organization and the identifying information contained therein are critical and essential to the location of children who need special attention.

Methods - The technique for diagnosis in the Navelida of Congenital Toxoplasmosis is ELISA capture of IgM antibodies because it is of great sensitivity and specificity. The choice of techniques for confirming altered toxoplasmosis results that allow detecting IgG and IgM class antibodies are most useful. The presence of IgM antibody, and a significant increase of IgG in the newborn's recoleta evidenced a recent infection. In the recovery of newborns, the mother's serum is also collected, and the result is delivered to the mother to take to her doctor.

III. RESULTS AND DISCUSSION

The information presented was extracted from the information system database of the Neonatal Screening Program of the State of Rondônia at Nativida - Neonatal Screening Service.

Of the 52 municipalities that compose the State of Rondônia, in 32 municipalities notifications of the change of Congenital Toxoplasmosis occurred.

During the study period, the number of live births was 114,793. Of these, 102,963 newborns were screened with 90% coverage, and diagnosed with Congenital Toxoplasmosis, 126 children, who received treatment and follow-up.

The municipality of Porto Velho (Capital) was where there was a greater number of Congenital Toxoplasmosis with 33 cases, that is, 26.19%. In 9 municipalities there was 1 case of Congenital Toxoplasmosis. In the municipality of Ji-Paraná, 9 cases were identified (7.14%) and in Cacoal 8 cases diagnosed (6.35%). In the municipalities of Ariquemes, Guajará-Mirim, Ouro Preto D'Oeste and Vilhena, 6 cases (4.76%) were confirmed in each municipality.

In the State of Rondônia, 114,793 children were born in the 4-year period, according to information from the Sistema de Nacidos Vivos - SINASC - of the State Department of Health, and 102,963 newborns were screened. Of these, 126 newborns were diagnosed with Toxoplasmosis, in which a incidence of 1: 817 of live births.

A study cited by Vidotto [31], presents the results of serological surveys on canine and feline species carried out in Brazil. From the Public Health point of view, infection in the canine population means that the area involved represents an ecological niche for the parasite and, consequently, a risk for the human population.

Table.1: Triad Newborns and Change of Congenital Toxoplasmosis in the State of Rondônia by Municipality in the period of 4 years.

COUNTIES	1º year RNT*	TC*	2º year RNT*	TC*	3º year RNT*	TC*	4º year RNT*	TC*
Alta Floresta d'Oeste	549	1	497	0	537	0	530	1
Alto Alegre dos Parecis	86	0	209	0	207	0	215	0
Alto Paraíso	31	0	173	0	226	1	249	1
Alvorada d'Oeste	317	0	319	1	275	1	308	0
Ariquemes	1.428	2	1.393	1	1.571	2	1.483	1
Buritis	717	0	681	0	772	2	831	0
Cabixi	109	0	96	0	95	1	94	0
Cacaulândia	115	0	80	0	63	0	79	0
Cacoal	1.480	3	1.381	0	1.492	4	1.355	1
Campo Novo de Rondônia	114	0	110	0	113	1	126	0
Candeias do Jamari	245	0	310	0	326	0	292	0
Castanheiras	31	0	39	0	45	0	65	0
Cerejeiras	149	1	325	0	350	1	308	0
Chupinguaia	18	0	44	0	67	0	62	0
Colorado do Oeste	347	0	354	0	315	0	329	0
Corumbiara	0	0	9	0	0	0	24	0

Costa Marques	202	1	219	1	198	0	288	0
Cujubim	139	0	126	0	146	1	147	0
Espigão d'Oeste	558	0	553	1	563	3	548	0
Governador Jorge Teixeira	128	0	125	0	153	0	150	0
Guajará-Mirim	525	3	650	1	716	1	764	1
Itapuã do Oeste	73	0	136	0	178	0	178	1
Jaru	1.184	1	1.170	3	1.147	1	1.187	0
Ji-Paraná	2.169	4	2.162	2	2.102	1	2.240	2
Machadinho d'Oeste	544	1	576	0	616	0	566	0
Ministro Andreazza	199	0	163	0	194	0	172	0
Mirante da Serra	203	0	249	0	211	0	221	0
Monte Negro	300	0	314	0	354	0	317	0
Nova Brasilândia d'Oeste	453	0	406	1	426	1	380	0
Nova Mamoré	208	0	285	0	264	1	356	1
Nova União	120	0	108	0	120	0	109	0
Novo Horizonte do Oeste	128	0	162	1	190	2	161	0
Ouro Preto do Oeste	943	1	846	4	780	1	740	0
Parecis	0	0	13	0	53	0	69	0
Pimenta Bueno	708	1	632	1	711	0	583	0
Pimenteiras do Oeste	22	0	57	1	38	0	27	0
Porto Velho	6.024	8	6.098	8	6.111	11	6.552	6
Presidente Médici	410	0	412	0	417	0	362	1
Primavera de Rondônia	60	0	86	0	64	0	68	0
Rio Crespo	28	0	80	0	46	0	41	0
Rolim de Moura	977	1	947	2	855	0	835	0
Santa Luzia d'Oeste	217	1	212	0	159	0	152	2
São Felipe d'Oeste	63	0	222	0	96	0	91	0
São Francisco do Guaporé	299	0	203	0	350	0	301	0
São Miguel do Guaporé	410	1	263	0	365	2	360	1
Seringueiras	227	0	240	0	259	0	256	0
Teixeirópolis	11	0	86	0	98	0	88	1
Theobroma	101	0	98	0	99	0	158	0
Urupá	235	2	203	0	256	0	200	1
Vale do Anari	0	0	0	0	0	0	61	0
Vale do Paraíso	105	0	121	0	102	1	130	0
Vilhena	1.202	2	1.203	1	1.224	1	1.283	2
TOTAL	**24.911**	**34**	**25.446**	**29**	**26.115**	**40**	**26.491**	**23**

Fonte: Natívida

Legend: RNT * = Triad Newborns. TC * = alteration by congenital toxoplasmosis

Table.2a - Prevalence of anti-Toxoplasma antibodies in dogs, registered in several serological surveys in Brazil.

DOGS				
State	**Serological test**	**Nº of animals**	**% Positive**	**Reference**
São Paulo	RIFI	276	46,1	Domingues et al (1996)
Goiás	SF	35	57,1	Fernandes & Barbosa (1972)
São Paulo	RIFI	47	63,8	Salata et al (1985)
Minas Gerais	RIFI	40	35,0	Silva et al (1997)
São Paulo	RIFI	80	94,0	Ishizuka et al (1974)

Rio de Janeiro	SF	101	79,2	Coutinho (1968)*
Paraná	SF	66	51,5	Giovanoni (1958)*
Minas Gerais	HAI	218	52,7	Duran et al (1996)[8]
Amapá/Rondônia	HAI	19	68,4	Ferrarone & Marzochi (1978)*
Rio Grande do Sul	HAI	43	21,0	Chaplin & Silva (1984)*
São Paulo	RIFI	1256	63,8	Ishizuka & Yasuda (1981)*
Rio Grande do Sul	HAI	64	3,1	Chaplin et al (1980)*
São Paulo	SF	20	90,0	Sogorb et al (1976)
São Paulo	RIFI	657	91,0	Germano et al (1985)

Citado por Vidotto (1992)

Table. 2b - Prevalence of anti-Toxoplasma antibodies in cats, registered in several serological surveys in Brazil.

CATS				
Locality	Serological test	Nº of animals	% Positive	Reference
São Paulo	SF	130	50,8	Sogorb et al (1972)
Amapá/Rondônia	HAI	32	90,6	Ferrarone & Marzochi (1978)*
Rio Grande do Sul	HAI	100	24,0	Mendez (1983)*
Rio Grande do Sul	HAI	27	40,7	Chaplin & Silva (1984)*
São Paulo	RIFI	27	25,9	Rosa et al (1987)
São Paulo	RIFI	350	37,7	Camargo et al (1998)
São Paulo e Paraná	RIFI	191	19,4	Langoni et al (1998)

Cited by Vidotto (1992)

Because Natixida is the referral service of the aforementioned States, and the examination of IgM toxoplasmosis in all newborns was performed in the body of the neonatal screening exams, it facilitated this work. However, the difficulty in obtaining incidence on Congenital Toxoplasmosis in other States, makes difficult an extended discussion of the comparative data of Congenital Toxoplasmosis.

Currently, it is estimated that 40% of the world's population is infected with Toxoplasmosis. Brazil has an index that is among the highest, where registered serological surveys show a prevalence ranging from 37% to 91%. Citing research conducted by Domingues [32], between November 2001 and January 2002, Brazil recorded the largest outbreak of Toxoplasmosis in the world, occurred in the municipality of Santa Isabel do Ivaí - PR, a total of 462 people presented suggestive serology for toxoplasmosis (IgM - Reagent) seven were pregnant, of these, six had their children infected, a severe congenital anamolia and a spontaneous abortion occurred. Also comparative studies with other states that have already done a pilot plan to show the incidence of congenital toxoplasmosis in Brazil, we can mention the studies in Minas Gerais by the NUPAD (Neonatal Screening Reference Service in the State of Minas Gerais) that showed an incidence of 1 / 1,500 live births [33].

In the State of Mato Grosso do Sul, IPED - APAE-MS Research and Diagnosis Institute, which is a reference in Neonatal Screening in that State, has been conducting Screening for Congenital Toxoplasmosis since 2000, with an incidence of 1: 820.

The authors Maciel, Philocreon, Leite [34] present the result of the systematic investigation of toxoplasma in aborted concepts, nati and neomortos, from the Hospital of Charity São Pedro D'Alcântara in the city of Goiás-GO, during a period of 5 years. After a brief review of current knowledge on congenital toxoplasmosis, the authors report the finding of a case of congenital toxoplasmosis in 121 concepts.

Prevalence of congenital toxoplasmosis of 1 in 110 births, with only 50% of births resulting in births, was described in Goiânia. Using the numbers obtained in this study, it is possible to infer incidence of approximately 5 per 1000 live births in that city. A study conducted in Rio Grande do Sul found an incidence of 8 cases for 10,000 live births. Mathematical model, developed in the city of São Paulo, shows incidence of congenital toxoplasmosis from 0.8 to 1000 births, which would mean 280 new cases per year, in that city [35].

In the city of Ribeirão Preto, a study was carried out at the Hospital das Clínicas of the Faculty of Medicine (HCFMRP) USP, where they found an incidence of 1/723 live births [36]. This shows that in all of Brazil, because it

is a tropical country, where the toxoplasmosis cyst finds a favorable environment, the toxoplasmosis index must follow the same proportion in all states. The number of confirmed cases of newborns due to toxoplasmosis in the two states concerned is a cause for concern, as it confirms the inefficacy of prenatal care and also the prevention of infectious diseases in these states, taking into account that Toxoplasmosis is a disease in the majority of cases, asymptomatic and can be avoided with a good elucidation to all the pregnant women in their first consultation, as well as the serology test for toxoplasmosis, both in the 1st trimester and in the third trimester.

It was observed that the incidences found in the other States of Brazil that have done research on Congenital Toxoplasmosis are equivalent to the results of the survey carried out at the Neonatal Screening Reference Service, Natívida - Neonatal Screening Unit, which is the incidence in the State of Acre 1: 638 and Rondônia 1: 861.

In France and Austria the incidence of congenital toxoplasmosis is 3-4 cases per 100 births, and in the United Kingdom 91 cases were reported between 1975 and 1980 [32]. Malm et al. [37] performed a prospective study to define the incidence of congenital toxoplasmosis in Sweden, where blood samples were collected on filter paper of 40,978 newborns, which were analyzed for IgM and IgG anti-toxoplasma. A preliminary report showed 3 children with congenital toxoplasmosis, defined by the detection of IgM antibodies. Two children were asymptomatic at birth. They had normal development until 12 and 15 months of life, respectively. The third child had confirmed congenital toxoplasmosis and treatment was instituted. The child had microphthalmia and peripheral retinochoroiditis in one eye. Despite the medications, he developed hydrocephalus, requiring neurosurgery at 3 months of age. Its development up to 14 months was normal. The incidence of congenital toxoplasmosis in Sweden, detected by the specific IgM in blood on the filter paper is less than 1: 10000.

Comparing the incidence with other countries, such as those mentioned above, it is observed that the incidence of Congenital Toxoplasmosis is lower than that registered in Brazil, as it can be said that in developing countries the incidence is higher than those developed. This may be because prenatal prevention is effective in these countries. Neonatal screening in Brazil took a major step forward after the Brazilian Ministry of Health included as a public health program. In establishing the guidelines for conducting the program in the state and municipalities and for the referral services that are selected by the state health secretariats, being inspected and empowered by the Ministry of Health. As a result, complicity was created

among those involved in the consequently, its improvement in the evolution of the children screened, increasing the coverage of live births, and thus, there was an increase in the incidence of the triaged diseases, including congenital toxoplasmosis. However, in the Amazon, although coverage in Rondônia is 94% of live births, and in Acre 62%, the difficulties are greater than in the other states of the federation due to the geographical location of the Amazon, where we have a large riverine population, and also a a very extensive rural area, and lack of infrastructure on the roads connecting municipalities. However, coverage in these states has increased significantly with the creation of the neonatal screening program because it not only performs the examinations but also provides care for children who present some congenital alteration through their multidisciplinary team.

IV. CONCLUSIONS

The study shows that in the State of Rondônia the incidence of Congenital Toxoplasmosis is 1: 817. It is possible that the warm and humid climate of the Amazon region is conducive to the reproduction of the oocyst and with that the contamination becomes greater in this region.

Due to the cat being the natural host of toxoplasmosis and contaminating the environment with the elimination of oocysts, which is the resistance form of toxoplasmosis, and that in hot and humid climates it resists up to five days after its elimination the proliferation of toxoplasmosis by felines high rates, according to Vidotto's research [31].

The only form of transmission of human toxoplasmosis is vertical and depending on the gestational period the sequels may be larger or smaller. The importance of inclusion in the neonatal screening of this pathology is due to the earlier the disease is diagnosed in the newborn and consequently the treatment is started the smaller the complications for the neonatal.

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Multi-professional Intervention in Centrals of Telemarketing Analysis Ergonomic and Cost-Effectiveness

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Abstract— Introduction: *Telemarketing service in Brazilian industry improved 400% between in 1996 to 2016, creating 450 thousand new jobs.* **Objectives:** *To assess the direct costs of absenteeism of worker in three companies of telemarketing services in the city of Sao Paulo before and after a program of health promotion and prevention of DORT.* **Methods:** *This is a prospective study conducted in central phone in the São Paulo city. It was assessed absenteeism index pre and post-intervention, as well as the direct costs of absenteeism. The intervention was performed by professionals of Physiotherapy, engineer, Nutrition and Psychology, The program of multi-professional intervention had duration of 3 months, were carried out consultations, ergonomic adjustments and therapies within camping of companies.* **Results:** *472 and 254 certificates were presented pre and post intervention respectively (p <0.0001), 7.5 and 3.5 hours not worked by employee, pre-and post-intervention respectively (p <0,0001). The hours worked in two months before start of the study was not different for groups of employees who have submitted medical certificates or not, in the one before month which it were data collected pre-intervention. There was a reduction of direct costs with hours paid but not worked in relation to post pre-intervention (p <0.0001), when the added cost with the team and spent hours not worked on post-intervention, was also found significant reduction (p <0005).* **Conclusion:** *There was significant reduction in direct costs with absenteeism after multi-professional intervention program. The total cost to multi-professional team was less than 40% of the cost with absenteeism pre-intervention.*
Keywords— Absenteeism to work, Cost-Effectiveness, multi-professional intervention.

I. INTRODUCTION

Until the eighteenth century there were no concerns about worker health. With the advent of the Industrial Revolution and new industrial processes to the modernization of machines, diseases or accidents arising from work began to emerge[1].

With the automation of companies and the evolution of modern life new services are created that allow the orientation and capture of customers via telephone: tele-service[2], which began in Brazil in the late 1980's[3]. Call centers or telephone answering centers aims at developing standardized and continuous marketing actions or favoring communication with the client, public or government agencies, using a telephone, computer and data system[4], with the existence of dedicated employees in the customer service, simultaneous use of telephone and computer and control of telephone calls made by an automatic call distributor (DAC) [3].

According to the Brazilian Telemarketing Association[5] (ABT), the Brazilian sector quadrupled in size between 1996 and 2001, reaching 450 thousand jobs and moving 67.4 billion realis and believed that by the end of 2020 it will have reached more than 600,000 direct jobs and according to the Telemarketing Workers' Union[6], the number of call centers grew 30% in the last 20 years.

The teleworking professionals' workload and job position provide a high mental and physical demand, which can often contribute to the presence of pain to these workers[7] and this promotes the removal of the employee from his post, called absenteeism[8].

According to the National Institute of Social Security (INSS)[9] the professional categories that lead the statistics of occupational injuries are bankers, typists, assembly line operators, telemarketers, secretaries and journalists. The same institute claims that there is an

increasing number of withdrawals from telemarketing work due to anxiety and depression.

According to INSS and others authors [10,11,12,13], the company spends about $ 3 billion in security payment for leaving the work. Reis et al [14] states that several studies indicate that short-term leave can provide information about the health status of a given group of workers, but may also be related to factors related to work organization, such as length of work, shifts, and autonomy at work, among others. The companies lose annually $2,5 billion with actions such as: emergency hospital service, production interruption, replacement of workers, training, overtime, employee recovery and salaries paid to outworkers.

The objective of the present study was to evaluate the direct costs of absenteeism in outsourced companies that provide banking telemarketing services in the city of São Paulo before and after a health promotion and ergonomic adjustments.

II. MATERIAL AND METHODS

This is a prospective study with intervention of 90 days in a specific population with telemarketing workers in call centers in the city of São Paulo. Data collection was requested in six companies, but only four companies allowed the data to be collected, access to the medical certificates presented and number of hours worked by each employee during the entire period of the study was allowed.

Prior to the intervention, data were collected regarding the number of medical certificates delivered to the personal department in February of the year of the study, as well as the number of hours worked by each employee referring to the two months prior to the beginning of the protocol. No personal data were collected, only ICD, the date of commencement of the certificate and the number of hours of absence.

From April of the same year an intervention of character of health promotion and prevention against diseases caused by "stresses" and repetitive efforts and food disturbances and ergonomic adequacy began.

Initially there were 654 employees, during the execution of the project the workforce was expanded to 661, the work schedule was 36 hours a week, with 6x1 scales, that is, six days work and one day off. At the place where the research is carried out, it develops telephone answering activities and data entry through typing, the mechanism for accomplishing this task is with the employees in the sitting position, with 15-minute snack breaks (not counted in the hourly load) and two 5-minute bathroom breaks for a total of 25 minutes of breaks.

They worked 24 hours a day, seven days a week. These telemarketing professionals required concentration with a high mental, physiological and anthropometric demand, they remained in the seated position for long periods, they were not allowed to stand up at all, even when there were no connections to be answered. The working mechanism was performed with data entry through the keyboard and searched the computer monitor and the service was performed with a headphone, requiring the professional, repetitive typing movements.

The 90-day intervention program was carried out by physiotherapists, engineers, psychology and nutrition professionals. It was carried out for 12 hours / day and these professionals stayed in the company for three hours for each shift, found so that the four shifts were also attended. These professionals were linked to the work safety of the company.

The health intervention and prevention program had educational classes once a week. The classes lasted 20 minutes and covered topics such as: alcoholism, smoking, stress, eating habits, physical activities, rest, relationships and behaviors. It was placed in strategic places in the companies posters encouraging the practice of the topics covered in the lectures, as well as, was created the incentive prize "the collaborator health of the week". A primer was created with models of exercises and stretches that the collaborators could carry out during the breaks at work or in the period that was not working.

With the objectives of the employees receiving physiotherapeutic, psychological and nutritional care, offices were made available in the camping of companies. also made an ergonomic acquisition of the workplace by the engineers.

III. RESULTS

In the last three months leading up to the study 472 certificates were presented for a population of 654 telemarketers who worked 6 hours a day. 53 subjects presented two medical certificates; three individuals presented three medical certificates. The mean age of the population was $25.1 + 6$ years, with the average working time in companies being $1.7 + 0.7$ years. According to data from the department of occupational health of companies, on average 95% of the workers did a routine medical examination, of which there were no individuals unable to work. Regarding the dimensionless medical examinations, 100% of the workers had performed.

The number of hours not worked, that is, the absence of the employee in the accomplishment of the task that was designated pre-intervention was 4,910 hours, after the intervention the number of hours not worked was reduced to 2,111 (p <0, 0001) Figure 1.
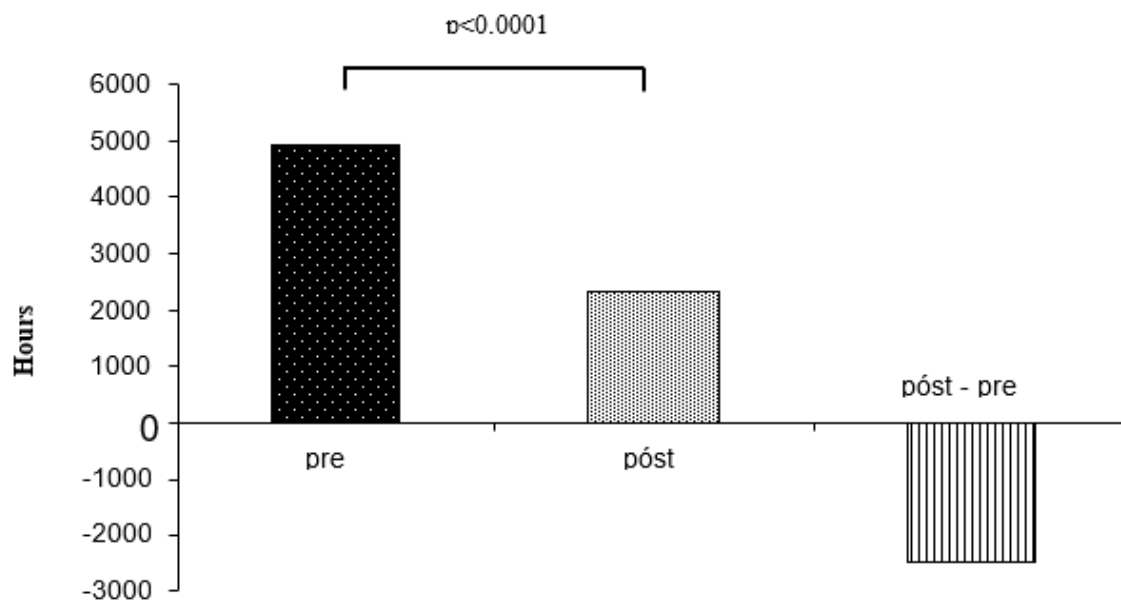
Fig.1: Number of hours not worked by the employees in a month before the post intervention

There were 472 and 254 medical certificates presented pre- and post-intervention respectively ($p < 0,0001$), with 7.5 and 3.5 hours not worked per employee, pre- and post-intervention respectively ($p < 00001$) Figure 2.
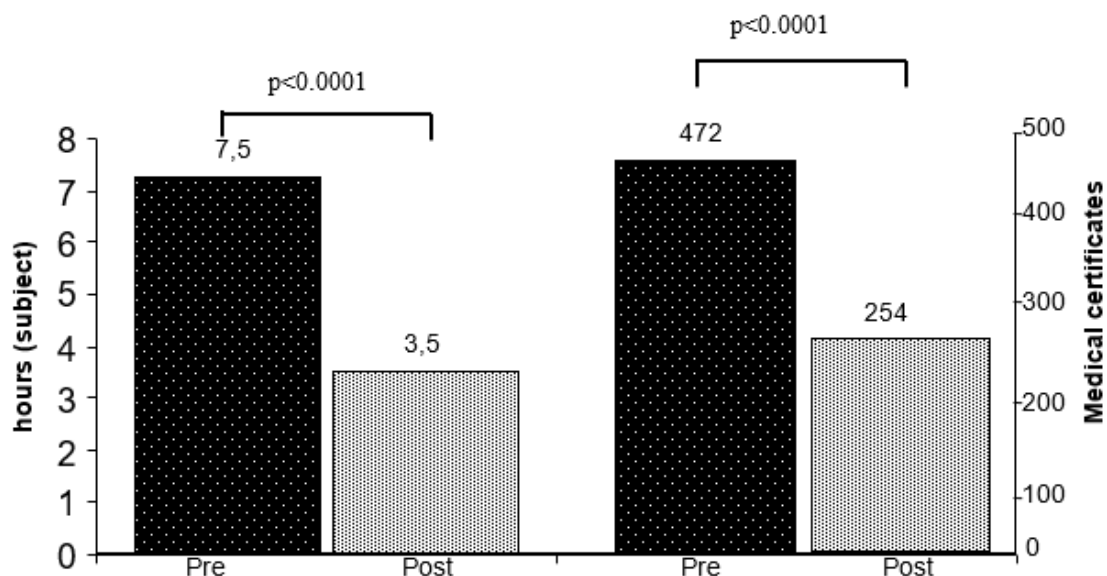

Fig.2: Number of hours not worked on average by individuals in a month and number of medical certificates delivered to the personnel department in the same period before and after intervention.

The number of medical certificates presented by women and men was similar in proportion. The medical certificate index for each employee in the pre-intervention period was 0.72, while in the post-intervention period it was 0.38 ($p < 0.0001$); during the intervention, consultations and treatments were carried out in the campsites for the employees who needed them. In the physiotherapy sector, 281 consultations / month, 179 psychology and 155 consultations were carried out.
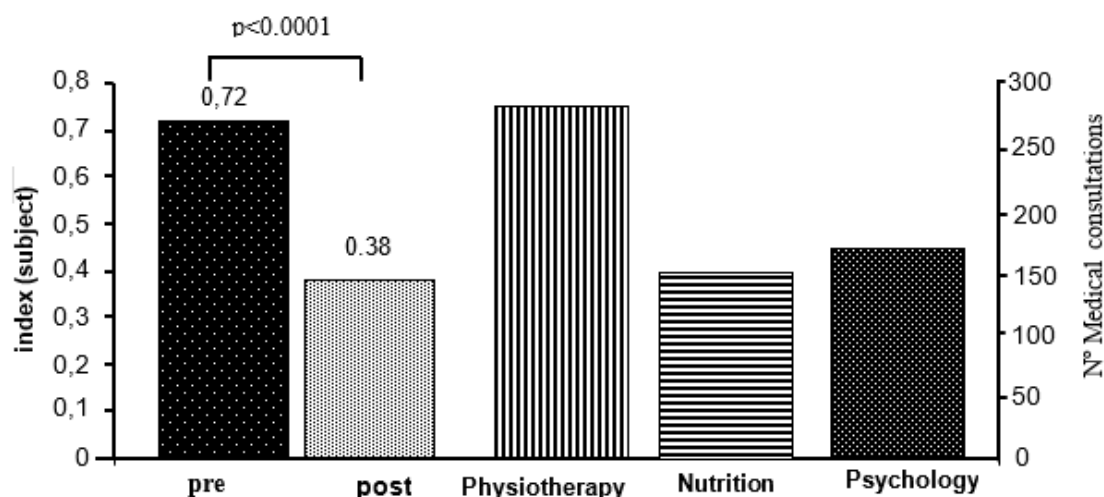
Fig.3: General index of medical certificates delivered to the personal department of the companies researched before and after intervention and average number of visits / month performed by the team of physiotherapists, nutritionists and psychologists.

The largest number of absences was presented by the Cid Z00 (general examination and investigation of people without complaints or diagnosed), pre-intervention 132 and post 75, among the reasons for diagnosed diseases, the main cause of absences justified by submission of attestations physicians was "osteomusculoskeletal" specialty with 79 pre and 18 post, followed by gastric diseases 53 pre- and post-intervention respectively, Table 1.

Table.1: Number of attestations by specialty presented in one month.

Specialty	Pre (%)	Post (%)	(post – pre)
Dermatology	1 (0.22)	3 (1.18)	2
Digestive	2 (0.42)	8 (3.16)	6
General clinical examination	132 (27.9)	75 (29.6)	-43
Gastrology	53 (11)	18 (7.1)	-35
Gynecology	1 (0.22)	12 (4.7)	11
Neurology	29 (6.1)	17 (6.7)	-12
Dentistry	26 (5.5)	14 (5.5)	-12
Ophthalmology	27 (5.72)	25 (9.8)	-2
Osteomusculoskeletal	79 (16.74)	18 (7.8)	-61
Otolaryngology	52 (11)	33 (13.0)	19
Others	14 (2.9)	0 (0)	14
Psychiatry	4 (0.85)	1 (0.36)	-3
Respiratory	25 (5.29)	16 (6.3)	-9
Traumatology	4 (0.85)	2 (0.72)	-2
Urology	21 (0.44)	11 (4.3)	-10
Total	472	253	-219 (- 46.4)

Regarding the probability of presenting a medical certificate by a collaborator, it was significantly higher in the pre-intervention than in the post-OR 1.8 IC 95% (1.68 to 2.09), also found significance for performing unspecified exams OR 1.7 (1.36 to 2.31), gastric specialties OR 2.9 (1.76 to 5.02), orthopedic and traumatic OR 4.4 (2.68 to 7.31). For neurology specialties OR 1.9 (0.956 to 3.10) and pulmonary OR 1.8 (1.00 to 3.45) were not statistically significant, Table 2.

Table.2: Chance of absenteeism at work by presentation of medical certificate without and with intervention.

Variables	Odds ratio	CI	p
Medical certificate	1.0		< 0.0001
(with intervention)	1.8	1.68 a 2.09	
Medical certificate	1.0		<0.0001
(without intervention)	1.7	1.36 a 2.31	
Perform exams	1.0		<0.0001
(with intervention)	2.9	1.76 a 5.02	
Perform exams	1.0		0.091
(without intervention)	1.9	0.956 a 3.10	
Gastric	1.0		<0.0001
(with intervention)	4.4	2.68 a 7.31	
Gastric	1.0		0.064
(Without intervention)	1.8	1.00 a 3.45	

The number of hours worked in the last two months prior to the beginning of the study was not different for the groups of employees who presented or not a medical certificate for the month in which the pre-intervention data were collected, but it was verified that the number of hours worked for individuals who had post-intervention absenteeism was higher than those who had pre-intervention absenteeism ($p = 0.032$), as well as those who had no absenteeism ($p = 0.036$), Figure 4.
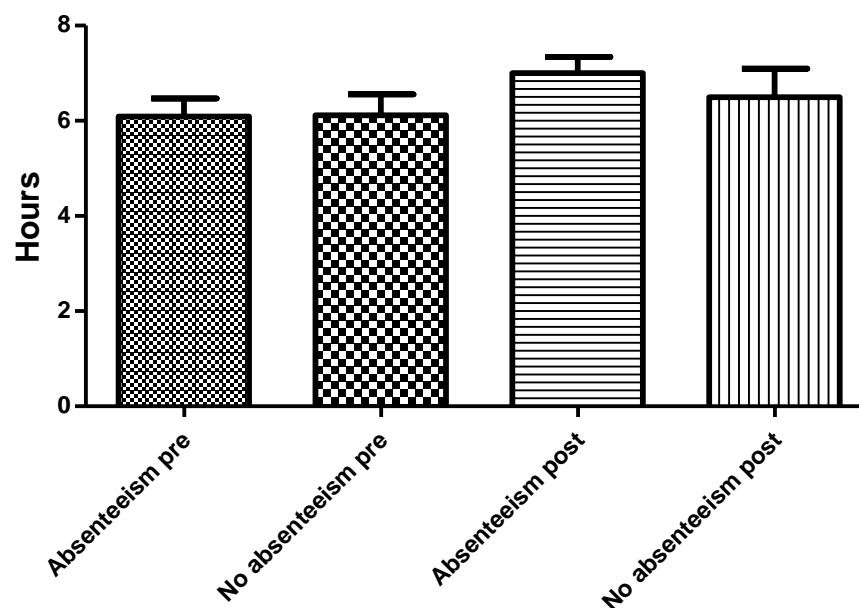

Fig.4: Hours worked during the last three months that preceded the study for the groups of individuals who presented and did not present medical certificates during the month of data collection.

Regarding the cost effectiveness of the prevention and health promotion intervention program carried out by physiotherapy, nutrition and psychology professionals, it showed a significant reduction of direct costs with paid hours, but not worked post in relation to pre-intervention ($p < 0, 0001$), when we added the cost to the team and the hours worked after the intervention, we also found a significant reduction ($p < 0.005$).

IV. DISCUSSION

Some findings from this study, three deserve special consideration. First, multi-professional intervention was effective in reducing absenteeism and direct costs. Second, the main reason for leaving work was routine examinations. Third, the number of hours worked in the last three months preceding the survey were similar

for those who submitted and did not present the medical certificate.

Medical records through the system resources human department of each company collected the data. Each employee left a record after leaving. The incidence of withdrawal was similar in the four companies; we believe that this was a safe method to evaluate the incidence of work leave before and after intervention.

Absenteeism has become a chronic problem for both organizations and administrators. Its causes are linked to multiple factors, making it complex and difficult to manage. Absenteeism is the absence of the worker in the service, when he was expected to be present. This absence of the worker has its negative effect, decreases the production and increases the direct costs of the company.

It was verified that the great majority of absenteeism was caused by medical examinations. It is estimated that every dollar invested in workers' health care programs will result in a savings of four dollars without health care expenses[15, 16].

Our study population remains all the time working in the seated position and performing repetitive movements which can increase absenteeism due to work-related diseases[17,18,19]. Grandjean [20] shows that in individuals who remain for long periods in the seated position there is sagging of the abdominal muscles and develops kyphosis, and it undermines the functioning of internal organs. For Nascimento et al[8], the pain promotes the removal of the employee from his post, called absenteeism, which implies an increase in the costs directed to public and private agencies that burden other employees and impair the quality of care[21].

During the month in which the data were collected prior to the intervention, 40% of the certificates with osteo specialty were referred to the absence of 6 hours, being 16% of 12 hours and 15% of 18 hours, in the post-intervention only 5 % of 15 hours and 95% of 6 hours. With these absences from the job, the calls were answered by those in the central office, with a consequent increase in the demand and effort of the worker, who had to answer the call within five seconds, the employee was allowed to perform two hours overtime. work per day, as requested by the company, especially in the first fifteen days of the month after 9:00 pm, but the breaks remained unchanged.

In 2002, in the Fundacentro auditorium in São Paulo[21], there was a seminar on tele-service activity in which 29 items were exposed that suggest as risk factors present in the attendant's activity and have an impact on worker's health, the main risk factors cited were : insufficient intervals, indisposition in the client and attendant relationship, constant conflicts with superiors, constraints and irregular working hours.

During the multi-professional intervention program it was encouraged that product recycling or employee motivation meetings were held outside the attendant's office hours, these hours being counted as a bank of hours or overtime. Another factor that we believe contributes effectively to the reduction of absenteeism was the consultations and therapies carried out in the companies themselves.

The limitations of this study were mainly due to the fact that the satisfaction of the company's employees about the health service offered was not verified, as well as not to verify if there was an increase in the company's productivity.

V. CONCLUSION

There was a significant reduction of direct costs with absenteeism after the multi-professional intervention program, mainly due to the hours not worked and justified by medical certificates and an increase in the number of hours actually worked by each employee. The total cost with the multi-professional team was less than 40% of the cost with pre-intervention absenteeism.

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