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FOREWORD

I am pleased to put into the hands of readers Volume-6; Issue-8: 2019 (Aug, 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.

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The Importance of Quality Tools in the Health Environment

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Abstract— Being education a fundamental factor to generate the welfare of society, together with research, which is a consequence of the first, a form of application of education and knowledge. Being these elements, generators of the progress and welfare of society, which is specifically important in areas such as health, in which the requirement of quality increases every day, since it is a sector in the service sector in the what quality is not optional and, yes, imperative, because it is tied to the well-being and life of your client, or patient. Thus, the objective of this work is to carry out an exploratory bibliometric research on publications made on the quality tools used in the hospital environment, from 2002 to 2019. In order to fulfill the objective of this work, a survey of articles available in two large databases - Scopus and Web of Science - was carried out using key words from the theme: "Quality tools & Health", then applied filters to determine characteristics to respect of these works. As results, a survey of the quality tools used in the hospital environs of the works over the years. Keywords— Bibliometric Analysis, Health, Quality Tools.

I. INTRODUCTION

The development of 21st century medicine is directly linked to the need to improve the quality of resource management processes, so patient safety and improved quality of health process management are linked to each other (ABUELSOUND, 2018).

For Abuelsound (2018), the main objective of quality improvement is to initiate incremental changes and measure the consequences of these changes over time, given that the changes made in the health area occur in conjunction with the health environment, society and, sometimes, some interconnected offices.

Such improvements in quality can therefore improve, on a large scale, different health settings (ABUELSOUND, 2018). However, health management is a complicated process in and of itself, since it involves interdependent steps, each with greater potential for failure than the other; failure that can result in harmful or even deadly outcomes for patients (Hughes, 2008).

Griffith et al. (2006) pointed out that 75% of 2500 public hospitals in their research did not have a significant improvement in nine performance indicators: (i) risk-adjusted mortality, (ii) risk-adjusted complication rate, (iii) patient safety index, (iv) length of stay adjusted for severity, (v) adjusted premium expense, (vi) change in the assisted community, (vii) profitability, (viii) cash adjustment for debt and (ix) tangible assets by adjusted release.

In addition, Schoenbaum, Audet and Davis (2003) pointed out that the costs of health care and declining quality in hospitals are a growing problem in the United States, requiring urgent attention.

Thus, it is necessary to create mechanisms that integrate the best practices of quality management with the reality seen in hospitals today. In the literature it is possible to find quality tools that have great impact from the point of view of improvement in management, besides being easily applied, if taken into account by the hospital environment. However, the gap between current management in organizations, manufacturing or services, and academic literature is striking.

Therefore, one must create ways of integrating these two environments, promoting both sides. One form of integration is to make the literatures already proposed and established in the academy more tangible from the market point of view, using bibliometric studies. These studies can greatly facilitate not only the understanding of tools and concepts, but also the process of obtaining information.

Thus, the general objective of this work is to conduct an exploratory bibliometric research on publications made on quality tools used in the hospital environment, from 2002 to 2019. It is hoped, at first, to survey the existing works that used quality tools in the Web of Science (WoS) and Scopus databases, highlighting details such as year of publication, journal and countries where they occurred and then analyzes oriented to the tools that were used in the applied works.

1.1 Theoretical Reference

The present theoretical framework was divided into two pillars: First, there is a discussion on quality management, focusing mainly on the characterization of the quality tools and at which levels they unfold, and then a survey of the current health situation and hospital settings.

1.1.1 Quality Management

According to Slack, Johnston and Chambers (1997), any process or operation inserted in a production or service can be improved, since the perfect one is unrealistic in practice, therefore a new state must be sought, obtaining a new standard every day that passes (MÉSQUITA; ALLIPRANDINI, 2003).

In view of the fact that today there is a high dynamism, encompassing several environments, such as markets, customers, techniques and methodologies, besides the constant changes, it is necessary to create a culture of constant improvement in the manufacturing and service environments (MESQUITA; ALLIPRANDINI, 2003). To that end, Juran (1990) points out that most quality improvement projects are obtained by the succinct adjustment of the process, rather than a drastic change, thus making the quality tools a valid contract to deal with problems in the process.

1.1.2 Quality tools

In order to improve the control of the industrial quality of the 60s, Kaoru Ischikawa organized the tools, so that he realized their possible use in procedures that involved quality control, aiming to detect problems and point the solution to them (CORREA; CORREA, 2008).

Such tools are, and should be understood as the name itself, that is, tools, so it is known that they are helpful in solving problems and do not solve them by themselves, and however much their use seems simple, the great challenge is to identify the appropriate tool for each situation and apply it correctly (CORREA; CORREA, 2008).

Therefore, quality tools are considered techniques used to define, measure, analyze and propose solutions to the various problems that interfere with the good performance of organizational activities (CORREA; CORREA, 2008) and are divided into (i) basic tools of quality, (ii) new quality tools or quality management tools, and (iii) advanced quality tools. There are 7 basic quality tools, which are described as follows:

1. Stratification: Divide a given group of data into subgroups according to the determined factors, known as stratification factors. The causes that act in productive processes create variations, therefore one can divide performance indicators, for example, allowing to observe if the variations are concentrated in a certain subgroup (WERKEMA, 2006);

2. Verification Sheet: Consists of a means of assisting, organizing and standardizing collections and records, for later analysis, so that it is optimized (WERKEMA, 2006);

3. Pareto Chart: This is a bar chart, where its bars are ordered from the highest to the lowest and thus a curve is drawn showing the percentage of each bar accumulated (WERKEMA, 2006);

4. Cause and Effect Diagram: It is used to show a relationship between a process result (effect) and process factors that, for some technical reason, may affect the result under consideration (WERKEMA, 2006);

5. Histogram: It is a bar graph in which its horizontal axis, divided into small intervals, presents the values assumed by a variable of interest, demonstrating the frequency of this variable for that interval (WERKEMA, 2006);

6. Dispersion Diagram: It is a graph that presents the type of relationship existing between two variables, through which one can identify the existence of correlations, tendencies, among other relations (WERKEMA, 2006);

7. Control Charts: Since processes can suffer variations in quality, control charts (or charts) serve to monitor this variability as well as to evaluate process stability (WERKEMA, 2006).

The Quality Management Tools, in turn, aim to provide managers and administrators with tools that enable the mapping of quality problems and the planning of efforts to design action plans. These tools were developed to address problems not solved by the Basic Quality Tools (CORREA; CORREA, 2008), and are presented below:

1. Affinity Diagram: Gathers a large amount of data of different natures and organizes them into groups, based on the natural / intrinsic relationship (Affinity) between each item, defining groups of items (CÉSAR, 2013);

2. Relationship Diagram: It takes an idea, a problem or a point considered central and, from it, constructs a map of logical relations of cause and effect between the variables described by the map (CÉSAR, 2013);

3. Tree Diagram: It shows in detail the wide range of paths and tasks that need to be covered in order to achieve

the main objective and each related sub-objective (CÉSAR, 2013);

4. Matrix Diagram: It is often used to organize large amounts of data, identifying and evaluating the relationships between them (CÉSAR, 2013);

5. Prioritization Diagram: Represents a tool of quantitative nature employed in those situations where there is a need to select, among several alternatives, those that can potentially contribute the most to the solution of the problem (CÉSAR, 2013);

6. Decisional Process Diagram: It is a tool that looks for probable events and contingencies that can occur in the implementation of a plan of action or a project. It aims to identify alternative measures / paths in response to problems that may arise during the implementation and / or implementation of a plan or project (CÉSAR, 2013);

7. Arrow Diagram: It is used to plan the most appropriate distribution of activities over time in order to carry out any complex activity / task and their respective developments (CÉSAR, 2013).

According to Gomes, Cisneiros and Vasconcelos (2017) there are several advanced quality tools, among which the following stand out:

1. Brainstorming: It is based on the meeting of multidisciplinary members seeking to find possible causes of a certain event or solutions for various types of problems, in general, members of the top management;

2. Benchmarking: It is a process of performance comparison. Both can occur from one company to another, as well as from one area of the company to another area. Normally, it is sought to measure how much its performance is inferior and which practices can be copied in search of improvement;

3. QFD: This is a method used in the product development process whose main purpose is to transform the product requirements defined by the market into product characteristics;

4. FMEA: It is a method of analysis of both products and processes in activities or in design, aiming to identify failure modes and determine their impact on the system;

5. Matrix GUT: It is a tool to aid in the prioritization of problem solving. It seeks to classify each problem by relating it to its gravity, urgency and tendency;

6. Kaizen: Refers to a practice of continuous improvement that originated in the Japanese quality model based on some principles. One of its main features is the fact that a great improvement is the result of several small improvements accumulated over time;

7. 5W1H: Refers to an action plan that allows you to consider the tasks that need to be performed objectively and ensuring their implementation in an organized

manner. The nomenclature comes from the English words "What", "When", "Where", "Why", "Who", "How", describing respectively what will be done, when will be done, where will be done, who will do it and how it will do it.

1.1.3 Current health picture

The panorama of Brazilian health institutions is not the most positive, according to a survey made, about 829 Brazilians die daily in public and private hospitals due to failures that, for the most part, could have been avoided. Thus, three Brazilians die every five minutes (INSTITUTO DE **ESTUDOS** DE SAÚDE SUPPLEMENTAR, 2017).

The failures occupy second place in the ranking of deaths most common in Brazil, losing only to cardiovascular diseases, responsible for the death of approximately 950 Brazilians per day. Even so, hospital failures are still far from other common causes of death, such as cancer (from 480 to 520 deaths / day), violence (164 deaths / day) and traffic accidents (129 deaths / day) (ASSOCIAÇÃO *BRASILEIRA DE CARDIOLOGIA*, 2017).

In addition, Brazilian hospitals have a problem of size, suffering, therefore, with a shortage of beds. Of the 6,774 hospitals in the country, 88% contain less than 150 beds (ASSOCIAÇÃO BRASILEIRA DE HOSPITAIS PRIVADOS, 2013). For Pedroso (2013), a hospital is operationally infeasible when it presents less than this amount.

Thus, asset management in health environments can contribute, among other aspects, to a better managerial performance, is it in equipment, people or capital, as well as greater precision to detect failures in operations (HEALTHCARE MANAGEMENT, 2019).

So, any assistance from the academic point of view is welcome in this scope, since the hospital panorama is worrisome and there is no expectation of imminent improvement for the next years.

II. MATERIALS AND METHODS

This research, according to Turrioni and Mello (2012), can be classified as applied in its nature, containing an exploratory bias and a qualitative approach, by using number of articles and analysis of terms present in the works.

The methodology of the present work was divided into two stages: (i) selection and (ii) analysis. In the selection part, the following steps were followed:

• Search for the term "Quality tools & Health" in the Web of Science (WoS) and Scopus databases with the time interval filter from 2002 to 2019;

• 36 papers were found in WoS and 134 papers in Scopus;

• After a brief reading of the summary of each paper, it was possible to see that not all articles found fit the theme, obtaining 33 articles in WoS and 110 articles in Scopus;

• Once obtained, a comparison was made to see if there were no repetitions between the bases. Thus, there were 26 equal articles, totaling 117 papers on the subject.

After this first step, the second step consisted of a deeper analysis of these articles in two parts:

1. After surveying the total number of articles, comparisons were made on: (i) years of publication, (ii) countries of origin, (iii) higher education institutions involved, (iv) published journals, and (v) most cited publications in the given time interval;

2. Finally, an individual analysis of all articles was made, in order to determine the main applications and, thus, survey the quality tools used in each of them.

III. RESULTS AND DISCUSSION

3.1 Selection

As explained in the methodology, a priori a search was performed with the term "Quality Tools & Health" in the chosen databases. After applying the filters and obtaining the 117 articles, it was necessary to read the full content of each one to know if they were within the theme.

After this reading filter, 27 articles were still not in conformity with the theme and were discarded, obtaining a definitive total of 90 papers. It is noteworthy that articles that addressed the theme, ie, did not necessarily talk about the application of tools, but made mention of them in the health environment were kept, because they are aligned with the objective, even indirectly. After this initial survey, it was possible to continue the work by classifying the articles found.

3.2 Articles Analysis

3.2.1 Publications per year

A priori, the works were distributed over the years of publication, between 2002 and 2019. Graph 01 shows their occurrence, according to the number of publications expressed in that year.



Source: Authors.

It is noted that it is possible to distinguish these publications in three stages every six years, which are: (i) from 2002 to 2007; (ii) from 2008 to 2013 and, finally, (iii) from 2014 to 2019. Regarding the first block, there was no return of research results for the search in the indicated bases for quality tools in the health field.

This is because the issue of quality in the health environment was not widespread in the early 2000s and, as an aggravation, was not seen as a priority in the health system. Thus, it became difficult for any operational tactic to manifest itself in a hospital setting, and did not generate relevant publications, that is, according to Graph 01.

The second period, covering 2008 to 2013, is where we see this paradigm change, as we have the first publications in 2008. Even if not expressive, being only two throughout the year - representing 2.22% of all works found, already was enough to begin the process of integrating this service area with quality tools, culminating at the end of the year with eight articles in 2013, representing 8.88% of publications, closing this period with 35.55% of articles.

Finally, between 2014 and 2019 we have a greater appearance of works involving quality tools in health, culminating in 2016, which presented 17 papers, or 18.88% of the articles found. It is noteworthy that 2019 has a low count due to the date the survey was conducted, even before closing this year. This third block represents 64.45% of the articles found and shows a maintenance and possibility that the quality tools generate in this area, since most were above the average of 7.5 articles per year; however there was no detection of growth trends in this most recent period, so that it expresses a consolidation of the idea of quality tools in health. **3.2.2 Publications by country** After the annual analysis, it was possible to build the analysis by countries that make publications related to this theme. Table 01 shows the ranking of the five countries with the most publications.

Region	Publications	Percentage
USA	39	43.33%
UK	12	13.33%
Australia	11	12.22%
Canada	10	11.11%
Brazil	8	8.89%

Table 01 - Number of Publications by Country

Source: Authors.

As we can see, the United States leads this ranking with 39 of the 90 publications found on quality health tools, while the United Kingdom, Australia and Canada follow the ranking, respectively, with a percentage between 13.33% and 11.11% of the articles. And finally, we have Brazil, which has surpassed the other countries and is ranked fifth in the ranking with 8 out of 90 papers found, showing that the importance of quality in various environments is already present in the country, even if with less intensity than the others presented.

3.2.3 Publications by institution

Following, it was also possible to classify the five higher education institutions that are linked to the most number of publications in quality tools on health, shown in Table 02.

Table 02 - Higher education institutions with most publications

Institution	Country	Publications	Percentage
McMaster	Canada	6	6.67%
University			
Johns	USA	5	5.56%
Hopkins			
University			
University	USA	5	5.56%
of			
Michigan			
Brown	USA	5	5.56%
University			
School of	Portugal	4	4.44%
Hygiene	_		
and			
Tropical			
Medicine			

Source: Authors.

It can be seen that the institutions are directly linked to the countries in the ranking presented in the previous subsection, since Johns Hopkins University, Michigan and Brown are all American universities, totaling 15 publications, but do not align with the order of countries, since McMaster University, with 6 publications, belongs to Canada, totaling 21 North American publications.

Fifth, the School of Hygiene and Tropical Medicine, which contains 4 publications, is located in Portugal, more specifically in Lisbon. Finally, it is observed that countries with Australia - third in the ranking and Brazil - fifth in the ranking - did not have representative universities, which may indicate a scattering of publications in several institutions, not being sufficient to remain among the five universities.

3.2.4 Publications by journal

The publications by journal, in turn, were also collected according to the number obtained and exposed in Table 03.

Journal	Publications	Percentage
Public	7	7.78%
Environmental		
occupational		
health		
Healthcare	6	6.67%
sciences		
services		
Health Police	5	5.56%
Services		
General Internal	4	4.44%
Medicine		
Medical	3	3.33%
Informatics		

Table 03 – Journals with the most publications

Source: Authors.

Just like the institutions, there is also a process of dispersing articles in journals, since there are many that deal with often similar subjects, as well as the journal with the largest number of publications -Public Environmental Occupational Health - which had 7 out of 90 papers. There are only 4 articles from the fifth place that is Medical Informatics and their percentages, therefore, very little from one to the other.

However, an interesting analysis to be made is that of the theme of the journals, since all of them are focused on the health area. On the one hand, this is obvious, since the researched quality tools are interactive in hospital environments in these articles; however, among the five with the most publications, there were none focused on management or quality per se, which shows an adherence or greater need for health by tools than quality by services.

3.2.5 Papers with more citations

To raise the number of citations of these 90 articles, Google Scholar was used, entering each of them in the search and recording the number of citations of each. Following the pattern presented so far, the articles with the five highest numbers of citations are shown in Table 04.

Ν	Paper	Journal	Year	Citations
1	Diet quality – what	Health	2009	295
	is it and does it	Nutrition		
	matter?			
2	Routine outcome	Evaluation	2010	205
	monitoring and	in Clinical		
	feedback on	Practice		
	physical or mental			
	health status:			
	evidence and			
	theory	~ .	0010	1=0
3	Toward an	Community	2012	178
	Evidence-Based	Psychology		
	System for			
	Innovation Support for			
	Support for			
	Inplementing			
	Quality: Tools			
	Training			
	Technical			
	Assistance, and			
	Quality			
	Assurance/Ouality			
	Improvement			
4	The role of	Informatics	2009	86
	quality tools in	for Health		
	assessing	& Social		
	reliability of the	Care		
	Internet for health			
	information			
5	Quality Indicators	hormone	2010	65
	for the Prevention	and		
	of Type 2	metabolic		
	Diabetes in	research		
	Europe – IMAGE			

Table 04 – Most cited papers

Source: Authors.

As you might expect, all articles are part of the second block, because they are older, but the 2008 articles are not in this ranking, probably because they are more introductory and still do not have as good a development base as the papers they have succeeded.

3.2.6 Survey of the quality tools

Regarding the tools used, it was necessary to make a last filter to determine the works that demonstrated applications in the health areas with them, since, as said before, some articles addressed the theme, and were not exactly the applications and benefits that such tools brought.

Thus, with the 90 papers found, a selection was made to distinguish the applications from the other article formats. This division is illustrated in Fig. 01.



Fig. 1: Division between paper types Source: Authors.

Thus, we can observe that 44% of the articles found are of applications of quality tools in health, which corresponds to 40 of the 90 articles, while the remaining 50 were in the other category. This category, in turn, encompassed the other types of studies, including systematic reviews, workshop summaries, surveys, and feasibility analysis.

Thus, the 40 articles were cataloged and their most important features were raised. Table 05 shows these papers, divided between authors and a brief explanation of each, explaining where the quality tools were used in the application.

Table 05 –	Quality	tools	in health
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Authors	Explanation
Khorfan (2008)	Implemented a daily
	checklist in the ICU of a
	hospital and obtained time
	reduction certain medical
	aspects.
Barnes et al. (2009)	It used checklists to improve
	the quality of information
	about bipolarity on the
	Internet, through a selection
	on various websites on the
	subject.
Aranha et al. (2009)	They identified a tool to
	better express a patient's
	length of stay in the
	operating room by applying
	a relationship matrix.
Tezak et al. (2009)	Used a prospective analysis
	to understand and improve
	the systematic errors of a
	hospital.
Nogueira Franco et	It used quality indicators in

al. (2010)	various areas of a hospital,		
	from the perspective of		
	nurses.		
Kaufman et al.	Achieved quality control in		
(2010)	the breast cancer segment by		
	defining quality, suggesting		
	methods for accurately		
	assessing and measuring		
	quality, and ultimately		
	developing tools to improve		
	breast care.		
Kanashiro-Cussiol	It used financial		
et al. (2010)	performance indicators to		
	improve a laboratory clinic		
	and, consequently, increase		
	the quality of the number of		
	tests produced		
Pajunen <i>et al</i>	It used quality indicators to		
(2010)	develop different strategies		
(2010)	such as risk prevention and		
	screening in a hospital		
Ouispo at al (2011)	Developed a questionnaire		
Quispe et al. (2011)	Developed a questionnaire		
	to improve quality and		
	customer satisfaction in a		
1111	pharmacy.		
Hilts <i>et al.</i> (2012)	It used best practices and		
	quality tools, especially		
	indicators, to improve first		
	care in hospitals and,		
	consequently, the other		
	processes.		
O'Reilly e Mccann	Desenvolveu uma		
(2012)	ferramenta para auxiliar na		
	qualidade da triagem		
	dietética para uso em um		
	ambiente de prevenção de		
	doenças cardiovasculares.		
Wandersman, Chien	Built a tool to improve		
e Katz (2012)	research and practice in a		
	health care environment.		
Manylich et al.	It established the use of		
(2013)	quality indicators to evaluate		
	three types of organ		
	donations: after brain death,		
	after cardiac death and still		
	alive donation.		
Bruno e Nagy	He proposed a quality-		
(2014)	oriented "toolkit" that		
	encouraged organizational		
	culture, teamwork. and		
	appropriate choice of		

	hospital.
Burrows <i>et al.</i>	Proposed tools to evaluate
(2014)	and improve the quality of
(2014)	nadiatria diata macompandad
	by nutritionists.
Levitt et al. (2014)	Validated indicators and
	established a framework
	created for a hospital in
	Canada.
Kim <i>et al.</i> (2014)	Evaluated the effectiveness
1 xiii <i>ci ui</i> . (2011)	of a smartnhona hasad
	of a smartphone-based
	health app for glucose
	control and patient
	satisfaction in a hospital.
Nielsen, Peschel e	It used real-time
Burgess (2014)	documentation feedback to
	improve compliance with
	practical improvement
	standarda in an amarage
	demonstration and emergency
	department.
Armijo-Olivo et al.	Determined relevant items
(2014)	to assess quality and risk
	through qualitative tools in
	physical therapy.
Vijav (2014)	It used 6Sigma and DMAIC
viju y (2011)	to reduce patient discharge
	time
D (2015)	
Bouras (2015)	Proposed tools to measure
	the quality and effectiveness
	of communication between
	surgeons and
	physiotherapists.
Marcelli et al.	Used checklists to improve
(2015)	quality in hemodialysis
(2010)	sessions
Cothy Colours	Used quelity to 1
Catny Coleman	Used quality tools to
(2015)	improve nospital culture, as
	well as stimulate employees.
Arkaravichien,	Developed a quality tool
Wongpratat e	able to assist accessibility
Lertsinudom (2016)	and quality improvement in
	pharmacies in Thailand.
Armstrong et al	Created a framework for
(2016)	establishing quality matrice
(2010)	through notion to the
	through patient voice.
Kuwaiti e	It used 6Sigma and DMAIC
Subbarayalu (2016)	to reduce patient fall rates in
	an academic hospital center.
Kantelhardt, Giese e	Created checklists with
Kantelhardt (2016)	follow-up measures, such as
	r

	standards accessible online,	
	as well as training of	
	hospital staff on these	
	updated metrics.	
Killaspy et al.	Created a quality tool to	
(2016)	evaluate mental health	
	facilities that provide long-	
	term care.	
Crawshaw et al.	Created a quality tool to	
(2017)	validate and measure the	
	quality of a hospital's	
	surgical activities.	
Silva <i>et al.</i> (2017)	Used a checklist in eve	
51174 07 41. (2017)	surgeries to identify their	
	compliance	
Maronna Souza e	It used quality indicators in	
Montes (2017)	the diagnosis of people with	
Wontes (2017)	tuberculosis at the National	
	Reference Laboratory	
Abuiudeb <i>et al</i>	Introduced basic concepts	
(2017)	about quality tools in	
(2017)	rediclogy of a bognital	
Diadhian at al	Implemented a sofety	
(2017)	implemented a safety	
(2017)	checklist to improve surgical	
	quanty at a nospital in	
Character at all	Senegal.	
Chwang <i>et al</i> .	Used quality tools to reduce	
(2017)	workflow	
XX7' / 1		
w immer $et al.$	Evaluated responses to a	
(2018)	nearth questionnaire for	
	quality improvement	
	through medical treatment	
	tools.	
Kasap (2018)	It used 6Sigma, FMEA,	
	QFD, among other tools to	
	improve public health	
	awareness about diabetes in	
	young people.	
Abuelsoud (2018)	Developed a quality project	
	for the child care service in	
	hospital, focused on	
	medicines.	
Bortolini, Maucieri	Stipulates parameters for	
e Borin (2018)	building a water quality	
	assessment tool.	
Ganz <i>et al.</i> (2018)	It outlined an approach to	
	selecting high quality	
	quality tools for use by	
	veterans in healthcare	
	administration online.	

Houston <i>et al</i> .	Gathered information on
(2018)	current data quality and
	clinical testing tools and
	procedures to develop
	monitoring procedures.
	monitoring procedures.

Source: Authors.

IV. CONCLUSION

The article built a bibliometrics that consisted in raising the quality tools used in health environments, from 2002 to 2019, using the bases of Scopus and Web Of Science, thus achieving its objective.

Also, it was possible to expose some years in which there was no research related to the theme, specifically from 2002 to 2007, showing how this importance is relatively new, given that the first article is dated ten years ago. In addition, it was possible to expose other aspects, such as countries, journals and institutions that prioritize these tools in the health field.

Regarding the tools themselves, they have maintained a constant over the years, considering the 40 final articles exposed, noting that, even with this large amount of work, the tools practically fall into two groups that are the basic and the proposals as new in each situation, showing the immaturity of this issue in the health environment.

Thus, as future works, we recommend more works applied in the area, as well as a bibliographic research to explore improving these nuances and the evolution of tools over the years.

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Bibliometric Study on Planning and Control in the Health Environment

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Abstract— Research assists in the creation of new tools, ideas, processes, among others that aim to facilitate progress and social management. Certain areas need some special attention, such as the health sector, which works to achieve maximum standardization of processes, enhancing quality, as the consequences of a failure can be fatal. Thus, to assist in these processes, the general objective of this paper is to analyze the concepts focused on Planning and Control in health environments. For this, a bibliometric survey of articles available in two large databases - Scopus and Science Direct - was performed using keywords of the theme: "Health & Care & Planning and Control", between 2002 and 2019. Then, applied filters to determine the works that were, in fact, within the theme. Thus, a qualitative survey of the planning and control within the hospital scope and its characteristics was obtained.

Keywords—Bibliometric Analysis, Health, Planning and Control.

I. INTRODUCTION

According to Fernandes (1999), humanity has been worrying about the use of resources, trying to avoid waste, thus some contemporary concepts, such as production systems and management functions have gained space. The Production Planning and Control (PPC) function and its related systems aim to exercise production and its processes so that the requirements are met as efficiently as possible (BONNEY, 2000).

In the literature it is possible to find different levels of understanding and application of the PPC in the organizational context, such as strategic planning, construction of theoretical, empirical or managerial models to expose the nuances of these concepts and even proposals for organizational development (ESTENDER et al., 2017).

In addition, the literature also contains a wide range of work on PPC, often always focused on manufacturing areas (ESTENDER et al., 2017), such as the adequacy of the strategic, tactical and operational plans present in Tubino (1997) or the work presented by Burgess and Simons (2005) in the Petrochemical sector.

However, it is possible to see that this concept has difficulties to unfold in the service sector, even if it is a very conducive sector for planning and control, especially if we think about the management of health environments, because it contains complicated processes by itself, involving interdependent paths, one with a higher probability of present failure than the other (HUGHES, 2008). Griffith et al. (2006) found that 75% of 2500 public hospitals in their survey had no significant improvement in nine performance indicators: (i) risk-adjusted mortality rate, (ii) risk-adjusted complication rate, (iii) safety index (iv) severity-adjusted length of stay, (v) adjusted discharge expense, (vi) change in assisted community, (vii) profitability, (viii) cash adjustment for debt and (ix) tangible assets for release adjusted.

In addition, Schoenbaum, Audet and Davis (2003) pointed out that health care costs and declining quality in hospitals are a growing problem in the United States, requiring urgent attention.

Recently, there have been advances related to PPC inserted in the health area, gaining greater visibility in approaches, especially with regard to demand forecasting and control of processes related to it, however to assist in bridging the actual application in healthcare environments techniques present in the literature, it is necessary to create mechanisms for their integration.

Thus, the general objective of this paper is to analyze the concepts focused on Planning and Control in health environments. It is expected, in a first moment, to make a quantitative survey, through a bibliometrics, of the existing works - from 2002 to 2019 - that used techniques focused on the Planning and Control in the Web of Science (WOS) and Scopus, highlighting details such as year of publication, magazine and countries in which they occurred and then an analysis focused on what concepts were introduced in the health environment.

The justification for this work is based on two main pillars, the first of which is the need for studies focused on the health area, in order to help the managerial demands of the same and, finally, the importance of studies that integrate the academic area with existing practice in organizations.

1.1 Theoretical Reference

1.1.1 Production Planning and Control (PPC)

Every organization must recognize the customer's wishes and, through the planning and organization of its productive resources, serve the stipulated demand, this activity being the essence of the PPC (*PUC-RIO*, 2005).

However, this simplistically described process previously receives recurring interferences and unforeseen variations, which originate in demand, process performance and other factors outside the company (PUC-RIO, 2005).

Thus, it is necessary to work together the production resources in parallel, seeking to meet this variable of customers and products, because PPC is an information system that controls the interaction of an organization's productive resources through planning, which can be described as short, medium or long term (DAVIS; AQUILANO; CHASE, 2001).

For Davis, Aquilano and Chase (2001), the long-term PPC is related to times longer than one year and can create scenarios of three, five or even ten years and is related to the company's strategic planning.

The medium-term PPC covers the period from three to twelve months and must be reviewed and updated quarterly. Because it is linked to the tactical level, standards of use must be established, needs to be hired, resources used, services, among others (DAVIS; AQUILANO; CHASE, 2001).

Finally, the short-term PPC deals with the production of the next four weeks, associated with the operational level, which is focused on the decisions of flexibility of the production process, time of production shift, demand fluctuation for its portfolio, variation among others (DAVIS; AQUILANO; CHASE, 2001).

Even with this segmentation, market prospects may not be clear, so correcting distortions requires continued monitoring and review of customer needs assessments. However, making predictions of demand is not a simple activity, involving a range of information analysis with the help of various techniques (*PUC-RIO*, 2005).

Expanding these concepts into the area of services, specifically health, more research is needed on the relationships between different activities, as well as the exchange of information and knowledge management within and between different hierarchical levels of health care order to develop the quality of health care (SVENSSON; HEDMAN, 2018).

1.1.2 Planning and Control in the health environment

Within a health organization, there are different professions from different functions and departments, which together organize health care. The goal is to provide high quality health care using the limited resources available (SVENSSON; HEDMAN, 2018).

Designing and organizing healthcare processes will involve planning and control activities. This design and organization process will also entail setting goals for activities and planning what to do, how to do it, when to do it, and who to do what, such as operations management (SVENSSON; HEDMAN, 2018).

Care management and planning include resource sizing, planning, programming, monitoring and control (HULSHOF et al., 2012). Health planning and management can, for example, be directed to planning operating rooms, planning nurses' needs and scheduling patients (CARDOEN, DEMEULEMEESTER and BELIEN, 2010).

However, there are characteristics of the health sector that lead to less effective management and planning (HANS, VAN HOUDENHOVEN; HULSHOF, 2012), which are:

• Health care consists of professional organizations with professions that lack communication, cooperation, collaboration and knowledge integration, and also sometimes have conflicting interests;

• Information systems used in healthcare are often not integrated, where necessary information is not available and knowledge cannot be integrated;

• Many hospital departments are autonomous and managers cannot see beyond departmental boundaries, leading to fragmented planning and management;

• Managers generally think that more resources will be applied to management. However, these resources will be taken from patient care;

• Management roles are often poorly defined;

• Activity scheduling is not based on production plans.

Thus, we have a current panorama of really worrying health, which increasingly needs the help of external tools, focused on asset management and especially in the planning and control of processes.

1.1.3 Current health picture

Brazilian hospitals have a problem of size, thus suffering with a shortage of beds. Of the 6,774 existing hospitals nationwide, 88% contain less than 150 beds (ASSOCIAÇÃO NACIONAL DE HOSPITAIS PRIVADOS – BRASIL, 2013). For Pedroso (2013), a hospital is not operationally viable when it has less than this amount. In addition, according to a survey, about 829 Brazilians die daily in public and private hospitals for failures that, for the most part, could have been prevented. Thus, three Brazilians die every five minutes (INSTITUTO DE ESTUDOS DE SAÚDE SUPLEMENTAR – BRASIL, 2017).

The failures occupy second place in the ranking of most common deaths in Brazil, second only to cardiovascular diseases, responsible for the death of approximately 950 Brazilians per day. Even so, hospital failures are still far from other common causes of death, such as cancer (480 to 520 deaths / day), violence (164 deaths / day) and traffic accidents (129 deaths / day) (SOCIEDADE BRASILEIRA DE CARDIOLOGIA, 2017).

Thus, asset management in healthcare environments can contribute, among other things, to better management performance, be it in equipment, people or capital, as well as greater accuracy to detect failures in operations (HEALTHCARE MANAGEMENT, 2019).

Thus, any assistance from the academic point of view is welcome in this area, since the hospital landscape is worrying. Thus, there is bibliometric analysis that is part of scientometrics developed to measure production-based scientific performance (GODIN, 2006; VERBEEK et al., 2002) and provides information on different aspects of scientific performance by examining "physical units" or bibliographic units or substitutes for either "(BROADUS, 1987).

II. MATERIALS AND METHODS

This research, according to Turrioni and Mello (2012), can be classified as basic in nature, containing an exploratory bias and a qualitative approach, by using number of articles and analysis of terms present in the works.

The methodology of the present work was divided into two stages: (i) selection and (ii) analysis. In the selection part, the following steps were followed:

• Search for the term "Health & Care & Planning and Control" in the WOS and Scopus databases with the time interval filter from 2002 to 2019;

• We found 22 papers in WOS and 39 papers in Scopus;

• After a brief reading of the summary of each work, it was possible to see that not all articles found fit the theme, obtaining 19 articles in WOS and 25 articles in Scopus;

• Once obtained, a comparison was made to see if there were no repetitions between the bases. Thus,

there were 10 equal articles, totaling 34 papers on the subject.

After this first step, the second step consisted of a deeper analysis of these articles in two parts:

1. After surveying the total number of articles, comparisons were made about (i) years of publication, (ii) countries of origin, (iii) higher education institutions involved, (iv) published journals, and (v) most cited publications in the given time interval;

2. Finally, an individual analysis of all articles was made, in order to determine their application and, thus, to survey which concepts of Planning and Control were introduced in the health environment.

III. RESULTS AND DISCUSSION 3.1 Selection

After searching for the term "Health & Care & Planning and Control" in the chosen databases and applying the filters, obtaining 34 articles between 2002 and 2019, it was necessary to read the full content to evaluate if all works really incorporated the theme.

After this filter, it was possible to realize that 8 of these articles were not in conformity and was discarded, resulting in a definitive total of 26 papers. It is noteworthy that articles that addressed the theme, that is, did not necessarily discuss a PPC application in health, but made mention of them were kept, because they are aligned with the objective, even indirectly. Thus, from this, it was possible to continue the work, classifying the articles found.

3.2 Articles Analysis

3.2.1 Publications per year

Firstly, the articles found were arranged over the determined time interval, i.e., from 2002 to 2019. Graph 01 illustrates their occurrence, according to the amount expressed per year.



Source: Authors.

It is possible to separate the years into two major blocks, which are: (i) from 2002 to 2007 and finally (ii) from 2008 to 2019. As regards the first period of time, there was no return in either base on the subject.

This is because the scope of health, inserted in the area of services, has recently begun to gain attention with regard to the use of quality management assistance, since the application of such techniques was not a priority, making it difficult their penetration into services, and not creating relevant publications.

The second block of time, focused on 2008 to 2019, is when we see this paradigm changing, as we have the first publications in the first year of the segment, with a total of three works, representing 11.54% of all works found. Of course, due to the low number of articles found in total, it is not possible to affirm a consolidation of this concern in the health field; however the following years kept publications focused on the theme, with fashion in two publications per year, with highs in 2008, 2010, 2013 and 2014, and with casualties only in 2009 and 2019, with just one article. It is noteworthy that, due to the moment this research was done, the reality about 2019 may change.

3.2.2 Publications by country

After the annual survey, an analysis was built now for the countries of origin that made the publications focused on the PCP in the health area. Table 01 shows the ranking of the five countries with most papers.

Region	Publications	Percentage
Netherlands	7	26.92%
Italy	6	23.08%
USA	5	19.23%
UK	2	7.70%
Germany	2	7.70%

Table 01 - Number of Publications by Country

Source: Authors.

We can see that the Netherlands leads the ranking with 7 out of 26 publications found on PPC in health, while Italy, the United States, the United Kingdom and Germany complete the ranking with 6, 5, 2 and 2 papers out of 26, respectively. It is also noted that due to the low number of works, the difference between the first and fifth ranking is not very large, only 5 works, or 19.23% of the 26 found, which shows an opportunity and even, need to develop more work focused on this theme.

3.2.3 Publications by institution

Following, it was possible to rank the five higher education institutions that are linked to the publications on PPC in health, as shown in Table 02. *Table 02 - Higher education institutions with most*

publications				
Institution	Country	Publications	Percentage	
Harvard	USA	3	6.67%	
Public				
School of				
Health				
Maastricht	Netherlands	3	5.56%	
University				
University	Netherlands	2	5.56%	
of				
Amsterdam				
Erasmus	Netherlands	2	5.56%	
University				
Complutense	Spain	2	4.44%	
University				
of Madrid				

Source: Authors.

In educational institutions there are two peculiar situations, and a priori there is a parallel directly linked with the countries exposed in the previous subsection, since the Harvard Public School of Health belongs to the United States, while the second, third and fourth place are from the Netherlands. However, the second point is that the Complutense University of Madrid stood out with two works and was fifth in the ranking, but it belongs to Spain, which did not appear in the ranking of countries, even the United Kingdom and Germany appear with the same amount of articles. This happened by an arbitrary choice in determining the draw.

It is also possible to notice that Italy, Germany and the United Kingdom did not have institutions that represented them in this ranking, but they have publications, but were distributed more evenly among the institutions, leaving them out of the five with the most papers.

3.2.4 Publications by journal

Journal publications were also surveyed and ranked by number, as shown in Table 03.

Table 03	- Iournals	with the	most	nublications
10016 05	- <i>journaus</i>	will the	mosi	publications

Journal	Publications	Percentage
Health Polices	6	23.08%
Computer Science	5	19.23%
information Systems		
Health Services and	4	15.39%
Management Research		

Public Health,	3	11.54%
Environmental and		
Occupational Health		
Health Care Sciences	3	11.54%
& Services		

Source: Authors.

It can be seen, as in the previous topics, that the ranking with the five largest can capture most of the publications, since the occurrence of works was only 26, so we see the journal with the largest number of publications - Health Policies - comprising 6 articles and the five with more articles 21 of the 26 papers surveyed.

Moreover, an interesting analysis to be made is that, of these five, four journals have the main theme focused on health, which is relatively expected, since part of the theme starts from this principle, but also shows that the need to look for management tools came from the inside out. In addition, the non-health journal - Computer Science Information Systems addresses computer problems, showing how computer mathematics is linked to the application of PPC in health.

3.2.5 Papers with more citations

To raise the number of citations of the 26 articles, Google Scholar was used, entering each of them in the search and thus recording the respective numbers of citations. Following the pattern presented so far, the articles with the most citations are in Table 04.

Ν	Paper	Journal	Year	Citations
1	Reduced Costs for	PLOS One	2012	52
	Staphylococcus			
	aureus Carriers			
	Treated			
	Prophylactically			
	with Mupirocin and			
	Chlorhexidine in			
	Cardiothoracic and			
	Orthopaedic Surgery			
2	Societal output and	Health	2010	44
	use of research	Research		
	performed by	Policy and		
	health research	Systems		
	groups			
3	How do strategic	Health Care	2011	38
	decisions and	Management		
	operative practices	Science		
	affect operating			
	room productivity?			

4	Big data logistics:	Procedia	2015	35
	a health-care	Computer		
	transport capacity	Science		
	sharing model			
5	Assessing health	BMC Public	2012	33
	and economic	Health		
	outcomes of			
	interventions to			
	reduce pregnancy-			
	related mortality in			
	Nigeria			

Source: Authors.

All articles appearing in the ranking presented are between 2010 and 2015. A priori, observing the years after 2015, it is to be expected, since they are more recent articles that have not had time to be cited, but before 2010 does not appear in this ranking and this is probably because they are more introductory articles that are still exploring the topic.

It is worth mentioning the first article in the ranking entitled "Reduced Costs for Staphylococcus aureus Carriers Treated Prophylactically with Mupirocin and Chlorhexidine in Cardiothoracic and Orthopaedic Surgery" since it has a relatively large number of citations, although it does not have a great disparity with the fifth, maintaining a difference of 19, being the same year. However, his theme is interesting because it showed how benchmarking between hospitals can help lower costs and also highlights a hospital that has an entire Planning and Control department.

3.2.6 Concepts of Planning and Control in health

Regarding the concepts present in the works found, it was necessary to apply a last filter, since, as previously stated, some articles addressed the theme and, thus, they were not exactly applications and benefits of these concepts. Thus, with the 26 papers found, an individual selection was made to distinguish the applications from the other article formats. This division is illustrated by Figure 01.



Fig. 1: Division between paper types Source: Authors.

Thus, it was possible to see that 77% of the articles found were related to applications of PCP in health, which corresponds to 20 of the 26 studies found, while the remaining 6 fell into the Other category. This category encompassed the other types of studies, including literature reviews and analysis of possible applications.

Thus, the 20 articles were cataloged and their characteristics were raised. Table 05 shows these works, divided between reference and a brief explanation of each one, showing where Planning and Control interacted with health in each case.

Authors	Explanation
Baars e Van Merode	Evaluated the requirements
(2008)	for implementing a hospital
	Care Planning and Control
	tool and its relationship with
	IT.
Silvestro e Silvestro	It proposed a Planning and
(2008)	Control model to increase the
	efficiency of the Strategic
	List, which is responsible for
	managing the scales between
	nurses and doctors at a UK
	hospital.
Cannavacciuolo,	It analyzed the technical
Ponsiglione e	Infrastructure bias of Health
Dellino (2009)	Planning and Control
	systems and presented a case
	study locused on the
	operating rooms
Mostert et al. (2010)	It developed a quantitative
Wiosten er ur. (2010)	approach to assess social
	production and research use
	by health research groups and
	to assist in their planning.
Villa e Bellomo	Analyzed models of
(2010)	improvement in Planning and
	Control proposed in
	industrial management and
	adapted some projects for the
	health sector.
Fruggiero, Iannone e	Built a hierarchical structure
Riemma (2011)	for the medium and short
	term Planning and Control of
	healthcare delivery systems,
	for standardization,
	rationalization and effective
	measurement of assets.

Table 05 – Quality tools in health

Peltokorpi (2011)	It analyzed the synergistic					
r (r)	effect of strategic decisions					
	and operative management					
	practices on operating room					
	productivity with a multiple					
	case study					
Van Dijon at al	It determined whether					
(2012)	tracting a particular surgery					
(2012)	treating a particular surgery					
	affects patient care costs					
	through benchmarking with					
	another nospital's Planning					
	and Control department.					
Salvatore, Boscolo e	It sought the long-term					
Tarricone (2013)	economic balance between					
	quality and cost of health					
	services through a publicly					
	accessible Planning and					
	Control system.					
Barsanti e Nuti	It described how health					
(2013)	access equity indicators					
	according to socioeconomic					
	conditions can be excluded					
	from performance evaluation					
	in the context of Strategic					
	Health Planning and Control.					
Drupsteen, Van Der	It investigated which					
Vaart e Pieter Van	integrative Planning and					
Donk (2013)	Control practices are used in					
	hospitals and their effects on					
	patient flow.					
Nuti e Seghieri	It outlined the first steps of a					
(2014)	long-term approach to					
(2011)	proactively addressing geo-					
	focused planning and control					
	in health care					
Ramos $at al (2014)$	Analyzed milk production in					
Kantos et al. (2014)	an intensive system to					
	classify processes into a					
	Value Streem Mon					
Ronhaiii Davra	It introduced a retient					
A nairrer (2015)	n introduced a patient-					
Anciaux (2015)	centered multi-agent system					
	for health care, specifically in					
	Hospital Flow Planning and					
	Control.					
Mehmood e Graham	Contributed to big data					
(2015)	focused on the development					
	of technical tools in Network					
	Planning and Control,					
	exploring improvements in					
	transport capacity sharing.					
Nap (2016)	Monitored scanner data					

	traffic between servers to					
	improve logistics control and					
	management perception in a					
	hospital.					
Shohet e Nobili	Implemented performance					
(2017)	indicators to evaluate the					
	maintenance, Control and					
	Planning of a clinic.					
Thomas Schneider et	Allocated ward beds for					
al. (2018)	emergency services using					
	demand forecasting in a					
	hospital.					
Svensson e Hedman	It analyzed the challenges					
(2018)	that hospital health care faces					
	related to capacity					
	management knowledge and					
	control of activities					
	performed.					
Bellandi et al.	Described critical issues for					
(2019)	elements of good practice in					
	the transition from the					
	current medical to electronic					
	process.					

Source: Authors.

IV. CONCLUSION

The article built a bibliometrics that consisted of analyzing the concepts of Planning and Control used in health environments, from 2002 to 2019, using the bases of Scopus and Web of Science, thus achieving its objective.

In addition, it was possible to expose some years in which there was no research related to this theme, more specifically between 2002 and 2007, showing how the importance given to management resources in health is relatively new. In addition, it was possible to expose other aspects such as countries, magazines and institutions that presented more representativeness of the concepts of Planning and Control in health.

With regard to these concepts, it is possible to notice that, besides not being standardized for a given situation, there are still few studies on the subject, since 20 applications over 18 years express an average of 1.11 articles per year. Thus, it is necessary to search other sources or keywords to research on the subject and also encourage the incentive to this theme.

For future work, therefore, a deepening of the subject is recommended, as well as a bibliographic research to better explore the peculiarities and the evolution of the concepts over the years.

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Mediated Information and Flipped Classroom -Information Retention Level Assessment

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Abstract— The Flipped Classroom methodology uses audiovisual products in general and video in particular as a means to make content available to students. In this study, we intend to verify and evaluate if there are significant differences in the retention of information mediated by the audiovisual products according to the type of resource that carries it. For this purpose we created eleven prototypes using the "Articulate Storyline ©" program. In these prototypes the information was presented exclusively in the following typologies of resources: i) Video; ii) Video, Audio and Text; iii) Video and Text, iv) Video and Audio; v) Image, Audio and Text; vi) Image and Text; vii) Image and Audio; viii) Image; ix) Audio and Text; x) Text; xi) Audio. In this study, the data revealed that the average levels of information retention mediated by the various typologies of resources were higher than 60%, either immediately after receiving the information or after eight days; and that the highest retention occurred when information is mediated through video, audio and text simultaneously with 92.31% and the lowest retention when information is only available through the 64.62% image.

Keywords— Evaluation of the Information Retention Level, Mediated Information and Retention Effectiveness, Multimedia Resources, Audiovisual, Flipped Classroom.

I. INTRODUCTION

Online distance education contexts should be based on the premise that teaching must be student-centred, promote autonomous, self-regulated and collaborative learning and encompass both the scope of formal education and the scope of informal education.

The main platforms that offer online distance education courses use audiovisual products in general and video in particular for the presentation and distribution of their content. In online teaching contexts, teacher-student communication takes place through multiple means of communication, in which the video assumes a role of excellence that teachers use to make content available.

In the Flipped Classroom methodologies, the video is used to present the contents to the students, which will be treated later in the classroom. The Flipped Classroom methodology follows a model of teaching and learning in reverse: students attend home-based classes (mostly embedded video-based video support) and use classroom time to interact with peers and teachers [11].

However, video as a learning support tool is (still) poorly exploited and often misused [12], [7] and [6]. The language of video has a synthetic nature, articulates moving and static images, sounds, speeches and texts, creating a juxtaposition of codes and significations, predominantly audiovisual [13], [10]. Video captures the attention for its moving images, for its audio and is often self-explanatory, which enhances the seizure and retention of information and consequently learning. The research of several authors raises questions related to the levels of retention of the mediated information according to the different resources in which it is transmitted. The British Audio Visual Society [1] and the Industrial Audiovisual Association [8], converge in their conclusions stating that we remember about: 10% of what we read; 20% of what we hear; 30% of what we see; 50% of what we hear and read simultaneously; 80% of what we say and 90% of what we speak and do simultaneously [1] and [8]. The study developed by Socony-Vacuum Oil CO. Studies [15], shows the relationship between the data retained in the first three hours, with the data retained after three hours after receiving the information, Table 1.

 Table. 1: Comparison of data retention before and after

 three hours

	Data Retained			
Teaching method	Up to 3 hours	After 3 hours		
We hear	70%	10%		
We see	72%	20%		
We Hear and See Simultaneously	85%	65%		

Glasser (2001), in his Theory of Choice, states that we remember things in terms of the interaction we have with

them. He says that we learn 10% of what we read, 20% of what we hear (such as podcasts, audiobooks, ...); 30% of what we see; 50% of what we see and hear (ex: videotapes, films, documentaries ...); 70% of what we discussed with others (e.g., talking, debating, asking, ...); 80% of what we do (e.g. writing, translating, proofreading, ...) and 90% of what we teach others (e.g. explain, summarize, elaborate, ...). For Glasser, to read, to hear, to see, to see and hear are considered passive forms of study, and what we discuss, do, and teach are active ways of learning [5]. Dale, in his study in 1969, says that after two weeks, the human brain recalls 10% of what you read; 20% of what you heard; 30% of what you saw; 50% of what you saw and heard; 70% of what you said in a conversation or debate, 90% of what you said and did, than you experienced during your practice. As for the type of involvement/engagement, Dale groups these experiences into two types: one that he calls passive involvement, in cases where information is received verbally and visually (reading, listening, seeing, hearing, and seeing); and another, which he calls active involvement, in cases where the subject participates (saying, saying and doing) [2], [9].

The majority of the educational videos that are used to make content available are grouped into two different types: videos with shots of the teachers verbally displaying/presenting contents and videos with relevant image plans of the subjects to be dealt with by the teacher's voice off explaining the contents.

In the videos with shots of the teachers verbally presenting/displaying content, the teachers present a verbal text in an expositive way. As a result, in this type of videos the student/viewer quickly ignores/abandons visual information (because it does not change, always the same image of the teacher - does not increase significant information) and focuses exclusively on audio information. In these situations the retention of the information is restricted almost exclusively to the auditory canal, and the visual channel is neglected. The interest and strength of the information is in the verbal/audio and often the student/spectator stops paying attention to the visual channel and concentrates exclusively on the audio channel - in the listening. Examples of this typology are the "Classroom Session", "Talking Head", "Webcam Recording", "Videoconference" [7] and [12].

In the videos with shots of relevant images of the subjects to be explored, with the teacher's voice off explaining the contents, the information retention happens simultaneously through the visual and auditory channel and the student/spectator gets "stuck" to the screen and concentrates on what they are seeing and listen. In these situations, the retention of information is enhanced by simultaneously activating the visual and auditory channels, which constitute the two main means of audiovisual communication - the eyes and ears. Examples of this typology are the videos "Demonstration", "Slide presentation with voice over", "Khan style digital capture ", "Udacity style digital capture", "Screen capture", "Animation" [7] and [12]. Regarding the online evaluation process and considering that, as Figueiredo affirms, any learning context must contain in itself the essential tools for the evaluation of its own success [4]. Video documents must provide questionnaires embedded at the end of each video in an integrated way, to allow students to self-evaluate their progress and also their success in the learning form that is proposed [12].

II. THE STUDY

This was the theoretical framework that based the design of our empirical study, whose main objective is to verify and evaluate if there are differences in the retention of the information at the moment immediately after its reception, and after eight days, depending on the information presented in resource video, still image, sound or text separately or in sets formed by combining paired groups or groups of three of these different features.

So we created eleven prototypes using the program "Articulate Storyline ©" in which the information was directed to what we see (video); we see (fixed image) and we hear; we read; we see (video) and listen simultaneously; we see (video) and read simultaneously; we see (video), listen and read simultaneously; we see (Fixed Image) and read simultaneously; we see (fixed image), listen and read simultaneously; we hear and read simultaneously.

III. INSTRUMENT OF STUDY

Eleven types of audiovisual resources were used with a digital quiz incorporated at the end of each one, which allowed obtaining quantitative data depending on the use of different combinations of the typology of the resource/media used. These features gave rise to eleven different types of arrangements that are explained below.

Table. 2: Type of Resource R1 – Video

	Resource - R1.1 - Video + Audio + Text In resource R1.1 the informative content is presented to the user in video audio and text.
F 10	Resource - R1.2 - Video + Text In resource R1.2 the informative content is presented to the user in video and text.
	Resource - R1.3 - Video + Audio In resource R1.3 the informative content is presented to the user in video and audio.
	Feature - R1.4 - Video In resource R1.4 the informative content is presented to the user only in video.

Table. 3: Resource Type R2 - Image





Resource - <u>R2.4</u> - Image In resource <u>R2.3</u> the informational content is presented to the user only in image.

Table. 4: Resource Type R3 - Audio



Resource - <u>R3.2</u> - Audio In resource R 3.2 the informative content is presented to the user only in audio.

Table. 5: Type of resource R 4 - Text



IV. SAMPLE

Our sample is made up of 143 students of higher education, of the courses of the teacher training of the Superior School of Education of P.Porto.

In each typology, 13 students of both genders were used in both test 1 and test 2 (eight days later - 8DL).

V. METHODOLOGY

The eleven features differentiated according to their typologies constitute Test 1 that was applied to all 143 subjects of our sample.

Eight days later, the completion of Test 1, it was applied to the same subjects Test 2, consisting only in part of the questions contained in each of Test 1 resources (audiovisual information of R1, R2, R3 and R4 was hidden).

VI. DATA COLLECTION AND TREATMENT

Data was collected through the incorporated quiz at the end of each type of audiovisual resource. For data processing, we grouped the eleven types of audiovisual resources into three different sets. Set 1 - videos that present the information in a single resource. Set 2 - videos that present information with two features simultaneously. Set 3 - videos presenting information with three counts simultaneously, Table 6.

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		Percentages Averages					
	Type of Resource	Test 1	Test 2	x	x		
Set 1	R1.4 - video only	82,31%	75,38%				
	R2.4 - image only	64,62%	74,62%	77 139/	77 60%		
	R3.2 - audio only	80,00%	69,23%	11,1270	72,09%		
	R4.1 - text only	81,54%	71,54%				
	R1.3 - video and audio	86,92%	76,15%				
	R2.3 - image and audio	77,69%	67,69%				
Set 2	R3.1 - text and audio	69,23%	66,15%	81,08%	70,46%		
	R1.2 - video and text	86,92%	73,85%				
	R2.2 - image and text	84,62%	68,46%				
Set 3	R1.1 - video, audio and text	92,31%	76,92%	00 28%	77 60%		
	R2.1 - image, audio and text	88,46%	78,46%	50,38%	11,09%		

The data of Table 6 shows that the highest average of information retention occurs in set 3, reaching 90.38% in test 1 and 77.69% in test 2. Following the set 2, with 81.08% in test 1 and test 2 at 70.46%. And with the lowest average (but above 72%), the set 1 with 77.12% in test 1 and test 2 at 72.69%.



Fig. 1: Mean percentages - Test 1 and Test 2

Fig. 1 shows that data from test 1 and test 2 follows the same evolution pattern as the typology used, with the exception of the image resource (R2.4-I), that undergoes a significant increase in test 2 (eight days later) in relation to the value of test 1.

VII. CONCLUSION

Overall, our study allowed us to verify that the levels of the averages reached in the retention of the information provided/made available by the different typologies of resources were high - higher than 70% - and that the averages increase with the increase in the number of resources at the same time as the information is served. When we use three resources simultaneously - video, audio and text or image, audio and text - we achieve the highest averages of information retention. We also verified that the lowest information retention average occurs when only one resource is used - only video, only image, only audio or text only. And that, when we use two resources simultaneously - video and audio, image and audio, text and audio, video and text or image and text -, the averages are between the previous two.

The study data also revealed that: i) the average of the retention of the information is higher when it is transmitted/made available through video, audio and text simultaneously; ii) when we offer/disseminate information through a single resource, the one that reaches the highest average is the video; iii) the lowest mean of retention of information occurs when it is made available to the information only in the image resource; iv) after eight days, the averages maintained the same relations between the different typologies of resources compared to those of test 1; v) after eight days, the averages of test 2 were all lower than those of test 1, with the exception of the image resource, which increased.

The results of the study, when compared with the results of Socony - Vacuum Oil CO.Studies [15], [5] and [2], allow us to conclude that the best resources to extend the acquired or constructed knowledge are those involving video, audio, and text, perhaps because they respond to the various modes of learning (auditory, visual, and kinesthetic). However, the best results come when it is "saying", "doing" and "debate/argue", so this study supports the Flipped Classroom approach that previously provides video, audio, text and other multimodal formats for students to have access to content before class, to retain the necessary information for a critical and reflective participation in the classroom reaching a higher degree of complexity of knowledge and a higher motivation in the act of learning.

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Response curve of *salvia hispânica L*. to different dosages of phosphorus in soils of the cerrado

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Abstract—This study aimed to evaluate the response curve of phosphorus fertilization to the development and productivity of Salvia hispânica

L. in Cerrado soils in the South of Tocantins. The Chia seeds used in the experiments came from producers in the region of Katueté — Paraguay. The experiments were carried out in the experimental area at the Federal University of Tocantins, University Campus of Gurupi-TO, in the agricultural years 2014/2015 and 2015/2016, through a randomized block design with four repetitions. The treatments consisted of five levels of phosphorus fertilizer (0, 30, 60, 90 e 120 kg ha⁻¹). At 120 days after emergence, the following characteristics were evaluated plant height, upper stem height, stem diameter, bunches number, length of bunches, and grain Productivity. The data were submitted to analysis of variance and regression at the 5% probability level by the F test. The analysis of the results showed that the doses of 30 and 60 kg ha⁻¹ of phosphorus influenced positively in the most development and productivity in the culture of Chia in the harvest 2014/2015. The results also showed that increasing doses of phosphorus had not positive effects in the agronomic characteristics at the culture of Chia n the harvest 2015/2016. The maximum grains Productivity found in the isolated doses of P was superior to 157 kg ha⁻¹.

Keywords—fertilization, Chia, management, tropical soils.

I. INTRODUCTION

The Chia (salvia hispânica L.) is a herbaceous plant in the family Lamiaceae, native to southern Mexico [1]. The cultivation is gaining importance by their grain they produce excellent nutritional value, could be used in food as a health supplement and food formulation, resulting in this way, an increase of production, consumption, and demand-led primarily by consumers worldwide as the United States, Canada, Japan and Australia [2, 3]. Currently, the commercial seed Productivity vary between 500 and 600 kg ha–1, more some producers of Salta (Argentina) and Acatic (Mexico) have obtained 1,000 and 1,260 kg ha–1, respectively [4, 5]. In Brazil, the Chia finds favorable conditions to good development, reaching between 200 and 800 income kg ha-1 [6], although not as farming

fertilizer recommendations and coverage, cultural practices, harvest season among others, one of the main limitations for raising the productivity of soil conditions.

The requirement of nitrogen and phosphorus are low, however, the fertilization recommendations change according to region and type of soil so if it makes necessary more research on agronomic techniques for culture [7, 8]. Brazilian tropical soil nutritional requirement is highly variable especially in the Cerrado biome that exhibits poor in nutrients, especially phosphorus, which is often the most limiting nutrition of plants not only by low concentration but also for your link to soil colloids, affecting your availability [9]. Thus, the phosphate fertilization is essential for proper growth and better productivity of crops, because this nutrient is involved in the participation of cell membranes, nucleic acids and ATP, essential functions for the plants [10].

Fornasiere Filho (2007) [11] states that the available phosphorus in soil is an element essential to the nutrition of plants, playing a key role in the transfer and use of energy. In addition to being part of the establishment of a series of important compounds of cell plant respiration, photosynthesis, and intermediaries several vital functions in the plant



metabolism. The match is considered as an essential element for plants, by your active participation of compounds and reactions, and may not be replaced by other nutrients [10].

Considering the increasing international demand for Chia, the scarce information on your agronomic management, and the importance of phosphate fertilization of crops in soils of cerrado in Brazil. Objective to evaluate the response to phosphate fertilization for the development and productivity of Salvia hispânica L. in cerrado soils in the southern region of Tocantins.

MATERIALS AND METHODS II.

The tests were carried out on 2014/2015 and 2015/2016 crop, in the experimental area of the University Campus of Gurupi, located 11° 43' 45 " South latitude and 49° 04' 07" w, with an average height of 285m. The experiments were installed on land classified as red yellow Latosols dystrophic, profound, acid e de texture sandy (EMBRAPA, 2013) [12]. The data on precipitation, temperature and relative humidity in the period of conducting the experiments were collected at the weather station on Campus of Gurupi, and are presented in Figure 1.



Minimum temperature --- Maximum temperature Relative humidity

Fig. 1: Daily average values of temperatures (°C), daily total pluvial precipitation (mm) and daily average values of relative humidity (%), that occurred during the period 9 December 2014 the 3 of May 2015 (A) and 14 December 2015 the 2 May 2016 (B), Gurupi, TO.

Precinitation

The areas presented history with common bean and soybean farming in the off-season and cultivation of rice in the year. The physical and chemical characterization of the soil of the experimental area, at a depth of 0.00-0.20 m in 2014/2015 presented the following characteristics: pH em CaCl2 = 5,2; M.O =

1,6% P (Mel) = 1,3 mg dm-3; K =37 mg dm-3; Ca+Mg = 2,5 cmolcdm-3; H+A1 = 2,20 cmolcdm-3;A1 = 0,00 cmolcdm-3; SB = 2,19 cmolcdm-3; V =50%; 69 dag kg-1 of sand; 5 dag kg-1 of silt and 26 dag kg-1 of clay. To harvest 2015/2016 presented the following characteristics: pH in CaCl2 = 5,0; M.O =

Precipitation

2,2 % P (Mel) = 39,3 mg dm-3; K =91 mg dm-3; Ca+Mg = 3,2 cmolcdm-3; H+Al = 2,0 cmolcdm-3; Al = 0,00 cmolcdm-3; SB = 2,19 cmolcdm-3; V = 58%; 75 dag kg-1 of sand; 5 dag kg-1 of silt and 20 dag kg-1 of clay.

In both cases, the tillage was performed conventionally with plowing and two harrows. The experiments were conducted in experimental design, in random blocks with five, doses of phosphorus (0, 30, 60, 90, 120 kg ha–1). The parcels consisted of 6,4 m2, each composed of four rows of 4 m and 0.40 m spaced. Was considered the area the two central rows, disregarding 0, 5 m from each end.

For both assays, the phosphate fertilization was performed in the furrow applying the doses at the time of sowing, in the form of triple superphosphate. Potassium and nitrogenous fertilization were performed according to soil analysis.

Chia seeds were from producers in the region of Katueté-Paraguay. Using 3 g in 4 linear meters, aiming to achieve population end of 750,000 plants per hectare. In both cases, the thinning to 25 days after the emergency, leaving only 30 plants per linear meter.

Weed control was performed with manual weeding to 20:45 days after emergence, what stage the plants are sensitive to herbicide applications. Furthermore, herbicides were applied with active ingredient Clethodim (0.30 L p.c. ha–1) at 60 and 75 days after emergence.

The culture has shown itself sensitive to common pests of other species, being made three applications of insecticide to 60, 80 and 120 days after emergence for caterpillar control falsa-medideira (Chrysodeixis includens and Spodoptera sp), vaquinha (Macrodactylus pumilio) and whitefly (Bemisia tabaci) being used Alfacipermetrina (0,5 g i.a. ha-1) e Diflubenzuron - Fenil-uréia (3,6 g i.a. ha-1), for the control of caterpillar and vaquinha, and for the control of whitefly Acetamiprid (75 g i.a. ha-1).

Due to the Veranico present in the last years in both cases a fixed conventional sprinkler irrigation system was installed. Both operating at a pressure of 20 MCA every two days, providing a water depth of 5.2 mm/hour. The water supply was carried out so that the culture did not suffer from water stress in critical phases such as emergence, flowering, and grain filling.

In the 2014/2015 crop due to the disuniformity of the natural maturation of the crop, the harvests were performed manually between 135 and 145 days after sowing, harvesting the useful area when the plants reached 90% of yellow and dry leaves. In the 2015/2016 crop, the harvest was carried out manually at 138 days after emergence, standardizing the harvest point with desiccant with active ingredient Parachate (1,0 L P.C. ha-1) when most bunches of plots reached 90% of dark coloration.

For evaluation of the characteristics phytotechnics, sampled ten plants representative of the area of each parcel. The characteristics evaluated were: number of curls obtained per plant, determined by direct counting in the plants sampled and transformed in m2(This characteristic was not considered in the 2015/2016 crop by the disuniformity that the crop presented in the emission of bunches); plant height measured in cm from the base of the plant's lap to the insertion of the bunches main; height of the upper stem measured in cm from the lap of the plant to the center point of the insertion of the last upper stem; diameter of the stem expressed in mm, using a digital caliper; length of the bunches expressed in cm, measured with ruler. Subsequently, of the bunches were threshing, cleaned identified by treatment and stored in plastic bags for evaluation of grain Productivity (kg ha-1), The seed Productivity was obtained from the seed mass of the bunches harvested in the useful area of the plot, and the weight was measured on a digital scale. The values found in each plot were transformed into kilograms per hectare.

Data were subjected to analysis of variance and regression to the 5% level of probability for the F-test. To check the significance of the effects of the chosen regression model of higher degree. Analyses were performed with the use of computational SISVAR application version 5.3 [13].

III. RESULTS AND DISCUSSION

For the characteristic plant height in the 2014/2015 crop, the Chia culture responded significantly to the phosphate fertilization, presenting a quadratic adjustment in response to the application of P. The highest plant height was observed in the dose of applied phosphorus, 60 kg ha–1 with 184.94 cm, and the lowest mean at the dose 0 kg ha–1, with 159.84 cm (Figure 2A). In the 2015/2016 harvest crop for the same characteristic, a quadratic response was observed, varying from 158.87 cm to 170.91 cm, although there was no significant difference between the doses (Figure 2B).


Fig. 2: Height of Chia plants as a function of five doses of phosphorus, 2014/2015 crop (A) and harvest 2015/2016 (B).

In the 2014/2015 crop for the characteristic height of the upper stem, the phosphate fertilization was significantly answered, presenting a quadratic response, in which the lowest height was observed at the dose of 0 kg ha–1 (129,84 cm), showing a decreasing behavior After the dose of 60 kg ha–1 (146,02 cm) (Figure 3A). In the 2015/2016 harvest for the same characteristic, there was no significance between the P doses, however, a quadratic response was observed, being the maximum at the dose 120 kg ha–1 (127,81 cm) and the minimum at the dose 0 kg ha–1 (117,52 cm) (Figure 3B).



Fig. 3: Height of the upper stem of Chia plants in the function of five doses of phosphorus, 2014/2015 crop (A) and harvest 2015/2016 (B).

In the 2014/2015 crop for the characteristic, stem diameter there were significances between the doses, P (Figures 4A). The quadratic equation was the one that best adjusts to the highest mean in the dose of 60 kg ha-1, with a value of 9, 15 cm, with an increment equivalent to 23, 93% when compared to the dose that results in a lower mean (6, 96 cm at the dose of 0 kg ha-1). In the 2015/2016 crop for the characteristic, stem diameter was observed quadratic response varying



from 6, 58 cm to 7, 17 mm, although there was no significant difference between the doses (Figure 4B).

Fig. 4: Stalk diameter of Chia plants in the function of five doses of phosphorus, 2014/2015 crop (A) and harvest 2015/2016 (B).

For the characteristic number of bunches, there was a difference between the doses of phosphorus, being the quadratic equation that best adjusted, with maximum point in the application of 90 kg ha-1 (227,03 bunches per m2) and lower mean at the dose of 0 kg ha-1 with 141,17 bunches per m2 (Figure 5).



Fig. 5: A number of bunches of Chia plants as a function of five doses of phosphorus, 2014/2015 crop.

In the 2014/2015 crop for the characteristic length of the bunches, there was no difference between the doses of phosphorus, however, presented a quadratic response, in which the lowest height was observed at the dose of 0 kg ha-1 (12,84 cm), showing decreasing behavior after the dose of 60 kg ha-1 (13,47 cm) (Figure 6A). In the 2015/2016 crop for the same characteristic, a quadratic response with a variation of 10, 47 cm to 11, 77 cm was observed, although there was no significant difference between the doses (Figure 6B).



Fig. 6: Length of the bunches of Chia plants in the function of five doses of phosphorus, 2014/2015 crop (A) and harvest 2015/2016 (B).

In the 2014/2015 crop for grain Productivity, there was no difference between the P rates and the quadratic equation was the one that best adjusted, with a maximum point of 157, 87 kg ha–1 estimated at the dose of 60 kg ha–1 and of minimum productivity at the dose of 0 kg ha–1 (122, 63 kg ha–1) (Figure 7A). The same behavior was observed for the plant height, upper stem height, stem diameter, and bunches length characteristics. In the 2015/2016 crop for the grain Productivity characteristic, there was no difference between the P doses, however, a quadratic response with a variation of 159, 17 to 203, 72 kg ha–1 was observed, although there was no significant difference between the doses (Figure 7B).



Fig. 7: The productivity of Chia grain as a function of five doses of phosphorus, 2014/2015 crop (A) and harvest 2015/2016 (B).

For the phosphate fertilization in the 2014/2015 crop, the results obtained for plant height, the height of the upper stem, stem diameter, number of bunches were expected, because it is an element that participates directly in plant growth, and both the Absence as excess may interfere in their development. According to Machado et al. (2011) [14], the level of availability of P existing in tropical soils is very low to

the point of compromising the development of plants. High concentrations decrease its absorption, reducing its availability in the plant, affecting the application and consequently, in its development [15]. However, at adequate levels, it promotes higher height, emission, and growth of leaves, besides resulting in larger leaf area, allowing greater uptake of solar radiation and increase in the production of Photoassimilates [16].

Naomi et al. (2014) [17] studied the growth and productivity of Salvia officinalis L. and observed that phosphorus shows significant effects on plant height and the highest results were obtained in plots where

60 kg ha-1 of P was applied and the lower results where there was no application of P.

It was observed that unfertilized plants had the smallest height of the upper stem (Figure 2B), showing that this element is indispensable for development. The absence of phosphorus can reduce several important biochemical functions in plant physiology [10], which may have negatively contributed to the height of the stems. Maia et al. (2008) [18] studying Hyptis suaveolens (Lamiaceae) reported that nutrient limitations caused alterations in plant morphology.

According to Bonfim-Silva et al. (2011) [16] phosphorus deficiency includes the reduction of stem length, which directly influences the size of the plant. Adequate phosphorus concentrations allow the production of carbohydrates and sugars indispensable for the composition of their vegetal tissues [19]. According to Coelho et al. (2007) [20], the stem diameter is a characteristic of little relevance, however, it has an important function in the support of the architecture of the plants decreasing the lodging indexes and favoring the mechanized harvesting.

A low number of bunches in unfertilized plants is observed. These results are plausible because this nutrient has a fundamental role in the transfer of cell energy, respiration, and photosynthesis, besides acting as a structural component in plants [10]. Thus, the absence of the nutrient may also limit crop production factors, mainly in soils, where the natural availability of this element is found at low levels [21, 22].

Phosphorus presents low mobility in the soil and a large capacity to be adsorbed by clay, minerals, and oxides. Faced with this problem, many plant species have shown that the supply of phosphorus is indispensable in the initial phase of the plant life for a satisfactory growth of the crop [9], since under conditions of low concentration and availability, can result in restrictions of which the plant does not recover, even if the supply of phosphorus at appropriate levels is subsequently increased. Although there was no significant difference between the different doses of phosphorus, it was observed higher productivity in the treatments with phosphate fertilization. Low phosphorus doses may have been similar to the highest doses due to residues present in the soil of previous crops.

For phosphorus in the 2015/2016 crop, no significant response was observed at plant height, upper stem height, length of bunches, stem diameter and grains productivity with an increment of doses. Souza et al. (2013) [23] verified that the phosphorus doses did not significantly influence the physiological aspects of growth and biomass production of Mentha piperita L. Belonging to the family Lamiaceae. However, David et al. (2007) [24] studied the same species, observed variation in behavior for many of the variables evaluated, when subjected to different levels of phosphorus.

The lack of response from Chia to high P doses for all evaluated traits could probably be explained by the fact that the crop is a rustic species, that is, little improved and not responsive to high concentrations of P. According to Gómez et al. (2008) [25] the Salvia hispânica L. requires a rescue program of the native species in order to better plan its management through a future breeding program and avoid loss of genetic material. Moreover, the lack of response may be associated with a slight loss of genetic variability in the process of domestication of Chia culture, the plant selection is being carried out from domesticated plants [26].

Another factor that may have contributed to the absence of response to phosphate fertilization is the content of the nutrient present in the soil (0.0393 g dm-3), with low phosphorus doses, has become satisfactory for the good development of certain characteristic of culture of Chia throughout the cycle, supplying the plant's need and consequently not responding to the high doses of applied fertilization. This is evidenced by analyzing the characteristic of the length of the bunches, which presented the best means at the dose of 0 kg ha-1. (11, 77 cm).

The response of Chia to phosphate fertilization, in this study, was mainly affected by the availability of P in the soil, due to the historic of the use of the area, which showed an addition of P corresponding to previous crops, allowing amortization in the doses of fertilization phosphate. According to Wright (2009) [27], the presence of phosphorus is dependent both on soil management and historic use of the area. However, to confirm the obtained results, it is necessary to perform other tests of phosphate fertilization, since the species is adapting to the edaphoclimatic conditions of the country and the region under study where the nutritional requirements are still unknown.

IV. CONCLUSION

The doses of 30 and 60 kg ha–lof phosphorus influenced positively in the higher development and productivity in Chia culture in the 2014/2015 crop. The increasing doses of phosphorus did not positively influence the agronomic traits of Chia culture in the 2015/2016 crop. The maximum grain productivity found in P doses was higher than 157 kg ha–1.

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EDM Process Parameter Analysis and Optimization using CD Function Multi Objective Optimization on EN-08 work Piece Material

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Abstract—High precision machining is possible in present era because of non-conventional machining methods like EDM, WEDM, AJM, ECM and many more. In present research study, EDM method is applied to optimize the selective process parameters of EDM machine on high strength steel material EN-08. In present study, four process parameters are selected which are T-on, T-off, Current and Pressure. Each factor has four levels as per machine range. Pilot experiments are also performed to find the exact range of machining parameters. Pilot experiments are based on "One factor vary and others constant" concept. After pilot experiments, Design of experiment (DOE) method called Taguchi method is applied to find the minimum experiments for this research study. L-16 orthogonal array is selected for this research study.

Keywords—Non conventional, EN-08 steel material, EDM, DOE, CD Function, ANOVA, S/N ratio analysis.

I. INTRODUCTION

EDM is a machining innovation which is today one of the best in class machining process for metals. It has been supplanting traditional machining operations and is equipped for machining mind boggling on hard material segments, that are hard to machine. Machining of any electrically conductive material regardless of its hardness, by the use of warm energy is one of the prime points of interest of EDM process. It is an electro-warm noncustomary machining process in which metal is expelled because of warm energy of the sparkle. EDM utilized electrical energy to produce electrical sparkle that happen between an electrode and a work piece within the sight of a dielectric liquid. EDM is primarily used to machine hard materials like hastalloy, nimonics, nitralloy, etc. The EDM methods were first found by Sir Joseph Priestley an English Scientist. He detected the erosive effect of electrical discharges on metals.

Current EDM created in late 1940 which have been acknowledged worldwide as a standard process in manufacturing.

1.1 Working Principle of EDM Process

EDM is a controlled metal expulsion process that is utilized to expel metal by methods for electric spark erosion. So, it is also called spark erosion machining process. The main aim of the process is controlled removal of material from the work piece. The tool is made cathode and work piece is anode. The tool and work and also the tool slide servo-mechanism, are connected into the circuit. The function of the servo-mechanism is to maintain a very small gap (approximately 0.025 to 0.075 mm) between the tool and the work piece. The spark is the transient electric discharge across the gap between work and tool. When the potential difference (voltage) across the gap (between the electrode and work piece) becomes sufficiently large, the dielectric fluid becomes ionized and breaks downs to produce an electrically conductive spark channel. Thus, thousands of sparkdischarge occurs per second across the gap between tool and work, which creates high temperature of approximately 10,000°C which causes erosion on the surface of work piece just as on the electrode. The temperature is constrained by managing the spark gap between the electrode and the work piece. Fig 1.1 shows the working principle of EDM process. The electrode and work piece ought to have great electrical conductivity to create the great spark. A necessary condition for producing a discharge is the ionization of the dielectric, i.e., splitting up of its molecules into ions and electrons. Both tool and work piece are submerged in a dielectric fluid having poor electrical conductivity. Distilled water, lamp fuel, transformer oil, paraffin oil, kerosene, lubricating oils, etc are normal sort of dielectric fluids utilized in EDM process.



Fig.1.1. Working principle of EDM process

II. LITERATURE REVIEW

Nagahanumaiah et al. [1] have displayed the spectroscopic measurement of temperature and electron thickness in the miniaturized scale EDM process. A precise report utilizing L18 OA tests dependent on the Taguchi technique is directed to comprehend the impact of shifting process parameters including voltage, current, spark gap and electrode measure on the plasma attributes. The line pair technique and the Stark widening of the ghostly line are utilized to figure plasma temperature and electron thickness, individually. The spark gap and electrode measure are found to impact the plasma qualities. The plasma delivered by low energy discharge in smaller scale EDM is more non-perfect, denser, and colder than the high-energy discharge plasma created in the regular EDM process. The bury molecule separate is generally equivalent to the Debye length, bringing about increasingly electrostatic associations between particles.

Jaswin et al. [2] have examined the improvement of the profound cryogenic treatment for En 52 valve steel utilizing the Taguchi strategy in mix with the GRA. The elements considered for the streamlining are the cooling rate, dousing temperature, splashing period, and hardening temperature, each at three distinct dimensions. The mechanical properties, for example, the rigidity, hardness, and wear opposition are chosen as the quality targets. Nine test runs dependent on L9 OA of the Taguchi technique are performed. An ideal parameter blend of the profound cryogenic treatment is gotten by means of the GRA. The ANOVA is connected to recognize the most persuasive factor and it is discovered that the splashing period is the most compelling variable for the profound cryogenic treatment of En 52 valve steel. The consequences of the affirmation tests demonstrate that the rigidity, hardness, and wear obstruction of the

profound cryotreatedEn 52 valve steel tests have improved all the while through the ideal blend of the profound cryogenic treatment parameters got from the proposed technique. The improvement in the rigidity, hardness, and wear opposition of the profound cryotreated tests at the enhanced treatment condition on the examples without profound cryogenic treatment is 7.84%, 11.16%, and 46.51%, individually. Through the profound cryogenic treatment, the wear opposition of the En 52 valve steel has improved more contrasted with different reactions.

Aghdeab and Ahmed [3] have studied machining responses such as material removal rate (MRR) and electrode wear ratio (EWR) under the effect of different machining conditions in EDM process. The process parameters taken by them were pulse on time (Ton), pulse off time (Toff) and electrical current (Ip). This work was carried out in order to achieve best MRR and least EWR using copper electrode with fixed diameter (10 mm) for the machining of stainless steel AISI 316L with a constant thickness (0.8 mm). They used different values for the Ton (25, 50 and 75) µs, Toff (9, 18 and 25) µs and Ip (16, 30 and 50). The results of experiments showed the main effects of machining conditions on MRR and EWR. Where, the MRR increased with increasing the Ton, MRR decreased with increasing the Toff and MRR increased with increasing Ip. While, the EWR decreased with increasing the Ton, EWR decreased with increasing Toff until access to a specific Toff then EWR increased with longer Toff and EWR increased with increasing Ip. The maximum MRR is (48.16 mm3/min) at Ton (75 µs), Toff (9 µs) and Ip (50 A) and minimum EWR is (0.179 %) at Ton (75 µs), Toff (9 µs) and Ip (16 A).

Ali et al. [4] have examined the portrayal of type of micro holes delivered by miniaturized scale Electrical Discharge Drilling (small scale EDD) on beryllium copper amalgam carbide electrode utilizing tungsten of 300 m measurement. Utilizing а fixed arrangement of miniaturized scale EDD parameters, smaller scale openings of various angle proportions are bored. They chose structure attributes width, roundness, and decrease points are researched. The gap measurement and roundness are assessed by utilizing SEM and graphical estimation. The smaller scale gap is segmented to measure the depth and decrease edge. The varieties of these structure qualities are plotted against perspective proportion. This test consider demonstrates that measurement, roundness mistake, and decrease point of the small-scale gap increment with the expansion of angle proportion nearly at a similar rate. The electrode wear proportion is not irrelevant for low angle proportion

micro hole. Be that as it may, it increments strongly with the expansion of angle proportion.

Prabhu et al. [5] have examined whether smooth surface completion could be acheived by utilizing multiwalled carbon nanotubes (external diameter=10 - 20 nm, length is upto 30μ m) in the dielectric. For this, graphite was utilized as an electrode. They detailed that the most predominant factor for SR was current trailed by pulse on time.

Tsai et al. [6] had developed the surface alloying of the composite electrode to improve the surface properties of the work piece. Ball shining EDM was proposed to improve SR. It utilizes hard smooth balls joined to the electrode to frame a plastic mis happening layer on the work piece surface amid sparking, yielding a solidified surface microstructure.

III. MACHINE SPECIFICATIONS

The experiments were carried out on a EDM machine {AGIE CHARMILLES (China), Model SP-1, ACT SPARK} of AGIE Machine Tools Ltd., China installed at Advanced Manufacturing Laboratory of Mechanical Engineering Department, CIPET, Jaipur (Rajasthan), India. The pictorial view of EDM machine tool (Figure 3.1) has the following specifications:

Descriptions	Unit	Value
Machine Dimensions (D, W, H)	mm	1200, 1500, 2200
Machine Weight	Ton	1.720
Tool Travel Length X, Y, Z	mm	320, 250, 250
Work Piece	mm	790, 480, 235
Work Piece Weight	kg	400
Max Electrode	kg	60
Head to Table Distance (Min/Max)	mm	250/500
Dielectric Fluid (Capacity)	L	290
Generator Type		ISOPULSE/R
Machining Current	А	50
Max MRR	mm ³ /mi	330
Best Surface Finish	Micro-	0.4
Power Supply Consumption	kVA	10
CNC Type		PC controlled (disk
Monitor		Color
Controlled Axis		3(X, Y-step motor,
Machining Current	Α	100
Diagnostic		Embedded





Fig.3.1 : Experimental Setup

IV. PROCESS PARAMETER SELECTION

In the present work, the Taguchi's strategy-based S/N extent, and the reaction surface logic have been used to design the preliminaries and coming about examination of the data assembled.

4.1 Factor's and machine range

In present research work two different DOE methods were adopted for experimental work, so factors were decided for Taguchi method and RSM methodology.

4.2 Pilot Experiments

The purpose of the pilot experiments is to study the variations of the EDM process parameters on performance measures such as cutting rate, MRR and TWR. Also, it is intended to ascertain the range of different parameters required for the two types of experimental design methodology used in this work.

The pilot experiments were performed on EDM {AGIE CHARMILLES (China), Model SP-1, ACT SPARK} (Figure 4.3). Various input parameters varied during the experiments are pulse on time (Ton), pulse off time (Toff), peak current (IP), pressure. The effects of these input parameters are studied on CT,MRR and TWR using one factor at a time approach.



Fig.4.1. Machine Pictorial View

Following parameters are kept constant at a fixed value during the experiments:

Work Material: Industrial Steel (Grade EN-08)

Cutting Tool: Cu Electrode of diameter 3 mm

Servo Feed: 2010 unit

Flushing Pressure: 1 unit (15 kg/cm2)

Peak Voltage: 2 unit (110-volt DC)

Conductivity of Dielectric: 20 mhos

Work Piece Height: 24 mm

Cutting rate in mm/min and gap current in ampere were directly noted from machine's control panel.

4.2.1 Effect of Input Parameters on Performance Measure Cutting Time

Table 4.1

PILOT EXPERIMENT (ONE FACTOR VARIABLE & VARIABLE & ANOTHER CONSTANT) FOR CT

Ton	СТ	Toff	СТ	Current	СТ	Pressure	СТ
50	480	20	465	3	472	0.5	476
75	469	21	393	4	432	0.6	405
100	351	22	412	5	402	0.7	390
125	270	23	430	6	398	0.8	378

4.2.2 Effect of Input Parameters on Performance Measure MRR

Table 4.2

PILOT EXPERIMENT (ONE FACTOR VARIABLE & VARIABLE & ANOTHER CONSTANT) FOR MRR

Ton	MRR	Toff	MRR	Curre nt	MRR	Pressure	MRR
50	16.3	20	16.1	3	16.2	0.5	16.4

75	15.1	21	12.6	4	14.1	0.6	13.1
100	11.3	22	13.3	5	13.6	0.7	12.5
125	8.7	23	13.5	6	12.8	0.8	12.2

4.2.3 Effect of Input Parameters on Performance Measure TWR

Table 4.3	
PILOT EXPERIMENT (ONE FACTOR VARIABLE &	k
VARIABLE & ANOTHER CONSTANT) FOR TWR	

Ton	TWR	Toff	TWR	Curren t	TWR	Pressur e	TWR
50	44.36	20	44.68	3	45.12	0.5	44.61
75	45.36	21	44.42	4	46.35	0.6	46.25
100	46.35	22	43.25	5	46.14	0.7	46.92
125	46.81	23	42.83	6	45.39	0.8	47.21

4.2.4 Parameter classification and selection of optimal levels

When the ANOVA on the raw data (identifies control parameters which affect average) and S/N data (identifies control parameters which affect variation) are completed, the control parameters may be put into four classes (Ross1988):

Class I: Parameters which affect both average and variation

(Significant in both i.e. raw data ANOVA and S/N ANOVA)

Class II: Parameters which affect variation only (Significant in S/N ANOVA only)

Class III: Parameters which affect average only

(Significant in raw data ANOVA only)

Class IV: Parameters which affect nothing.

(Not significant in both ANOVAs)

The parameters design strategy is to select the proper levels of class I and class II parameters to reduce variation and class III parameters to adjust the average to the target

4.2.5 Orthogonal Array for current study

Table 4.3

L16 ORTHOGONAL ARRAY FOR PRESENT RESEARCH WORK

S.N.	Ton	Toff	Current	Pressure
1	50	20	3	0.5
2	50	21	4	0.6
3	50	22	5	0.7
4	50	23	6	0.8
5	75	20	4	0.7
6	75	21	3	0.8
7	75	22	6	0.5
8	75	23	5	0.6
9	100	20	5	0.8

S.N.	Ton	Toff	Current	Pressure
10	100	21	6	0.7
11	100	22	3	0.6
12	100	23	4	0.5
13	125	20	6	0.6
14	125	21	5	0.5
15	125	22	4	0.8
16	125	23	3	0.7

V. RESULTS AND DISCUSSION

The present research study is present the role of EDM process parameters for creating the hole in sheet of thickness of 5 mm made of EN-08 steel material. The selection of process parameters is done using literature review and local industrial survey among operator of EDM machine installed in Jaipur industrial regions. The process parameters which are selected for the present research work are Ton, Toff, current and pressure. Design of experiment method is used to develop the experiment table. Taguchi method is applied for these factors and each have four levels and the developed table is present in table 5.1. All experiments are conduct at CIPET, central tool room where this EDM machine is installed.

Table 5.1

L-16 ORTHOGONAL ARRAY FOR EDM RESEARCH STUDY FOR EN-08 MATERIAL

Run	Ton	Toff	Current	Pressure
1	50	20	3	0.5
2	50	21	4	0.6
3	50	22	5	0.7
4	50	23	6	0.8
5	75	20	4	0.7
6	75	21	3	0.8
7	75	22	6	0.5
8	75	23	5	0.6
9	100	20	5	0.8
10	100	21	6	0.7
11	100	22	3	0.6
12	100	23	4	0.5
13	125	20	6	0.6
14	125	21	5	0.5
15	125	22	4	0.8
16	125	23	3	0.7

Each experiment is conduct three times to get more accurate results from EDM machine.

5.1 Signal to Noise ratio analysis

In present test, Signal to noise ratio-based log formula is used to find the rank among all factors for selective response. In present study three responses are selected for finding the rank using S/N ratio method. The theory part is discussed in previous section of this thesis chapters. Detailed analysis of S/N ratio for all response variables are present in following section.

5.1.1 S/N ratio analysis for Cutting Time(CT)



5.1.2 S/N ratio analysis for Material Removal Rate (MRR)







VI. CONCLUSION AND FUTURE SCOPE

In present experimental research work, effect of process parameters on EDM machine is studied on EN-08 steel base work piece. Experiments are designed as per Taguchi method and total 16 experiments are designed for selective factors and their levels which are present in table 6.1. The main conclusion of present research study is following:

Table 6.1			
FACTOR	AND LE	VELS	

Levels	TON (micro sec)	TOFF (micro sec)	CURRENT (Amp)	PRESSURE (kg/cm2)
Ι	50	20	3	0.5
Π	75	21	4	0.6
III	100	22	5	0.7
IV	125	23	6	0.8

The Signal to noise ratio analysis is performed for all three response variables which are CT, MRR and TWR. The rank identification for these variables are present in following table 6.2.

Table 6.2

RANK IDENTIFICATION FOR ALL THREE RESPONSE VARIABLE

Desman	First	Second	Third	Fourth
Response	Rank	Rank	Rank	Rank
CT	Ton	Toff	Pressure	Current
MRR	Ton	Toff	Pressure	Current
TWR	Current	Toff	Ton	Pressure

Multi objective optimization is performed using CD function optimization for all three-response variables, CT, MRR and TWR and the optimum result for this optimization technique is present here:

75.75 20 3 0.569 46.0057 17.58 236.67 0.95	Ton	Toff	С	Р	TWR	MRR	СТ	CD
	75.75	20	3	0.569	46.0057	17.58	236.67	0.95

Future Scopes:

Although major outcomes are presented in this paper, but there is some scope of work, which may be analyzed in future study and which are following:

As the person place things, materials systems and machines are different in place to place, effect of different materials on same process parameters like high strength alloys, Role of FEM simulation modeling technique, Effect of different optimization techniques like ANN, Fuzzy Logic, MOGA etc can be taken up for more scientific research.

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Foster Care and Reintegration: Different Portuguese Similarities

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Abstract— Foster care is a legally recognized family-community alternative in Portugal, designed to protect and care for children in situations where their rights are under attack. With the intent of expanding our knowledge of the Portuguese experience, through an intercultural dialogue between Brazil and Portugal, this article allows us to problematize what has happened with the process of family reintegration of those under care. To this end, we have used the content analysis methodology proposed by Bardin. It was possible to see that Portuguese foster care has been a residual protective social response if compared to institutionalization and reintegration has proved itself to be a complex challenge.

Keywords—Foster care; reintegration, rights.

INTRODUCTION I.

Foster care has come as a formal alternative in current times, joining, in a singular way, the aspects relating to access to rights, protection, and continuous care that are necessary to child development (Delgado, Carvalho, & Pinto, 2014; López, Delgado, Carvalho, & Del Valle, 2014; FEC, 2014). It's a measure to be executed outside life's natural environment when the demand to remove a child from their family of origin is presented. The child must then spend a period of time in another family's house, named the foster, previously selected and trained for this activity. During the foster period, the strengthening of the origin or extended family is privileged, so the child can rejoin and later reintegrate.

Portugal established the foster care measure in 1979 (Decreto-Lei nº 288, 1979) and it's contemplated in the Lei de Proteção de Crianças e Jovens¹ em Perigo ([LPCJP] Guerra, 2016) [Law of Endangered Child and Youth Protection]. Since promulgation until current times, this legislation went through important changes to be put to practice. In 2015, the time of its second ratification, it was clear that its main assumption was that it was meant to be used for children between 0 to 6 years old, replacing residential care (Guerra, 2016, art. 46). For Guerra (2016), the law recognizes the importance of keeping small children in family environment due to their increased potential for development.

In this context, in order to better understand the foster care process in Portugal, the current article will show some of the steps experienced by family care in this country through some years, as well as problematizing the process of reunification and reintegration experienced by the children that go through such measure.

II. **METHOD**

This article is part of a wider research. However, we opted for presenting a theoretical review of the theme, privileging the study's conclusions. It begun in Brazil, with the early research stages counted with the approval of two Ethics Committees presenting minimal risk and being based in resolution 466 from December 12 of 2012, which approves of directives and regulation norms for research involving human beings. Both semi structured interviews [the second and third steps] as well as the rest of the investigation were qualified by an examining board made by a professor from Universidade Federal do Rio de Janeiro (UFRJ) and two others from Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio). After qualifying, the instrument was appreciated and approved by the PUC-Rio Ethics Committee.

In Portugal, the research was submitted to approval by Social Security. Afterwards, the first author

¹ Children and youths are, according to the Lei de Proteção de Crianças e Jovens em Perigo, "subjects from 0 to 18 years old exclusively or until 21 years of age, exclusively, where their protective intervention was started before 18 years old". The term "child" is used to address the whole of these ages through this period of time

participated in a video conference with representatives of different initiatives of foster care in the country with the intent of explaining the work to be done. After collective approval and adjusting the instrument to Portuguese reality, the first contact followed by interviews were initiated. Before initiating the process of collecting samples the term of consent was signed, ensuring all the necessary recommended ethics.

The interviews were transcribed and floating readings were made in intent of deepening the total content and preparation of the material. The interviews were isolated in analysis unities with different acronyms and each text was subdivided in specific unities, exposing manifest and latent content separately. The research corpus followed the exhaustiveness, representativeness, homogeneity, pertinence and exclusiveness having been evaluated as adequate.

In the final step, the results were treated through inference made from the deductions and conclusions from the responses collected. In this way, the interpretation and the discussion of the results was done in critical manner, in the sense of understanding the respondent's communication, relating it with the theoretical input.

Through all the process, the historical and social context of content construction was respected and the synthesis and integration of analysis' elements was made through establishing a relation between the whole and its parts through a dissertative text in the style of an article.

III. RESULTS AND DISCUSSION

The current Portuguese economic and social policy has been the target of constant debates and reflections and the country is going through an economic rebalance with important aims for 2020. IN 2014, it got recommendations from many UN countries (UNGA, 2014) regarding endangered youths. In 2016, the new political directives were a part of these orientations, and among them is the eradication of poverty and social exclusion for a large number of people (CUE, 2016).

In this way, suggestions were made for family support; help the issues of childhood poverty and child homelessness; analyzing the human rights crisis, especially for the most vulnerable groups; strengthen childhood protection promoting financial resources for endangered children, suffering abuse or neglect, among others. In this perspective, the alternative of foster care seems to be aligned with the gap relating to childhood protection in the human rights guarantee protection.

Historically, institutionalization is seen as the oldest practice when seeking to protect children with

different difficulties. Despite the many issues caused by them, many institutions remained the only available survival resource. However, the vast majority of children who suffered a violation of their rights found themselves in environments that were more damaging, such as streets, irregular workplaces, wars and conflicts, intrafamiliar struggles and many others.

In current times, the international guidelines are based in juridical structures and policies where the family unity is recognized, as well as child participation and the child's best interest (IAGCR, 2016). Thus, the understanding of the need for preventive and protective action for children tends to advance every day (OMS, 2014; McCall, & Groak, 2015; Guerra, 2016) and the tendency in developed countries has been using protective alternatives focused in families. In this direction it is important to think of more individual support such as the one proposed by safe foster care (UNGA, 2010; Delgado, Lopez, Carvalho, & Valle, 2015; Guerra, 2016; Delgado, 2016a, 2016b; Baptista, Zamora, Vilhena, Novaes, & Rosa, 2017; Bertão, Delgado, Carvalho, & Pinto, 2017).

In this direction, the protective mode in question is the closest community alternative to what has been a precondition of several studies about the importance of living in stable continuous family environment (Winnicott, 1975, 1999; Dias, 2012; Gomes, & Melchiori, 2012). However, unlike other countries in Europe, in Portugal, family foster care has little social response if compared to institutionalization (Delgado, 2016b; Portugal, 2018; López et al., 2014). According to Delgado (2016a), in comparison with other fourteen countries, Portugal is placed last, with only 4% of its child population using foster families as a resource.

The reversal in relation to this possibility of alternative support shows how much the studied country needs to act alongside with normatives and international directives for protecting childhood (UN, 1989; Luna, 2010; Eurochild, 2010; Cantwell, Davidson, Elsley, Milligan, & Quinn, 2012; UNDP, 2014; FEC, 2014). However, to problematize this protective activity, it is necessary to go beyond the available data, understanding the steps lived by foster care along some years, and evidence, qualify and problematize what is reunification and reintegration.

The story of Portuguese foster care has its beginnings in the Rodas dos Expostos, following the consolidation of institutions as a form of protection network for children, being initially regulated by wet nurses, the first workers to provide this kind of service in this sense (Palacios, 2016). In this way, against what current statistics might say, the maintenance of children in families has been a part of Portuguese culture during a certain time.

Today, beyond solidarity or financial expectations, there are striking characteristics in the Portuguese workforce whose legislative changes have shaped new nuances in social responses, reformulating the state of play. Thus, it is necessary to understand the three important moments in the Portuguese foster care system.

In the first time of institutionalization of foster care in Portugal (1979), family with many challenges had [Social Action] Ação Social with the state apparatus responsible for helping their difficulties with the children. However, the excess of labour for the workers ended up denouncing an impossibility to handle the necessary apparatus so this model of care works.

Around the 1980s, public authorities decided to delegate the field work to NGOS and [private institution of social solidarity] Instituições Privadas de Solidariedade Social [IPSSs]. At that moment the idea had become of a less intervening state, where such institutions would start to occupy spaces in a contractual manner, decentralizing some care. Such initiatives favored some families which could count with nearby and constant care because with this new format, local workers had begun to know care support for children.

From the union between the work from different institutions, the workers from IPSSs and Social Security began to share the responsibilities related to service. However, large difficulties remained relating to implementing and developing the work. Care was scarce and many workers had inadequate backgrounds, were often overloaded and had many other challenges.

At first this characterized a time that care was not done primarily by professionals. Once children were sent away from their environment, the new guardians were given maintenance grants for the children, to help with expenses.

In this way, families that showed interest in having the children were not formally prepared in the necessary manner for someone who would take the function of foster parent (Leschied, Rodger, Brown, Dunnen, Pickel, 2014). Such a reality brought consequences that were at times negative to the children. Thus, the lack of proper handling in some situations could at times damage the acceptance and understanding of the proposal.

Around 2000, Social Security evaluated foster families that were still permanent and found slightly negative results. The general opinion was that foster families caused problems. So, the recruitment and selection of new interested members was stagnated so it was possible to reflect upon it and find safer ways to work.

At a following moment, after a few years that the Lei de Proteção a Crianças e Jovens em Perigo was ratified, from the Decreto-Lei 11 of 2008, a new phase began where the foster care role became a profession. The regulamentation of foster care today does not allow that the family keep the children as foster families.

From that point on, there was no longer the possibility of foster care for members of the extended family (ISS, 2009). Such a modification stimulated the decrease of foster families and, as such, many children migrated to institutions.

According to the Relatório Casa (ISS, 2017), with the 2008 regulations, there was a 70% decrease of children in foster care. From then on, Social Security, despite having the full theoretical and practical apparatus prepared for its acting (ISS, 2010), hasn't done anymore family selections.

The financial grant directed to this type of care has been diminishing at every year. In 2016, there were only 261 children in foster care, concentrated mainly, in the north region of the country, especially in Braga, Vila Real, Porto and Viana do Castelo (ISS, 2017). As time goes by, the number of institutions has increased in large amounts and children began to be largely sent to this way of social response.

Thus, the grant given to foster families has diminished and one of the consequences of it has been damaging, as being in a family, generally speaking, is better than living in institutions (Williamson, & Greenberg, 2010; UN, 1989).

A third moment brought a new change to the law, in 2015, when foster care was prioritized for children between 0 and 6 years old. However, even today there is a gap between the rewritten law and its execution, since regulation for it is still to come.

In this way, small children still live in institutions, even those who are considered fit for adoption. Then, faced with this reality, we can see that the number of foster children has decreased at every year while the number of children in institutions has risen (ISS, 2017). This means that in order to have better data on reunification and reintegration, there is a need to understand the legislative functioning regarding the interventions on families in Portugal.

Understanding the work of access to childhood and youth protective rights in Portugal (Gersão, 2014, 2015) is necessary when dealing with the scenario of reintegration. The policy of reducing judicial processes intends to make matters easier to courts, since they don't always intervene in the decisions relating to keeping or removing the child from their natural environment. This gives some autonomy to work with families.

Guerra (2016) makes an analogy comparing the system to a pyramid where the people with competency relating to childhood and youth are at the base, acting, as prevention system, in case of danger. In this space, intervention is consensual, which means it only happens with family approval. Besides that, such entities cannot apply measures to promote and protect (Guerra, 2016, art. 35).

This where preventive work relating to child maintenance in their families. As a part of this system, the [Family Care and Parental Evaluation Centers] Centros de Aconselhamento Familiar e Avaliação Parental (CAFAP, & MDVIDA, 2017) follow systematically them to stimulate parental competence, work on reunification and help other more practical factors in regard to habitation, hygiene, among others.

In the second bit of the pyramid are the [Child and Youth Protection Commission] ([CPCJs], Portugal, 2018) acting in case the first step cannot solve the conflict situations, now with enough autonomy to apply protective measures. This intervention also can only happen with consent. The protective commissions have legitimacy in applying the measures they are not judicial commissions, but are para-judicial.

At the top of the pyramid are the most dangerous situations that must be solved with or without the consent of families. These are the issues raised to the courts in the Family and Minors sections.

For Delgado (2009), the difference of consensual or nonconsensual placing can make the relationship between the parts easier, and, as a consequence, the interaction between them. However, even with agreement, the contact mechanisms are challenging, especially between foster families and origin families (Delgado, 2016b; Atwool, 2013; Bertão et al., 2017).

Once the judicial dynamic is understood, we have to reflect on the challenges and possibilities of thinking about reunification and reintegration for those still in foster families and the few who join the system.

During research, the reports of insufficient data related to reunification and reintegration, externalized in the discourse of experienced professionals, has been disquieting. In the same way, the first contacts revealed a lack of reunification in foster care cases. However, further ahead it was possible to understand what the interviewed said about the moment that regards the category of *action time*, which was approached later. For Wedge, Krumholz and Jones (2013), differentiating the terms is fundamental. The authors affirm that reintegrating goes beyond the fact that a child returned to their original environment. It is necessary to feel like one belongs and is wanted not only by their family, but by their community. As such, the concept of reintegration expands from simply returning to the environment they came from and can be understood as a process (Rise Learning Network, 2016). Before that fact, reunification is characterized as the return to a safe and stable environment, without the need for reintegration. These terminologies will be adopted so it's possible to better understand and problematize these processes.

On what concerns the return, the law (Guerra, 2016), in article 4, points out, first, the importance of remaining within a family: "whether biological or any other way of stable family integration" (p. 26), which means, at all times it is relevant to keep the children in some kind family unity as said in IAGCR (2016). Next, article 46 deals with the return to a family environment as an important goal: "family care has a place when following integration of the child or youth in a family is foreseeable." (Guerra, 2016, p. 103).

The assumption of foster care is that it is temporary while the matters that caused the separation are dealt with (Bertão et al., 2017; Delgado, Carvalho, & Pinto, 2014). Effectively, regulation in 2008 the proposal is that this measure is used for children and youths who have **reunification and reintegration as a perspective.**

It is clear that the judges have a position in relation to protecting the child's wider interest. Remaining in the family is above any possibility of returning to the first environment. As such, interventions operate in the sense of keeping the child within a family, whether their own or not (IAGCR, 2016; Del Valle, & Bravo, 2013). Therefore, the family reunification in the original context is not always possible. This means that in many cases, foster care stretches during many years in Portugal.

In effect, time appears as an undefined making foster care in Portugal a lasting social response, and at times permanent in the lives of many children and youths until their autonomization (Delgado, Carvalho, & Pinto, 2014). Which means, in practice the length of stay is unknown, as there is no specific time set for the stay with the foster care family.

This means that the lasting **bond** with foster families and the insignificant response rate by the families of origin makes so many children unwilling to leave. They can make themselves autonomous, until they can work, either in the country or abroad but hey always return to that family unity that they consider their family. With this, the possibility for **reunification** becomes, in many cases, very little, making some bonds stronger and others weaker.

This is justified as a professional perspective of foster families demands that this family acts in an active manner before the family of origin (Duchrarne, 2016; ISS, 2010). For T8, the first have a fundamental role in reunification and later, the familiar reintegration.

There are controversies and criticisms about this action where, at times, families of origin end up feeling like the child's "owner", overruling the initial carers (Delgado, 2016b; Bertão et al., 2017). However, good practices in this sector have also contributed to strengthen and empower families of origin.

About the reasons for being sent away, neglect is the biggest cause for intervention. According to the Relatório Casa (ISS, 2017), the lack of supervision and family attention, the exposure to deviant parental role models, neglect about education, health or to risk behavior in children and youth are the most frequent reasons.

The reflections of the difficulties of leaving and returning (Delgado, Carvalho, Pinto, & Martins, 2016; Carvalho, Delgado, Benbenishty, Davidson-Arad, & Pinto, 2017) are also shown in the scepticism about the possibility to reverse the situations of the families of origin considering the allegation that generational compromised parental behavior repeats itself, which seems to make remaining after returning impossible.

The difficulties of reunification might be related, in the same way, to the fact that foster families are professionals with certain sets of skills and obligations, from which relationship conflicts with the families of origin might arise. The time before the removal, where the maintenance of the child stays in the natural family, might make the return more difficult later. Or even, once removed, their long stay in foster families. Especially once the scepticism of experienced professionals in the rebuild of the situation that caused conflict is considered.

For Delgado et al. (2016) what cannot be given up is the investment on safe and healthy contact between the parts, even if there is no reunification. The author claims that these encounters are the child's rights as well as one of the natural families, and when possible, it can happen after the child is taken in. In this perspective, healthy bonds might contribute to minimize the impact caused by separations and offer continuity at work with families and children, a relevant factor in keeping mental health.

Among the possibilities that refer to reunification and reintegration we find the development

of a resource whose target was redefining the life project for institutionalized children. This happened around 2007, when the decision was taken to reexamine the paradigm of institutionalization, removing some children from that environment and keeping some from entering the system. According to one interviewee, the DOM project is important because it is an attempt to deinstitutionalize and change the character of institutions.

The Plano DOM (ISS, 2012) qualified professionals, reducing the number of children for institutions, increasing the amount of adoptions and thinking of new life projects for those under institutions. According to a professional, the aim was not just redefining the intervention but to study the life project of those children so they might lead their own life project.

Another important resource, equally weakened, to deal with the impossibility of reunification and reintegration is civilian patronage (Carmo, 2016). This socioaffective alternative privileges stay in the family for those who cannot return to their initial environment or cannot be adopted. The parental responsibilities are directed to a family with significant bonds [here meaning foster family] without the family of origin being excluded from the child's life.

It is a more lasting social response which provides the stability of bonds in a juridical sense. The foster family holds the parental responsibilities without excluding the parents from information about their children, since they remain as rightful parents.

With that said, we see many challenges and some tangible possibilities for this way of working with the families. However, for possible advances to come, it is important to defeat the permanent forces in a culture where the institutions are broadly strengthened. Maybe it is possible to say that foster care has never been a Portuguese option.

Reintegration has to be understood in a broad sense, beyond the act of returning. Besides this, it is also the possibility of returning home, in some cases, and with the due support, respecting different realities, preparing, following up and evaluating results continuously (Rise Learning Network, 2016; IAGCR, 2016). In this way, reintegration is defined as a group action with many aspects, influenced by different variables that need to be evaluated and dealt with in their singularity.

IV. CONCLUSION

The results of the work can be understood as a contribution for a better understanding for the process of family reintegration for children in foster care. This investigation allowed us to glimpse into Portuguese reality in what refers to the theme, revealing on one hand the fragility of reintegration work and on the other hand, pointing out the viable alternatives for this complex system.

Currently in Portugal lives a moment for political and social reconstruction with important targets to be met in the name of whole protection for children and youths. Foster care has been a residual social response if compared to institutionalization. Several factors, mentioned here, could contribute to the lack of investment.

We propose a reflection about the meaning of reintegration and its challenges faced with a reality that is not used to family care. Reintegration reminds us of a process initiated before the removal of the child of its family core, culminating in their return and stay in a safe environment. In this sense, the follow up and later monitoring can avoid new separations, making stay easier.

In the perspective of specialists in the matter, in fact, family care has shown its efficacy for some children and youths. However, the lack of investment in the media, the inherent difficulties to the process and the political issues seem to undermine the continuity of this alternative.

We can also point to the need of deeper theory about the possible and viable alternatives where the contact between the families can be preserved in safe conditions. Maintenance and rescuing of the feeling of belonging is an indispensable resource in reconstructing the trajectories of lives marked by so much conflict and separations.

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The Impact of Effective Communication between Users in 3D Collaborative Virtual **Environments: the conversational agent use case**

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Abstract— This paper aims to aid in the development of interactivity in virtual worlds, especially within the context of a virtual museum that serves the purpose of introducing its visitors to computing and basic electricity. We opted for the use of software agents with instructional and interactive purposes, which were personified as intelligent avatars serving as guides to a museum. This paper presents both a virtual 3D museum about the history of computing, developed using the OpenSimulator virtual worlds platform, where its 3D modeling and development tools were used with the help of scripts, as well as the focus of the project, which is the development of software agents. For the sake of achieving the objectives of this work, a research was conducted with a case study in order to verify whether the use of an intelligent agent in a virtual world can facilitate or support in the process of teaching and learning providing knowledge about the historical part of computing. The construction of this environment, integrated with an intelligent agent named AGIMC (the portuguese acronym for Intelligent Agent of the Museum of Computing) used the public web server pandorabots. To verify the feasibility of using the environment, a case study was carried out, which demonstrated that the use of these environments does contribute as a mean to support teaching, but there are also some technological limitations that may hinder its practical use in the educational context. An assessment was carried out with IFRS (Federal Institute of Rio Grande do Sul). The results obtained during the evaluation with the students met our expectations, obtaining good results and indications that the agent did support the student's conception of knowledge in the discipline introduction to computing, despite some difficulties found in its implementation.

Keywords— Virtual Worlds; OpenSimulator; Virtual Museum; Software Agents.

INTRODUCTION I.

Usually, both computing and related areas have in their curricula an introductory discipline to the area of computing, which seeks to explore the history of computing and its relation to the main uses and applications of computers, presenting students with an overview of the scope of computing in the most diverse segments of society. The best regarded books in the study of introduction to computing also address these topics, as well as aspects of a computer's functioning and its programming languages [6], [5].

In this context, different approaches have been proposed to add to the classes considered "traditional", among them the use of simulations, computer games and virtual environments [4], [11]. Such strategies seek to make the student become an active being in the process of learning, as opposed to the classical view of the content receiver. The constructivist use of 3D immersive virtual environments advocates the construction of knowledge from "x" to "x + 1" by balancing cognitive structures as an interactive learning process, conditioned on the balance between heredity and central nervous system physical maturation, and logical-mathematical experiences and the social transmission of knowledge

[13]. That environments also enhance the collaboration and interaction process promoting a new educational paradigm, where students act on this knowledge, manipulating content in various ways and, consequently, analyzing, exploring and giving it meaning, [17].

One possibility is the use of Virtual Worlds in support of education, [12] which enable a series of educational and training activities to be carried out. Considering these premises, the development of a virtual museum immersed in a 3D virtual world began, where students can carry out a virtual tour through the history and evolution of computing. There, they may interact with artifacts from different eras, providing them with both general and chronological views of subjects regarding technologies, personalities, concepts and related subareas.

In this sense, it is possible the students to interact with an elementary electricity experiment designed to work on basic concepts of electrical current, voltage and resistance due to the need for its application in computational logic circuits. This experiment was designed to be in line with Piaget's approach to the need for progressive and reversible actions (such as increasing or decreasing the resistor R1 electrical resistance value) to become concrete and formal cognitive operations [13].



Fig. 1: Elementary electricity experiment

This article aspires to insert intelligent avatars into the aforementioned context. These should interact with students, playing the role of guides to the museum, [4]. They may act in two different modes: as informational agents, who offer help so that the students can have an orientation about the museum and its galleries; and as intelligent conversational agents, or chatterbots, that respond to users' questions, contributing with information and knowledge about the artifacts, potentializing the teaching and learning process of students. Moreover, the agent may also act as a companion through social dialogues, searching for a greater interaction and proximity to students immersed in the environment.

II. CONVERSATIONAL AGENT

For Russell and Norvig [13], an agent is something that perceives and acts in an environment, being able to perceive its environment through sensors and to act on this environment through actuators. Wooldridge [15] conceptualizes an agent as a program that assists the user in performing some task or activity. Smart agents are basically a system capable of making decisions and interacting with the environment or other users based on some data source. Every intelligent agent must have at least four characteristics [16]:

1. Autonomy, having control over its actions;

2. Reactivity, perceiving changes around it;

3. Sociability, interacting with other agents through some kind of communication language;

4. Pro-activity, not only reacting to the environment, but taking initiative when convenient.

The term intelligent agent can be used to refer to any software agent that has some sort of intelligence. Artificial intelligence (AI) has exerted a very strong influence over the field of agents and has already displayed a great evolution [16].



Fig. 2: Communication agent

According to Russell and Norvig [13], before starting the design of an agent, a clear idea regarding the possible set of perceptions, actions, objectives and the environment in which the agent will act will have to be well defined. This set is known as PAGE (Perceptions, Actions, Goals and Environment).

Russell and Norvig [13] propose several agent architectures: reactive agent, reactive agent with an internal state, objective-based agent and optimizing agent. Within these architectures different types of agents can be developed: agents for simulations, commercial agents and conversational agents, as well as educational conversational agents which are the focus of this article.

Guetl [7], the concept of an intelligent pedagogic agent comes from the meanings of the names agent and

intelligent and pedagogic agent. The agent is a software component that can act by itself in a goal-based environment. In the educational context, the intelligent agent has pedagogical abilities to achieve educational objectives. The agent provides personalized instructions, improving student motivation. Each agent acts and interacts with the environment based on the goals to be achieved.

Intelligent agents are attractive for contributing to learning environments especially for group work involving individual learning and decision making as well as group learning activities. This requires strong intellectual interactions and social skills between individuals, [16]. Work related to this will be discussed in the next section.

III. RELATED WORK

Related to this work are projects such as the "Greybeards Project" in which virtual guides are created for virtual worlds that can help people in their journeys. This project originally started using another platform for the chatterbot's AI. Sun Tzu - The Greybeards Project [14] is now using Daden's Artificial Intelligence technologies inside the game Second Life [14]. This advancement in Artificial Intelligence offers many features for using automated avatars in virtual worlds for training and as virtual guides, such as guided tours, avatar movements, teleportation, chatterbots, instant messaging, Twitter updates and the ability to learn from the environment. It uses web scraping technology, allowing the Virtual Guide to answer users' questions using a web service database such as Wikipedia to provide it with data to respond to these questions [14]. This work is very similar to the work proposed in this article, since agents are used as virtual guides, using artificial intelligence techniques so that the agent answers questions using its database, although now inside the Second Life virtual world context. The proposed agent is a conversational one and it also answers the user's questions about the history of computing, but in a different open source platform, called Opensimulator.

Refund.me is another Virtual Assistant. It serves a flight company as an assistant and also functions as a smart helpdesk. InteliWISE is a service software, which provides buyers with immediate answers to most of their questions, at a more cost effective service. It has the smart combination of search, with a very minimalist look and intuitive page navigation, providing immediate answers. [8]. Thus, this work is differentiated from the work proposed in this article, because it is designed to be a virtual assistant and a web page, not being used in an immersive environment.

IV. PROJECT

This chapter presents the implementation of the conversational intelligent agent called AGIMC, a Portuguese acronym for Intelligent Agent of the Computer Museum. Some characteristics of the agents are necessary so that the active elements can interact with the other elements and with the virtual world. "Fig. 2" shows the elements that bring the viewer, the interface and avatar agent conversational [3].



Fig. 3: Agent conversational



Fig. 4: Architecture effective communication



Fig.5: Implementation Pandorabots

Regarding the software implementation, Figure 3 Architecture effective communication. It also illustrates the entire necessary computational structure, starting with the MySQL database, which is free and open source, followed by MOODLE, which is the virtual learning

environment, where all the theoretical material regarding the content is added. There is also OpenSim, the 3D virtual world creation environment, and SLOODLE, which interconnects them, allowing classroom data such as videos, slides and texts to be displayed dynamically in the virtual world. An AIML database was also created on a public server called pandorabots at Figure 4 for storing software agent categories. All these software are installed and stored on the server with the Linux operating system, all of them free and open source. it the use of scripts it was possible to make the museum's artifacts interactive, making the environment more attractive to the student, increasing his attention during the visit. The museum structure is divided into an entrance hall, four exhibition galleries and two rooms. In the entrance hall is the museum agent, as well as a map of the museum for students to orient themselves and an environment for the visualization of an introductory video about the museum, presenting its structure and its main attractions.

The framework was developed using OpenSim's 3D object modeling and creation tools, as well as the use of scripts for some interactive parts of the artifacts. The student can interact with the artifacts inserted in the scenery of the museum and some galleries that compose the Museum of Computing.

For the NPC creation stage it was necessary to make some modifications to certain lines of code in the "OpenSimini" file, as shown in the official OpenSim page. The NPC (Non player character, i.e., a programmable character in virtual worlds) was created. In this way the user will have the feeling that he is interacting with another avatar, which will give him a sense of constant mentoring. Configuration commands Table. 1: Changes needed in OpenSim

1. Allow_osNpcCreate = true;
2. Allow_osNpcMoveTo = true;
3. Allow_osNpcRemove = true;
4. Allow_osNpcSay = true;
5. Allow_osAvatarPlayAnimation = true;
6. Allow_osAvatarStopAnimation = true.

The [XEngine] has been changed in the [GridInfo] section and the following specific lines of NPC functions were added. Table 2 shows the changes:

Table. 2: specific lines of NPC

- Enabled = true in the [NPC] section;
 Enabled = true in the [XEngine] section;
- 3. AllowOSFunctions = true in the [XEngine] section;
- 4. OSFunctionThreatLevel = VeryHigh in the
- [XEngine] section.

After this part of the configuration is complete, the OpenSim.ini file has been saved. It should be noted that such changes will change all regions. The following scripts were created in a prim (virtual world object) NPC trigger. When this object is touched by the avatar an NPC will be instantiated. Following inside the object (prim) was created another script called "Appearance". To visualize the appearance it is necessary that the object be touched, displaying a notecard called "appearance". Table 3 shows the code:



Default
{
touch_start(integernum)
{
osAgentSaveAppearance(llDetectedKey(0),
"appearance");
}
}

It was necessary to create an appearance for the NPC that was suitable for use inside the Museum. With that he was dressed in a suit and tie to simulate a human avatar inside the museum. In order to communicate with the NPC it is necessary to type in the imprudence viewer chat imprudence the /create command. After this, the user will be dialoguing with the NPC, integrated with the Pandorabots chatterbot and the virtual world server OpenSim. While interpreting AIML, the chatterbot seeks to seamlessly match patterns by searching word for word instead of category by category. For this, the Graphmaster algorithm is used [7].

The development followed the model of the ALICE Artificial Intelligence Foundation. To integrate pandorabots with the Opensimulator it was necessary to create an account at http://www.pandorabots.com/botmaster/en/home. The bot is based on the AIML (Artificial Intelligence Markup Language) language, which is the agent's base of knowledge.

The possibility of interconnection by this implementation involves the use of scripts and the ability of NPC communication with the knowledge base, thus allowing the search for information in this database. In this sense, the ability to interconnect an NPC with the agent enhances the interaction capacity between the users and the NPC. The chatterbot knowledge base has been customized for the project specifically where the chatterbot will come into play. Editing the chatterbot knowledge base was done by creating a file built with the AIML markup language.

Next, the AIML knowledge classes were implemented in order to make the bot intelligible to interact with, guide the user and dialogue about social interactions and specific knowledge regarding the introduction to computing. Through it, the system can be hosted in the public server and be available for user access. The system offers the possibility to publish the bot project with specific names and create more documentation. The tool expedites this step of coding the questions and answers made in the elaborated documentation, thus showing an efficient structure for tests with the language.

The AGIMC was fed with approximately 1800 categories in six tables in its knowledge base, in order to enable a very effective dialog on the chatterbot's behalf. The agent's knowledge base can be improved when necessary, expanding its capacity for dialogue and interaction, mainly through the inclusion of categories. The agent has skills such as interaction, autonomy, reactivity and proactivity. At the moment, the agent identifies the user in its range of action, it establishes a communication channel through the chat, thus being interactive with the user, being able to interact and dialog.

V. RESULTS

The application of the experiment was carried out during the end of a semester in the second semester class of the systems analysis and development course with a group of ten students. The students had a tutorial available online on the use of the museum to carry out the experiment. There was an introductory class for students to have contact with the virtual world and familiarize themselves with its use, where the inserted content and learning objects in the museum were approached. Some students already knew some game commands and linked the system to a game. Others not knowing virtual worlds, even after an explanation, had difficulties to assimilate the software.

As this evaluation is considered both qualitative and quantitative, we used the Likert scale to do the analysis, using five levels. This analysis deals with the questionnaires that are used to stimulate the opinions of students, [9]. Regarding the questions, the students participating in the evaluation filled out the questionnaire and it consisted of five statements in which the student could: 1. disagree completely, 2. disagree partially, 3. be indifferent, 4. agree partially or 5. Fully agree. The mode used to analyze the results obtained was to calculate the percentage for each question, assuming that all items approached attitude and opinion.

As a first step the students were directed to the computer lab and invited to download and install the viewer. In order to have access to the virtual world it was necessary to have installed a virtual world viewer, in which case it was suggested to use the Imprudence viewer. The user goes to the agent and interacts with it in the museum. The agent is represented by an intelligent conversational software agent that aims to communicate with the users by improving the interaction during the visitation. The agent has a sensor to establish contact with the user, identifying it within its radius of action. At the end of this visitation, users had to respond to a questionnaire that will be addressed below. Some students left recommendations, while others did not want to mention their considerations. Students who agreed on most of the questions recommended that the environment may assist the student as a complement to their learning. Most students mentioned that they were satisfied with the agent and that they would recommend the use of the environment with the insertion of the agent in other disciplines of their institution's computer courses. The students' feedback about the recommendations and suggestions also mentioned the similarity of a real environment, proving that the representation of a dialogue with the agent was satisfactory. In addition, the experiment conducted with student's shows significant clues that the agent is able to support the student in their conversation. That's because the students confirmed that the testing environment worked properly and the simulation of the dialogue was even more motivating.

VI. REFLECTIONS

This article aimed to present the development of a software agent, immersed in a 3D virtual world, to act as a conversational guide in a Virtual Computer Museum. In the development of the AGIMC, the integration of a chatterbot simulating a conversational intelligent agent was carried out, in order to provide the student with an environment of knowledge and to assist in the doubts regarding the history and introduction to computing. For this, it was necessary to develop an adequate knowledge base for the topic. The use of tools such as the Pandorabots public server facilitated the product development and the use of the software with intelligent agent interconnection was necessary, in order to verify if the proposed solution was able to achieve the objectives of the work. Given the above, it became possible to verify simulations of dialogue with the agent and to see if the dialogue was motivating to stimulate the students to continue interacting, identifying associations with the real world. According to the evaluation of the results, it was possible to observe that the indexes indicate that at the moment of the evaluation the students felt themselves talking with the agent, thus making the learning more motivating, continuing the dialogue and wanting more interaction on the subject. The use of the topic introduction to computing for the students of a course of Technologist in Analysis and development of systems favored the dialogue, for having interests in knowing more about the area mainly because it is a simulated environment in a virtual world. The inclusion of the intelligent agent facilitated, therefore, the use of the dialog in the computer museum in which the student can recognize the object in 3D and be able to use more of the interaction, besides enabling the use of the software in the classroom in classes of introduction to computing or courses that follow this teaching methodology.

The use of the agent allowed a better interaction with the student, making him feel more motivated towards the dialogue, which was observed during the evaluation. Another characteristic of the AGIMC was the availability, since it was constantly active as a bot allowing the student to clear up their doubts and get an answer to a question at the time that better suits him, i.e., he can access the virtual museum at times outside the room and gain knowledge using the virtual world as a complement to the discipline.

VII. FUTURE WORKS

More research is needed to advance studies on virtual worlds, intelligent agents, immersion. Current researchers are working on the use of neuroeducation using these technologies. An example is the use of wearable equipment (EEG) to track a student's brain while the student performs the activity in the virtual environment, [2]. We will be proposing the reading of biosigns, detecting stimuli during the traditional class process and the comparison with the use in virtual reality. Some studies already indicate this use in education and with surprising results.

The study "Research in Brazil - A report for CAPES", conducted by the US company Clarivate Analytics, points out that Brazilian scientific production is done almost exclusively within public educational institutions. One of today's challenges for public universities is transform scientific research into products and services available in the form of solutions, promoting job openings and financial results that feed the academic system and enhance the production of scientific research.

In this context, this project will continue with the development of a new gallery, where the intelligent agent, through tools such as Model Plan Canvas and Minimum Viable Product (MVP), will provide the researcher with validation of his application to the market. , as well as the simulation to launch the new product or service with the lowest possible investment, aiming to test the business before making major investments. It is noteworthy that this Virtual World can be adapted to educate from young to mature adults, and can be used in any area of knowledge, reaching audiences that often because of distance or resources, has no access to traditional education, ie in classroom.

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Influence on the Productivity of Ethanol by two Strains of Yeasts in must Fermentation of Sweet Sorghum

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Abstract—Currently, the world's energetic matrix is in a modification, resulting from the worsening global warming. In this scenario, Brazil presents the generation of electric energy through Hydro consolidated, as well as the ethanol in gasoline replacement in vehicles. This biofuel is produced from the ethanolic fermentation of sugar cane juice or residual molasses of sugar manufacturing. With the high marketing of "flex-fuel" cars in the country, it is estimated that the demand will increase considerably, being necessary to the expansion of sugar cane plantations, or the use of other raw materials that can complement the production. In this context, the sweet sorghum outstands, which have been studied by presenting short vegetative cycle, high-yield in ethanol per area, co-generation from bagasse burning, the possibility of mechanization, besides being cultivated in sugar cane plantations renewal areas. Considering that sweet sorghum is a relatively new crop, there is a lack of information in the literature concerning the ethanolic fermentation of sweet sorghum juice and the characteristics of the resulting wine. In this way, the objective of this work was to assess the influence of yeast strains PE-2 and BG-1 in the must fermentation process of sweet sorghum, it was observed that the raw material offers levels of sugars suitable for industrial processing, and the PE-2 adapt more easily to the must sweet sorghum than the BG-1, producing high alcoholic content.

Keywords—Chemical analysis, fermentative efficiency, alcohol content, bio-energy.

I. INTRODUCTION

With high pollution and with the problem of global warming, humanity has been seeking ways to minimize the impacts on the environment. One possible alternative is the generation of renewable energy such as ethanol because it releases less harmful gases into the atmosphere, besides being energy from inexhaustible natural resources.

Brazil has won the worldwide market for the production of ethanol, being today second place in the ranking of the major producers of this biofuel [1, 8, 14].

The sugar cane industry plays an important role in the domestic market since it is the main source of raw material for biofuel ethanol; not only for production, but also the sugar product that most countries and food industries consume, and therefore depend on marketing [22].

Currently, the production of ethanol from sugar cane is approximately 23 billion and estimated a 2020 production of around 64 billion [32]. For this it is necessary to expand the area to be cultivated, creating more jobs, but on the other hand, it causes many impacts not only to the environment and the economy but also social impacts [13, 23, 33].

Targeting an increase in the production of ethanol, the sweet sorghum can be deployed as a rotation culture at the time of the sugar plantation reform, as it is a plant with a shorter life cycle, providing a greater yield of the land already used for cultivation and minimizing the impacts to the environment [5, 30]. Sweet sorghum is a promising crop, with high potential for use in ethanol production, complementing the culture of sugar cane and has as its main feature the use of water equivalent to 1/3 of the quantity used in sugarcane [26].

The ethanol productivity is directly linked to the type of yeast used in the fermentation process. These yeasts must be genetically selected, taking into account especially the speed with which the fermentation is performed and the transformation of sugar into ethanol [28].

One of the ethanol production processes (extraction of juice, juice clarification, fermentation, and distillation) fermentation is one of the most important, it is the phase in which the sugar is converted into ethanol by yeast activity, with the release of carbon dioxide and energy in the form of heat [6]. This conversion process is carried out by means of 12 chemical reactions, where each one is stimulated and accelerated by different enzymes, which are very influenced by the atmosphere, depending on factors such as temperature and pH, for example, the enzyme activity will be greater or lesser [15].

Industrial processing of sweet sorghum resembles with the production of ethanol from sugarcane as raw material, using the same sugar cane structure, requiring only a few adjustments [31]. The yeast studied, Saccharomyces Cerevisiae, grows easily in temperatures ranging from 30 to 34° C and in environments with an acidic pH around 4.5-5.0 [16].

In the proposal of sorghum usage as raw material, supplementary to the sugar cane, the ideal requirements of yeasts to ferment this material are still not well defined, under this view, should consider the viability of the yeast cells and their stay in the fermenter through the budding and the viability of the buds formed. In this regard the objective of this work was to assess the influence of yeast strains PE-2 and BG-1 in the must fermentation process of sweet sorghum.

II. MATERIALS AND METHODS CHARACTERIZATION OF THE EXPERIMENTAL AREA AND CROP CONDUCTION

The The experiment was developed at the SagradoCoração University -USC Experimental Farm, located in the region of Agudos, in the state of São Paulo, Brazil (22°28'S, 48°34'W, at a mean altitude of 530m a.sl.). The climate of the region is subtropical (Cwa-Koeppen). The soil was classified as a typic Hapludox. Its chemical and physical characteristics determined in the 0-20, 20-40 and 40-60 cm layers. Were made the

plowing and harrowing at the area, and later planting and fertilization, following the recommendation of 80 kg ha⁻¹ N, 40 kg ha⁻¹ of P₂O₅ 40 kg ha⁻¹ of K2O and 20 kg .ha⁻¹ S.

The sweet sorghum genotype used was Malibu®, the seeds were hand-planted, 2 to 4 seeds per hole, in an area of 504m², the depth of seeding ranged from 3 to 5 cm. The weed control was accomplished with manual weeding and herbicide application in the sown area. The used were Atrazine herbicide; Fipronil pesticides insecticide to control cutting ants (Atta .sp) and pyrethroid military caterpillar for control (Spodopterafrugiperda).At 26-days after sowing of sweet sorghum was held topdressing with urea. At 115-days after sowing were harvested 300 sweet sorghum stalks, removing leaves and pointers.

PREPARE JUICE, CLARIFICATION AND OBTAINING THE MUST

The juice was extracted by milling, being characterized as to °Brix, pH, total acidity, reducing sugars, total reducing sugars [9], Pol and Purity [10].

The extracted juice was subjected to clarification using the simple liming process with pH correction to 7.0 \pm 0.2 using calcium hydroxide (Ca (OH)₂). The pH value predetermined by preliminary tests was and methodologies to obtain maximum enzyme activity. It was then heated to boiling and transferred to 6000 ml vats containing 2 mg L⁻¹ of polyelectrolyte Magnafloc® to accelerate the sedimentation of impurities. Later, the juice was cooled and kept at 90 °C for applying the alphaamylase enzyme Termamyl 2x (Novozyme® 50188) in dosage 0.020 L.Mg⁻¹ of the processed sorghum. It remained in the decanter for 60 minutes for hydrolysis of starch. The supernatant was siphoned, for separating sedimented impurities, resulting in clarified juice. To obtain the musts was performed to standardize the °Brix to $16^{\circ} \pm 0.5$, pH 4.5 ± 0.3 with sulfuric acid (10N) and 32°C.

FERMENTATION PROCESS TESTING TWO YEAST STRAINS

They have used in the experiment two yeast strains Saccharomyces cerevisiae (PE-2 and BG-1), obtained from industrial units of Jaboticabal –SP region. Its main features are the high resistance to pH shocks, long stops during the fermentation and recycle process. Also have low foaming, high capacity deployment and prevalence and high fermentation yield [17]. The fermentation was carried out in stainless steel vats, in a batch process without yeast recovery, in the proportion of 10% of the yeast in must 6L. The feeding occurred in two stages, the first stage with 3L and after 2 hours was added over 3L must.

The fermentation process was monitored by the reduction in °Brix, with the aid of densitometer, every 4 hours, is considered finished when the concentration of soluble solids was less than or equal to 1, or when values kept stable during 1 hour.

Forty minutes after the last feeding and the end of the fermentation process were performed cell viability analysis, budding and viability sprouts. At the end of fermentation (8 to 10 hours), the wines were recovered by centrifugation at 1650g, 25°C for 5 minutes (HIMAC® CR21G centrifugal). They were evaluated according to °Brix, pH, Total Acidity [9], Residual Sugars Total Reducers and glycerol [7].

The wines were distilled into micro distiller, the distilled was analyzed in digital hydrometer Antoon-Paar to determine the alcohol content. The fermentation efficiency was calculated according to [10].

EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS

The experimental design was completely randomized with two treatments and three repetitions. The treatments consisted of two yeast strains, used during the fermentation process (BG -1 and PED- 2). The results were submitted to analysis of variance by F test and the averages compared by Tukey test (5 %).

III. RESULTS AND DISCUSSION FEATURES FROM EXTRACTED SWEET SORGHUM JUICE

In the extracted juice treatments and clarified juice (Table 1), there was a decrease in the concentration of starch of 2156 to 296 mg. L⁻¹ after enzyme application and as a result, the increase of total soluble solids (°Brix) from 15.2 to 15.8 comparing extracted juice and clarified respectively. These results are in agreement with those obtained by Gomes (2014) [12] in sweet sorghum juice CVSW80007 genotype on order 2183 mg.L⁻¹. According to Nan et al. (1994) [21], the concentration of starch in the juice can range from 300 to 9900 ppm, with the more common average close to the 2000 ppm.

The results for the pH were significantly different, having presented greater values for the clarified juice. The result can be expected because in the process of clarifying the juice, this is treated with 300 ppm of calcium hydroxide and its pH is raised to 7.0 so that the process of coagulation and precipitation of impurities is optimized. On the other hand, the extracted juice pH can represent the condition of maturation of stalk, as well as its quality (deterioration). Table 1. Analysis of original and clarified juice of sweet

sorgnum.			
Juices	Extracted	Clarified	
°Brix	15,2A	15,8A	
pH	4,9B	6,5A	
Total Acidity (g.L ⁻¹ H2SO4)	2,6A	0,96B	
Reducing Sugars (%)	1,74A	1,4A	
Total Reducing Sugars (%)	12,2A	12,8A	
Pol (%)	9,9A	10,8A	
Starch (mg.L ⁻¹)	2156A	296B	
Purity (%)	66A	68A	

Measures followed by distinct letters differ significantly by Tukey test to p<0.05.

Physiological behaviour of yeasts

The results obtained for cell viability at the beginning and end of the fermentation process are presented in Table 2. It was observed average values of 93.22% for BG-1 and 87.86% for PE-2 when the beginning of fermentation was assessed. At the end of the process, there were no significant differences between the strains studied. These values were similar to those obtained by Masson et al. (2015) [18], that evaluating fermentation juice of sweet sorghum, cell viability near 90% at the beginning and end of the process when using FT858 yeast.

Table 2. Cell viability of yeasts.

Yeasts	Cell Viability Start	Cell Viability End	
		%	
BG-1	93,22A	92,98A	
PE-2	87,86B	94,30A	
TestF	3,87**	0,19ns	
DMS	7,56	8,37	
CV	3,68	3,94	

BG-1 and PE-2 commercial yeasts. Measures followed by distinct letters differ significantly by Tukey test to p<0.05. ** significant at the level of 1%. NS: not significant. DMS: Differentiates Significant Minimum. CV: coefficient of variation.

For the budding yeast index (Table 3) there are similar values between the two strains, however at the end of the process there was an expected increase in the level, which according to NAGODAWITHANA et al. (1974), cited by MUTTON (1998) [20], with the intensification of fermentation, temperature increase occurs, leading to an increase in metabolic activity of yeasts, and consequently increasing the budding. Higher values for the PE-2 at the

end of the process were recorded. According to AMORIM et al. (1996) [2], it was reported that the percentage of budding varies from 5 to 15%, with values above this being indicative of increasing temperature or the low maintenance of yeast in fermentation vats. *Table 3. Budding yeast during the fermentation process.*

Vaarta	Budding	Budding		
reasts	Start	End		
	%			
BG-1	14,43A	20,68B		
PE-2	18,61A	33,05A		
Test F	1,36ns	11,98*		
DMS	9,93	9,92		
CV	26,48	16,29		

BG-1 and PE-2 commercial yeasts. Measures followed by distinct letters differ significantly by Tukey test to p<0 .05. ** significant at the level of 1%. NS: not significant. DMS: Differentiates Significant Minimum. CV: coefficient of variation.

To the beginning of fermentation (Table 4), the yeast BG-1 presented greater quantities of living sprouts about PE-2. However, at the end of the process, the yeast PE-2 presented greater values concerning BG-1. In this sense, one can infer that the PE-2 yeast adapts more easily to the sweet sorghum than BG-1. This fact confirms the results of the analysis of the budding index. Furthermore, the values were similar to those obtained by Masson et al. (2015) [18] who observed more than 90% shoots viability throughout the fermentation process.

Note that the percentage of viable cells and buds during fermentation is of extreme importance to the maintenance of yeast population, being essential it is monitoring, since, in addition to unwanted metabolites contained in the raw material, toxic compounds to yeasts that are produced during fermentation can accumulate in yeast, promoting viability loss and reducing industrial efficiency [25].

Table 4. Viability of buds			
Vecata	Viability of buds	Viability of buds	
reasts	Start	End	
		%	
BG-1	93,45A	79,25B	
PE-2	85,16B	96,48A	
Test F	5,08ns	57,55**	
DMS	10,21	6,31	
CV	5,04	3,17	

BG-1 and PE-2 commercial yeasts. Measures followed by distinct letters differ significantly by Tukey test to p<0 .05. ** significant at the level of 1%. NS: not significant.

DMS: Differentiates Significant Minimum. CV: coefficient of variation.

CHARACTERISTICS OF WINE AND FERMENTATIVE EFFICIENCY

In Table 5are presented the results obtained for °Brix, Residual Sugars Total Reducers, pH and total acidity of the wine.A significant difference in the concentration of Residual Sugars Total Reducers present in the wine when compared the two strains of yeasts was shown. Larger values of Residual Sugars Total Reducers indicate inefficiency of the conversion of sugars into ethanol. This result confirms with the determined for °Brix, which was also greater for the resulting wine fermentation using BG-1. However, the values were higher than those determined by Masson et al. (2015) [18], which verified the Residual Sugars Total Reducers 0.09% order.

The values of pH and total acidity differ from those obtained by Silva et al. (2014) [29] and by Ferreira et al. (2015) [11] that found lower pH (4.2 and 3.9) and total acidity (2 g.L⁻¹), researching the influence of emerging and enzymatic treatment respectively. Can assign such differences to the action of the yeast strains used in this study. Note also the largest amount of acids produced by the BG-1 about PE-2. For the production of biomolecules to happen, there is a conversion of sugars in the must by yeast. This fact is due to the reduction in the amount of ethanol produced [4].

Table 5. Wine Analysis					
Wine	°Brix	Residual Sugars Total Reducers (g.L ⁻¹)	рН	Total Acidity (g.L ⁻¹ H ₂ SO ₄)	
BG-1	3,3A	0,81A	4,4B	3,0A	
PE-2	3,0B	0,78B	4,6A	2,7B	
Teste F	16,0**	9,8**	202,3**	28,2**	
DMS	0,2	0,1	0,0	0,2	
CV	2,6	1,9	0,4	2,3	

Measures followed by distinct letters differ significantly by Tukey test to p<0.05. *CV: coefficient of variation

The wine glycerol values (Table 6) showed differences for the yeast strains studied. Glycerol is a second compound that is formed in the same path of ethanol and is inversely proportional to its production. Therefore, the idea of fermentation is the lowest possible production of glycerol [2].Differences in glycerol levels according to BEROVIC et al. (2006) [3], can be explained by the strains studied by temperature, substrate concentration, and the osmotic stress. Fermentation carried out resulted in a wine with an alcohol content between the two yeasts, BG-1, and PE-2 (Table 6), showing the consumption of sugars by the yeast in this sweet sorghum juice. RIBEIRO FILHO et al. (2008) [27] observed values of 5.9% of the ethanol from sweet sorghum processing, while Masson et al. (2015) [18] found mean values of 6.3%.

RATNAVATHI et al. (2010) [24] achieved efficiency values in the range of 86.5 to 94.7% off sweet sorghum, using yeast Saccharomyces cerevisiae CFTR 01. Masson et al. (2015) [18] determined values of 81%. The results obtained in this study were similar to those reported in the literature and many factors influence the fermentative efficiency, as the quality of raw material, temperature, pH, yeast strains, among others.

Table 6. Wine Analysis				
	Glycerol	Alcohol	Fermentation Efficiency	
		%		
BG-1	0,66B	8,2A	92,7A	
PE-2	0,69A	8,1A	93,3A	
Test F	28,0**	0,7ns	5,9	
DMS	0,01	0,5	0,9ns	
CV	1,2	2,7	2,8	

BG-1 and PE-2 commercial yeasts. Measures followed by distinct letters differ significantly by Tukey test to p< 0.05. F-test: Fisher **DMS method: minimum variation Differs. *** CV: coefficient of variation.

IV. CONCLUSION

Sweet sorghum (Malibu [®]) offers sugar levels suitable for industrial processing aiming at the production of bioethanol.

Starch concentration reduced after the clarification of the juice, resulting from the action of alpha-amylase which was applied.

The yeasts PE-2 and BG-1 produce alcoholic high levels when you use sweet sorghum as raw material. Although the PE-2 yeast adapts more easily to the concentrated sweet sorghum than BG-1. PE-2 was considered more adaptable because the budding end of the yeast was greater in 12.37%, as well as the viability of these buds was greater 17.23% about BG-1, i.e. almost total.

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Wind Farm Implementation Factors: A Bibliometric Analysis

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Abstract—Researches focused on identifying the factors that influence the implantation of wind farms have been found in the academic scope, considering the technical, environmental, economic and social points. The objective of this study is to map the scientific activity based on the theme "factors that influence the implementation of a wind farm", using in principle the entire period of coverage of the Web of Science - WOS platform, in order to compose a portfolio of bibliographical references on the subject. The process selected 9 relevant articles, aligned to the theme and present in several areas of study. A qualitative bibliometric analysis of the portfolio was also carried out in order to characterize and analyze the selected articles, also elaborating a SWOT Matrix with positive and negative factors on the researched topic.

Keywords—Bibliometric, Renewable energy, Wind energy, Wind farm.

I. INTRODUCTION

Since the oil crisis in the 1970s, the search for alternative energy has been sought in order to achieve the energy security widely discussed today. According to Other factors motivated such demand, such as environmental, economic and social factors, giving rise to new sources of energy in the electric matrices of several countries, among them is wind energy [11].

Wind energy uses the wind for its generation. Brazil has advantages in the energy aspect, since it has relief, hydrography and tropical climate favorable to the use of several renewable sources of energy, such as wind energy [3] [14] [6] [18].

Brazil reached the end of 2018 with 14.71 GW of installed wind capacity, in 8th place in the world ranking, with 583 wind farms, which represents 9% of the Brazilian electricity matrix [1].

The Brazilian Wind Potential Atlas published in 2001 identified the Brazilian regions with great potential for the use of wind energy, with about 0.8% of the territory having winds with average speeds equal to or greater than 7 m / s, 50 m above of the soil, with potential of 143.4 GW, with capacity to generate 272 TWh / year [16].

Most of Brazil's wind potential is located in the Northeast, South and Southeast regions [19]. In order for such energy to be produced, it is necessary to implement wind farms, in Brazil the majority is located in the Northeast region.

With the increase of discussions regarding diversification of the energy matrix, renewable energies and energy security, and seeing the potential of wind

energy in Brazil, the opportunity to generate scientific knowledge through a bibliometric analysis on the factors that influence the implementation of a wind farm.

The studies that are based on bibliometric analysis have been receiving prominence in the academic scope, since this is recognized for its relevance to quantify, classify and evaluate scientific works.

Thus, this work identifies the factors that are considered important when planning to implement a wind farm, using academic research tools. The objective is to map the scientific activity based on the theme "factors that influence the implementation of a wind farm", using in principle the entire period of coverage of the Web of Science - WOS platform.

II. MATERIALS AND METHODS

The present research is an exploratory-descriptive study, and it aims to provide a familiarity with the problem, making it explicit, through standardized techniques of data collection and treatment [20].

This work used as a database the Web of Science -WOS platform, which contains periodicals of great relevance to the academic and scientific milieu. Being initially selected the whole period available by the platform, from 1945 to 2019.

After defining the database, the keywords were determined that determine the focus of the research through topics. Since the theme is "factors that influence the implementation of a wind farm," the keywords chosen were: wind energy, wind farm and power plant. From the tags, the selection of the materials that will compose the portfolio of publications that form the theoretical reference and the results will begin. The first refining consisted of selecting an article-type document on the WOS platform itself. The materials resulting from this research were exported to Microsoft Excel in the form of a spreadsheet so that it could follow the selection.

A new selection was made, based on a cutoff number for the articles that were most cited, the articles were ordered decreasingly in relation to the number of citations, being selected the articles in which the quotations accounted for approximately 85% of the total obtained [13].

The Word Cloud tool was used to present the study areas in which the selected articles were published up to that stage in the analysis., Such a tool converts a given set of words into a word cloud, where each word is sized according to the number of occurrences and can be used as a data analysis tool [8] [24].

Due to the number of resulting articles plus a selection method was adopted, this time to define the sample number considered valid for analysis. The sample size (number of articles required) depends on the population size (total articles) and the degree of reliability desired for the results obtained [5].

For this study the size of the sample was established by the expression presented in Equation 1 [7], this calculation is necessary to guarantee the representativeness of the data collected and the legitimacy of the research:

$$n = \frac{Z^2 \cdot \left(\frac{x}{n}\right) \cdot \left[1 - \left(\frac{x}{n}\right)\right] \cdot N}{(N-1) \cdot e^2 + Z^2 \cdot \left(\frac{x}{n}\right) \cdot \left[1 - \left(\frac{x}{n}\right)\right]}$$
(1)

Where: n is the sample size; N represents the size of the population; and is the sampling error; x / n is the estimated proportion of the item surveyed in the sample (%); and Z is the abscissa value of the normal curve associated with the confidence level [4].

An acceptable sampling error of 5% was considered, since no estimate was used, the value of 50% was used and the confidence level was 90%.

The selection of the articles published in the last 10 years was used, followed by the abstracts of the articles to exclude those that do not fit the research focus, so the theoretical reference portfolio was composed from this quantitative analysis.

In addition, the qualitative analysis of the portfolio, presenting a synthesis about the conclusions and perspectives of the authors of these articles on the theme, and based on the considerations collected in these articles,



Fig. 1 shows a flowchart with the steps taken to select the portfolio for better understanding. Source: Prepared by the authors

III. RESULTS AND DISCUSSION

When using the mentioned keywords, and considering the maximum time of publication of the data base chosen, were found 1,495 publications. Then the first refining was done, since only article type documents were selected, resulting in 777 publications, with the first work in 1995, until the year 2019, Chart 1 shows the evolution of the publication of articles of this theme to the logo of the years.



Graph 1 - Evolution of publications over the years Source: Prepared by the author

The first published article is entitled "Wind Farm Economics" by Milborrow, D.J. [15], a publication in the journal Proceedings of the Institution of Mechanical Engineers Part A-Journal of Power and Energy.

It can be observed that from the year 2007 the growth of publications on the subject is of ascending form with a peak in the year 2018, the decline of the year of 2019 is justified by the research was carried out on 06/29/2019. But this year was not excluded in the total time span of the research, keeping the scope of the research the relevant papers published in the current year. Therefore, studies on wind energy have been showing an increasing interest on the part of researchers.

The sum of all citations of the 2,608 articles results in 13,606 citations, and with the cutoff method are 84.76% of the citations, being composed by articles that were cited 16 times or more, reducing the selection to 241 articles.

From these 241 articles it was possible to identify the countries that publish the most on the subject, Graph 2 presents the countries with three or more publications:



Graph 2 - Number of publications by Country Source: Prepared by the author

It can be observed that the United States is the country that has published most on the subject, 37 publications, being an advanced country in scientific research. Brazil also has its share of contribution, however small, with a total of 3 publications.

One of the ways to evaluate the relevance of a scientific work in academic terms is the analysis of the journal where the work was published, the theme of this work has articles published in several magazines, each with a different evaluation and research themes. Graph 3 shows the journals with their respective numbers of published articles, only those that had three or more publications.



Graph 3 - Number of publications by Journals Source: Prepared by the author

The journal Renewable Energy presented the largest number of publications, with 31 publications, which in turn has impact factor 4.9. Followed by Applied Energy magazines (impact factor 8.426) and Energy (impact factor 5.537) with 23 publications each. The impact factor is of great importance in measuring the relevance of journals, using the JCR (Journal Citation Report) platform to find this value [21].



Fig. 2, which uses the Word Cloud tool for a better visualization, can be found in journals of several areas. Source: Prepared by the authors

It can be observed that the areas of the periodicals in which more articles have been published on the subject are Energy & Fuels, Science, Ecology and Economic Sciences.As a further refining was necessary, within the 241 articles, at a confidence level of 90% the sample of 129 articles was still selected according to the descending order of citation, resulting in articles cited 29 times or more.

In order to reach the desired portfolio, the articles published in the last ten years (2010-2019) were selected, obtaining 90 remaining articles. And from the reading of the summaries of the articles were excluded 82, resulting in the composition of the portfolio 8 articles as presented in Table 1.

Table 1	- List of a	rticles in t	the portfolio
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Title	Author	Year of Publication
Wind plant power optimization through yaw control using a parametric model for wake effects-a CFD simulation study	Gebraad, PMO; Teeuwisse, FW; van Wingerden, JW; Fleming, PA; Ruben, SD; Marden, JR; Pao, LY	2016
Environmental management framework for wind farm siting: Methodology and case study	Tegou, LI; Polatidis, H; Haralambopoulos, DA	2010
Study of decision framework of offshore wind power station site	Wu, YN; Zhang, JY; Yuan, JP; Geng, S; Zhang, HB	2016

selection based on ELECTRE-III under intuitionistic fuzzy environment: A case of China		
A multicriteria decision making approach for evaluating renewable power generation sources in Saudi Arabia	Al Garni, H; Kassem, A; Awasthi, A; Komljenovic, D; Al-Haddad, K	2016
A method for the assessment of the visual impact caused by the large-scale deployment of renewable-energy facilities	Rodrigues, M; Montanes, C; Fueyo, N	2010
Wind farm siting using a spatial Analytic Hierarchy Process approach: A case study of the Stadteregion Aachen	Hofer, T; Sunak, Y; Siddique, H; Madlener, R	2016
Climate change impacts on the power generation potential of a European mid- century wind farms scenario	Tobin, I; Jerez, S; Vautard, R; Thais, F; van Meijgaard, E; Prein, A; Deque, M; Kotlarski, S; Maule, CF; Nikulin, G; Noel, T; Teichmann, C	2016
Maximizing the overall production of wind farms by setting the individual operating point of wind turbines	Gonzalez, JS; Payan, MB; Santos, JR; Rodriguez, AGG	2015

Source: Prepared by the author's

From the selected articles it is possible to present a synthesis of the authors' comments on the subject. For example, present contributions for the optimization of energy in a wind power plant, for this the authors show elements that must be considered for such optimization process, which in turn, when considering the
implementation of a power plant the optimization of energy will already be significant since the start of production of the wind power plant [9]. The elements studied extensively are: position of each turbine in the plant, wind direction, wind speed, turbulence and atmospheric stability and turbine type (generator torque, blade pitch angles or yaw angle). But consider the individual operating point of the wind turbines [10].

In a study to identify sites with potential wind farm installation in Greece, using a multicriteria analysis method mentioned that for such deployment includes environmental, economic factors, social constraints, and techniques [22]. In their research were identified and evaluation criteria for the choice of locality, these are presented in Table 2 below.

Table 2 -	Criteria	for	evaluation	ofthe	article
1 u Die 2 -	Criteria	jur	evaluation	ojine	unicie

Evaluation Criteria	Criteria Type\	
Visual Impact	Environmental / Social	
Visibility of settlements	Environmental / Social	
Visibility of archaeological sites	Environmental / Social	
Earth Value	Economic	
Slope	Technological	
Ground Cover	Environmental	
Wind Potential	Technological	
Distance fromElectrical network	Economic	
Distance from the road network	Economic	
Electricity demand	Environmental	
Source: Adapted fron	n Tegou et al., (2010)	

Also uses a multi-criteria analysis method, but focuses on offshore installations involving wind resources, construction and maintenance conditions, ground support conditions, environmental impacts, economic and social benefits [25]. Table 3 shows the criteria established by these authors.

Table 3 - Criteria for evaluation of the article

Wind Reso urces	uction and mainte nance conditi	Groun d suppo rt condit ions	Environ mental impact	Econo mic	Social benefi ts
	ons				
Wind	Weathe	Traffic	Marine	Total	Emplo
Wind speed	ons Weathe r	Traffic conditi	Marine environ	Total Invest	Emplo

its distrib ution status	ons		impact		
Wind energ y densit y	Marine conditi ons	Electri cal transm ission and distrib ution system	Coordin ation of marine life	Total return period of the project	Benefi t from the foggy climat e
Effect ive wind hours	Under water geologi cal conditi on	Distan ce to load center	Bird co- ordinatio n	Ratio of B / C	
Wind shear	Depth of sea water, distanc e from shore and width of the beach			Operat ion and mainte nance costs	
Turbu lence				Local financi al subsidi es	

Source: Adapted from Wu et al. (2016)

Used the multicriteria analysis in their research in their study as well, this time regarding the evaluation of renewable energy generation in Saudi Arabia from five different sources, among them wind [2]. As the criteria used for the generation of energy, these are considered important in the implantation of a power plant, such as socio-political, technical, economic and environmental factors.

Por large penetrations of renewable technologies, such as wind energy, the general visual impact can be substantial and can provoke a public reaction, ie a factor of fundamental importance when implementing a wind farm [17].

Also numbers criteria to determine the potential of a wind farm, but in Germany, and they are: Wind power potential / Wind speed; Distance from the road network;

Distance from the power grid; Slope of the terrain; Distance from urban areas; Distance to places of interest; Distance from natural environments; Type of soil cover; and Landscape architecture [12].

In turn consider two important points in their studies, the climatic projections of the region and the force of the wind [23]. As they point out that the wind energy resource is subject to changes in the climate, in this way, they investigate the impacts of climate change on future European wind power generation potential.

Thus, based on the considerations collected in the articles that compose the portfolio, it was possible to elaborate a SWOT Matrix (Table 4), with pertinent information, thus evaluating the positive and negative points for the continuation of the photo survey in the topic addressed. With the SWOT Matrix it is possible to identify the strengths and weaknesses that are internal factors, and opportunities and threats that are external factors, in order to visualize advantages, disadvantages, contributions to achieve objectives and harmful to the execution of these.

Table 4 - SWOT Matrix based on the information
collected by the articles

Positive	Negative	
Strengths	Weakness	
- Renewable and clean	- Give greater importance	
source;	in technical and economic	
- Choice of a better location	factors than environmental	
for the implementation of a	and social factors.	
wind farm.		
Omerturities	Threats	
Opportunities	Threats	
-Possibility of reducing	- Lack of studies on social	
-Possibility of reducing environmental, social and	- Lack of studies on social factors.	
-Possibility of reducing environmental, social and economic impacts;	- Lack of studies on social factors.	
-Possibility of reducing environmental, social and economic impacts; - Possibility of studies for	- Lack of studies on social factors.	
-Possibility of reducing environmental, social and economic impacts; - Possibility of studies for other types of generation	- Lack of studies on social factors.	
-Possibility of reducing environmental, social and economic impacts; - Possibility of studies for other types of generation and for hybrid plants.	- Lack of studies on social factors.	

IV. CONCLUSIONS

With the bibliometric research carried out on the Web of Science platform, it was possible to identify the growth of scientific production regarding factors that influence the implementation of wind farms, and also to generate a portfolio to be the theoretical base of this study and future research.

Most of the publications are in the area of energy, which has been gaining its space in several discussions and studies, whether it is focused on technical, environmental, economic or social area. This research used only one database (WOS), since it is a complete and rich database of academic works used by several countries of the globe, but it is suggested that other databases be used to make a comparison with others bibliometric studies in other languages.

The study brought to light the importance of the theme addressed from different perspectives, and to identify and list the factors that may contribute with other academic studies or real projects of wind farm deployments, thus generating a greater knowledge construction.

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Ground Reaction Forces during the Biomechanical Gait Analysis in Children

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Abstract—The objective of this article was to review the aspects related to the biomechanical variables that influence human gait and to understand how the ground reaction forces act during the process of ambulation. The research was made through Scopus and Google Scholar database and the key words used were: "gait", "children", "walk" and "ground reaction forces". Gait evaluation is used in many fieldsto make diagnoses, recommend interventions and monitor their effect. Muscle recruitment, immature stride dynamics and, strategies of equilibrium control, immature sensory integration during stance, are some of various biomechanical parameters and methodologies applied to analyze the gait pattern in children, and severalstudies have addressed medical treatments and their influence in the gait parameters. Therefore, the study of the relationshipbetween biomechanical variables and the gait maturity of the children is important to the development of new treatments and interventions in this population.

Keywords—biomechanics, childhood, force platform, kinetic, walking.

I. INTRODUCTION

Gait is a unique and fundamental movement of the individual, considering that two people do not move in an identical way. During the walk one of the feet is always in contact with the ground and, for a moment, both feet touch the ground, for this reason walking is an alternating sequence of single and double support of the feet with the floor. Periodicity of gait is supported by two basic requisites: periodic movement and ground reaction forces to support the body, which characterizes the gait cycle. Thus, gait descriptions, in general, refer to what happens in the course of only one cycle, assuming that successive cycles are all equal [1].

The gait cycle is initiated from the foot contact on the ground, usually done with the heel, starting the stance phase, which is divided into first double support, single limb stance and second double support. The first double support is characterized by the initial contact. The single limb stance, on the other hand, is divided in loading response, midstance and terminal stance. The second double support is characterized by the beginning of the next gait phase, the swing phase. The swing phase is characterized by the initial swing, midswing and terminal swing. The end of the gait cycle occurs when the same foot again comes into contact with the ground [2].

Fundamental motor skills, such as walking and running, are intimately linked to factors such as biological maturation, growth and life experiences [3]. The human gait is the result of a complex interaction of muscular forces, joint movements, and neural motor commands. In the last century, many variables that characterize human gait have been identified and quantified. These include ground reaction forces, muscle activity, limb movement, energy-metabolic cost and others [4].

Although the purpose of gait is the forward movement, upper limb movements will occur to maintain displacement of the center of mass of the head, trunk and upper limbs with a low amplitude and symmetrical coordination in the vertical and lateral directions [4]. The beginning of the walking process is considered the main challenge to overcome by children in the motor development phase. The upright position in babies is found around 1 year old. At this age, they are able to perform the first steps independently. The pattern of walking at this stage is continually challenged by the characteristics of the gravitational field, in addition to being influenced by the lack of muscle strength, by difficulties in balance and control [5].

Kinematic analysis and electromyography measurements of the gait require time-consuming procedures for attaching markers and skin electrodes to the body of the subject. On the other hand, the evaluation of the ground reaction force-time curves acquired with force plates has a considerable advantage of the possibility of immediate visual inspection of a measured test and is a relatively simple method that allows obtaining the magnitudes of the reaction forces that act in the human body.

The purpose of this study was to review the literature related to the kinetic evaluation of the children gait through the ground reaction forces (GRF) measurement. Firstly, the article describes the normal gait and its characteristics in children. Secondly, we review the aspects related to the GRF and force platforms. Then, we review some evidence about kinetic parameters. The article concludes with a discussion of the literature and clinical applications for biomedical engineering.

II. METHODS

The research was carried out in the following electronic databases: Scopus and Google Scholar. The

search included articles published in English and Portuguese with no period limitation. The descriptors used were: "gait", "children", "walk" and "ground reaction forces". After reading the abstracts of the articles, we selected the papers that used force platforms for gait analysis and evaluated the ground reaction forces, as showed in Fig. 1.

In addition to the use of academic articles that presented the purpose of the study of the gait of children with the help of force platforms, we also included in this article books related to gait analysis, dissertations and thesis that were related to the gait of healthy children or children with an abnormal gait.



Fig. 1: Flowchart of the search and selection process.

III. RESULTS

3.1 Characterization of gait

The human gait is the result of a sequence of events, initially occurs through the command from the central nervous system and then withthe transmission to the peripheral nervous system. After this stage, the muscles that will develop tension will be contracted and will happen the generation of moments and forces on the joints, resulting in the regulation of the forces and torques in the skeletal system, generating the displacement of the segments and the production of forces that lead to movement [6]. Following the international convention, gait analysis laboratories characterize the trajectory followed by the right lower limb, in two distinct phases, supporting phase and oscillation phase (also known as balance sheet phase) [7]. Fig.2(adapted)shows a summary of the running cycle[2].



It is possible to define the support phase as the period in which the foot is in contact with the ground and can be subdivided into first double support from0% to 12%, simple support from12% to 50%, and second double support from50% to 62%. The first double support is characterized by the initial contact. The single limb stance, on the other hand, is divided in loading response, midstance and terminal stance. The second double support is characterized by the pre-swing and the start of the next gait phase, the swing phase. Thus, the swing phase is characterized as the period where the limb is in progression movement and without presenting contact with the ground. It is subdivided in initial swing, midswing and terminal swing phase[8].

During the process of normal locomotion, the human body is erect and in movement, performing alternate movements of support phase and swing between the lower limbs. As the body moves to the supporting leg, the other leg will be projected forward in preparation for the next support phase. One of the feet will always be on the ground during the period when the support is transferred from the supporting leg to the advancing leg; there will be a brief moment when both feet will be in contact with the ground. As the individual walks faster, this double footing condition will occurin smaller fractions of time [1].

3.2 Force platforms

One of the instruments used the kinetic analysis of the gait is the force platforms. Basically, the force platform will be composed of two rigid surfaces, one upper and one lower, interconnected by force sensors [9].

Regarding the configuration of the construction of the force platforms, they can be made basically with the application of strain gauges for the instrumentation of the transducers or with the application of piezoelectric materials.

The strain gauge or resistive extensometer is a sensor that provides deformation measurement. It consists of a set of wire or metal strips in the configuration of a serpentine, always presenting the least space between the wires or the blades in order to reduce shear stresses [10]. The materials used to make these sensors should have the following characteristics: high sensitivity, good weldability, corrosion resistance and high resistivity as well, as high flow stress, low hysteresis and low sensitivity to variations thermal [10].

The strain gauges sensors, when subjected to the action of a force, will determine the mechanical deformation of a structure with the variation of the electric resistance, which will be proportional to the applied force. However, the piezoelectric materials will be able to produce alternating electrical voltages at the moment of alternating tensile or compressive stress [11].

It is important to point out that piezoelectric materials will present higher cost when compared to strain gauges, but they have many advantages such as repeatability, linearity, high frequency and low hysteresis [11].

Regarding the positioning of the sensors, three types of platforms should be highlighted: with a single sensor in the center of the platform, with a triangular distribution of the sensors in the three corners and with a rectangular distribution (sensors distributed in the four corners of the platform).

Currently, there are several options of commercial force platforms, for example the Bertecforce plate(Fig.3). Among the models of the company cited, one that is employed for both clinical analysis and research related to human gait is the model 4060-08[12].



Fig. 3: Bertec force platform.

With regards to platforms that use piezoelectric sensors, it is possible to cite the model Type 9285BA, from the company Kistler (Fig.4). In this case, it will be possible to determine the measurements of the GRF, as well as the recording of the contact areas[13].



Fig. 4: Kistler force platform.

BTS Another platform is that from the Bioengineering, INFINIT-T P6000 (Fig.5), which features spherical head sensors that provide а homogenous distribution at the points of contact[14].



Fig. 5: BTS Bioengineering force platform.

3.3 Noise

With regard to data collection related to gait analysis on force platforms, a major problem that must be addressed is noise elimination. Noise can be define as an unwanted signal that will impact the communication, perception or processing of a signal [15].

To reduce the noise problems we can apply filters during the signal processing. One example of a filter used is the low-pass filter, considering that the cutoff frequencies of these tests will be at most 50 Hz. This filter will allow the passage of low frequencies and will reduce the amplitude of the frequencies greater than the cutoff frequency.

One example of filter used in ground reaction forces analysis during the children is a method applied [16], the estudged the balance and symmetry of gait in children with cerebral palsy. Using two force platforms, with a sampling frequency of 960 Hz, the gait of 18 children was analyzed. In this study, the data were filtered using a loworder filter with a cutoff frequency of 10 Hz.

In order to analyze the gait of 40 children with Autism Spectrum Disorder [17],were used two force platforms in their essays. A low-pass filter with a cutoff frequency of 30 Hz was used to treat the noise in the ambulation processes. In this study the researchers used a sampling frequency of 1000 Hz.

In a project that performed the comparative analysis of the forces in the gait of 30 deaf children and listeners [18], were used two force platforms to evaluate children's walking, with a sampling frequency of 1000 Hz. In order to filter the signal, a low-pass filter of fourth order, with a cutoff frequency of 20 Hz was applied.

3.4 Ground reaction forces

Ground reaction forces can be known through Newton's third law, which stands out for being equal, but meaningful inverse to the forces that gave rise to it. During the gaitof a child, some forces acting on this process will be observed: the force exerted by the body on the ground, as a result of the action of gravity and the ground reaction forces, which will be the surface support reaction [19].

A challenge for the study of ground reaction forces is to decompose them into left and right profiles, considering that there will be two consecutive steps with the feet on separate force platforms. Usually, the individual who will be performing the gait will use visual guidance to correct their route and reach the platforms correctly, which may affect the trials and impact on the step length variability. One way of correcting this type of problem will be to carry out several tests according to the need, but one must be aware of a high number of repetitions, considering that the excess of these can result in fatigue and alter the gait pattern [20].

Among the variables most frequently evaluated in studies on gait biomechanics, we can mention the ground reaction forces on the Z axis (vertical component), ground reaction forces on the Y-axis (anterior-posterior) divided inbraking and propulsive phases. On the other hand, ground reaction forces on the X-axis (middle-lateral) are less frequently used due to relatively high [21].

Fig.6 shows a vertical ground reaction forces curve, where it is possible to evaluate the first peak (F1 - initial contact of the foot with the ground), the valley that is between the first and second peak (F2 - medium support phase), as well as the second peak (F3 - pre-swing phase) [5].



Fig. 6: Ground reaction forces on the Zaxis.

The first peak F1 represents the force that will occur in the instant we have the impact of the heel on the ground. This force will vary between 110% and 120% of the individual's body weight during a normal gait [22].

It should be noted that the valley between the first peak F1 and the second peak F3 is related to the moment when the foot is flat on the ground and the strength recorded will be approximately 80% of the body weight of the individual [22].

The peak F3 will be referring to the force necessary to separate the foot from the ground, allowing it to continue advancing. This force will be similar to the force recorded at the FZ1 peak, varying from 110% to 120% of the individual's body weight during a normal gait[22].

The anterior-posterior forces, measured in Y-axis direction of the movement are shown on Fig.7. We can

notice the heel moment (F4-braking) and the propulsion phase (F5-maximum strength) [5].



Fig. 7: Anterior-posterior ground reaction forces curve.

The force marked as F4 corresponds to the braking force, which represents the force exerted by the heel in the direction of the gait. Peak F5 is related to the force generated by the anterior foot in the opposite direction of the gait, representing the propulsive force [22].

It should be noted that the values of the braking and propulsion forces will register values close to 20% of the total body weight of the individual [22].

3.5 Biomechanics of gait in children

During the process of gait maturation, we can observe that at the beginning of the child's walking, each step tends to be independent of the following one. The child gives small steps with a small extension of knees and hip. During this maturation phase childrenwill step with flat feet and pointing out your toes. Individuals at this stage will have the habit of putting their feet well apart from each other to improve their lateral balance [23].

When analyzing the mechanisms of locomotion of a child, it can be observed that theywill occur in the supraspinal centers and will involve the conversion of a desire for movement in a pattern of muscular activity, necessary for the execution of the gait process (Fig. 8,adapted)[2].



Fig. 8: Seven components that form the basis of gait.

The gait process presents seven distinct events, as shown in Fig. 8: (1) recording and activation of the gait command in the central nervous system, (2) transmission of gait signals to the peripheral nervous system, (3) (4) generation of forces and moments in the synovial joints, (5) regularization of the forces and moments applied in the joints by the anthropometry of the rigid segments, (6) displacement of the segments in such a way that they are recognized as functional gait, (7) generation of ground reaction forces. This model, called cause and effect, will presentgait as a process of neural coordination and collaboration of the nervous and musculoskeletal systems, in order to achieve a correct dynamics, with the maintenance of body balance in a small support base [24].

When the child reaches two years of life it is possible to observe during running the aerial phase (moment of absence of both feet), characteristic of this initial stage of development. However, in the development of the 4th and 5th year of life, one can perceive greater control and coordination of fundamental movements, even though the notion of space and time is still in development [25].

IV. DISCUSSION AND CONCLUSIONS

Gait evaluation is used in many fields to make diagnoses, recommend interventions and monitor their effect. In most cases, the clinical method will be limited to visual observation of the patient's gait. However, the observational analysis of gait has questionable validity. Quantitative analyzes with kinetic measurements showed higher reliability since they will be based on the analysis of the ground reaction forces [26].

Various methods were used to investigate gait biomechanical models in children as the study [27], which points out in a systematic review that evaluated the effects of shoes on walking and running gait, compared to barefoot in healthy children.

One of the clinical aspects of interest is the evaluation of the dynamic balance during gait. With regard to the development of a child's balance system, it should be noted that it presents postural control techniques similar to adults as it approaches 7 to 8 years of age. At ages below 7 and 8 years, the child presents incomplete development of the vestibular and nervous system integration, which affects their static and dynamic posture [28].

It is through the posture that the individual has the control of the beginning of the movementand can maintain the continuation of the gait. Another fundamental aspect in which the posture will contribute will be in the realization of precise movements. In some studies it is possible to verify a relationship between gait symmetry and cadence in pre-school children [28].

In astudy carried out with children with Autism Spectrum Disorder, one of the most important parameters to analyze the neurological function was the symmetry of gait. In healthy gait, minimal asymmetries are observed and in pathological gait exaggerated asymmetries are observed [29].

Some studies have used gait analysis as a tool for decision-making in medical procedures in children with spina bifida. They have evaluated excessive hip flexion and femoral rotation through kinetic and kinematic gait analyzes in children with this disease [30]. The authors emphasize the importance of the use of quantitative data of gait analysis for clinical evaluation and surgical recommendation.

In young children, walking is influenced mainly by age and walking speed. In this way, it is possible to perceive the importance of correlating temporal parameters such as average speed, maximum speed and cadence with gait maturity [31].

Among the variables that will be influenced by speed, we can highlight the increase in stride length, reduction of cycle length and duration of the support phase as speed increases [4].

Another important aspect is the time required for a walking cycle that is approximately 1.03 seconds as well as the number of steps per minute that varies from 90 to 120 steps. Also, the speed during comfortable walking is around 1.25 meters per second. On the other hand, the

mean distance between the two feet (width of the stride) is 8 cm, with the foot presenting an angle of $6.7 \degree$ [32].

In another study [33] the following temporary time parameters were measured for healthy boys and girls of the same age group, when studying gait characteristics of the subjects with a mean age of 6,8 years, who presented crooked feet and underwent surgery. They found a running speed of 1.02 m / s \pm 0.18; cadence of 136.36 steps / min \pm 32.38; pass time of 0.92 s \pm 0.20 and stride length of 0.91 m \pm 0.05. The authors observed that gait parameters of children who underwent surgery presented abnormal patterns when compared to gait parameters in healthy children, since operated children tended to compensate for foot and ankle abnormalities by altering gait. The researchers believe that changes from the support stage of the crooked foot may alter the swing phases of the normal side, as well as changes in the range of motion.

In a project that conducted the comparative analysis of the gait of children with and without flat feet, Chen et al. [34]described the percentages of duration of the support and swing phases of healthy children agedfrom 5 to 11 years: 59.1% for support phase (barefoot gait) and 40.9% for swing phase (gait was performed barefoot). In this study, the authors were able to perceive that the gait of children with flat feet is characterized by a greater range of motion, lower vertical force in the first and second peak (FZ1 and FZ2) and longer duration of ground reaction forces when compared the gait of healthy children.

In another study [35], an analysis of patients with hemophilia was performed in a sample of 42 patients aged 4 to 18 years. It was found that the walking speed of the young with moderate hemophilia was 1.22±0.15 m/s and the support and swing phase percentages were respectively 56.4% and 43.6%.

The speed of displacement influences the vertical acceleration, because decreasing the speed, momentum and the vertical acceleration will also decrease impacting both force peaks and valley resulting in values close to body weight and the absence of peaks. Differently from what happens in the cases of speed reduction, when the speed of gait increase, it will be possible to perceive the increase of the force peaks, as well as the reduction of the existing valley[36].

Two important variables that will impact the analysis of the gait are the vertical braking impulse and the vertical propulsion impulse. The vertical braking impulse is calculated by integrating the areabelow the vertical ground reaction force curve from the start of the stance phase with its final limit at point F2 (mid stance phase), as shown in Fig.6. The vertical propulsion impulse is calculated through of the integration of the area below the vertical ground reaction force curve from F2 until the end of the stance phase (which will be after F3- second force peak, when the ground reaction forces are equal to zero again)[37].

When analyzing the gait of a group of children aged from 5 to 11 years, with and without flat feet [34], were measured the vertical ground reaction forces and its respective times. In this study it can be seen that for healthy children the first vertical force peak (FZ1) was $115.66\pm9.20\%$ (normalized strength value, expressed as a percentage of children's body weight) with time in FZ1 (TZ1) of $20.9\pm2.20\%$ (time expressed as a percentage of the support time).

Regarding the second vertical force peak (FZ2) of the previous study [34], researchers reported that it was $104.20\pm7.90\%$ (normalized strength value, expressed as a percentage of children's body weight), with time in FZ2 (TZ2) of 77.20\pm4.70\% (time expressed as a percentage of the support time). It should be noted that between the two peaks was presented a valley with a minimum value of force (FZ0) of 72.20\pm10.80\% (normalized force value, expressed as a percentage of children's body weight), with time in FZ0 (TZ0) of 48.80\pm7.00\% (time expressed as a percentage of the support time).

In a study that analyzed the progression of children with an autism spectrum disorder [17], investigated the ground reaction forces of 15 children with autism spectrum disorders and 25 children with typical development aged from 4.3 to 12.4 years. In this study the researchers measured the ground reaction forces in the vertical of healthy children and found that the first vertical force peak (FZ1) was 109.86 ± 10.90 (normalized force value, expressed as percentage of weight of children) with time in FZ1 (TZ1) of 23.20±2.70% (time expressed as percentage of support time). Regarding the strength of the second peak (FZ2), the researchers reported that it remained at 109.51±6.92%, with time in FZ2 (TZ2) of 77.96±2.83% (time expressed as a percentage of the support time). On the other hand, the value between the two peaks (FZ0) presented a force of 78.95±7.22%, with time in FZ0 (TZ0) of 44, 98±5.53%.

In another study[38], children up to 5 years of age were observed. The most important finding in this study was that about 24 months of age the ground reaction forces are similar to the adult pattern. They noticed that between the age of 2 and 3 years it is possible to notice a significant increase in the development of the heel strike, from the beginning to the complete development of the walking pattern, confirming that the study of ground reaction forces is appropriated for the analysis of children's gait and also to detect abnormalities that can be related to neurological disease.

Muscle recruitment, immature stride dynamics, and strategies of equilibrium control, immature sensory integration during stance, are some of various biomechanical and neural factors related to the kinetic pattern of walking in children. For this reason, a study [39] was carried out in order to identify the age differences in kinematic and kinetic gait parameters between the ages of 3 and 13 years. The authors suggested that in general children present gait kinetics similar to adults by the age of five years, which can be related to differences in the ankle joint moments.

After the analysis of several gait-related studies, it is possible to understand the importance of gait biomechanical parameters for the development of human locomotion and how it is related to the gait level's maturation.

Several studies have highlighted the need to analyze variables such as cadence, speed, support phase, swing phase, body weight distribution as well as the importance of studying the ground reaction forces, through analysis of the anterior-posterior components, mid-lateral, and a vertical component.

The cited studies have presented different biomechanical parameters with different diseases that can affect children in distinct age groups. Some studies have addressed medical treatments and analyzed their performance through gait parameters.

Through the analysis that some authors have performed with the gait variables, such as gait speed and cadence, with the maturity of the studied individuals, we can prospect the development of new studies that will investigate parameters that can impact on the maturity of the human gait like braking, propulsion, speed and distribution of body weight.

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Compatibility Evaluation of Point Clouds Acquired with Terrestrial and Mobile LiDAR Scanners

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Abstract— Light Detection And Ranging (LiDAR) is a technology that arose in the last years as one of the best technologies to capture tridimensional information about features on the Earth's surface. LiDAR measurements can be carried out over the ground in a static mode, with the scanner fixed on a tripod. This mode is known as Terrestrial LiDAR. LiDAR measurements can also be acquired in a kinematic mode when the scanner is assembled and transported on aircrafts, cars, boats and even in special vehicles that operate in underground mines and galleries. That second mode is called Mobile LiDAR where the LiDAR scanneris connected to an Inertial Navigation System (INS) and a dual frequency GNSS receiver that respectively provide the orientation and the position of a platform and consequently the direct georeferencing. This paper focus is to compare results obtained from data collected over the same area in both scanner modes but with uncertainties. This study has used both terrestrial and mobile LiDAR scanners to generate a 3D model of the terrain of a chosen area and to calculate the volume above a predefined reference plane. The same area using RTK - GNSS receivers. Keywords— Point Cloud, LIDAR Technology, Terrestrial Scanner, Mobile Scanner, GNSS.

I. INTRODUCTION

In the last decade the large offer of new technologies for mapping, like the Light Detection and Ranging (LiDAR) and the Unmanned Aerial Vehicle (UAV), or drones, for example, made the geoscience studies advance to limits not totally explored before.

Whether the cost of the instruments or the lack of specialized professionals, the fact is that these two technologies are not being used as everyday tools and still deserve studies and research to better define their areas of application.

Despite that, these technologies can certainly be applied to Civil Engineering and Transportation Engineering, particularly to road and railroad design and construction. The study presented in this article is to better know and exploit the LiDAR technology.

LiDAR scanners have the ability to provide detailed information on the benefits of the project, its construction and its management.

One LiDAR scanner can measure a large amount of points in a short period of time which means the 3D environment can be quickly captured and analyzed [1].

The concept behind the LiDAR scanner measurement is similar to the total station measurement. The 3D position of a certain point is defined by the bearing and distance from the scanner that has its position georeferenced.

In a simple way, we can say the azimuth that goes from the LiDAR scanner to a certain point is defined in function of the scanner intern orientation. The distance for each 3D point is measured in a similar way like used in GNSS positioning measurements. One beam of light after trigged reflects on the point and returns to scanner giving the distance in function of the time of beam of light propagation. Once the LiDAR scanner has a known position the measured point position can be acquired by vector calculation.

Some LiDAR scanners measure distances using the phase shift technique [2], comparing the returning wave to the trigged one in the beam light to obtain the time difference or the wave travelling time. The phase shift technique relies on modulating the amplitude of the light emitted and measuring the phase difference between the emitted light and the received light. Once the phase difference, the modulation, frequency (*f*) and the speed of light (*c*)is known the distance can be estimated as follows:

$$d = c\frac{t}{2} = c\frac{\Delta\phi}{4\pi f}$$

This kind of scanner can measure over 100,000 points per second with precision of 1 millimeter.

Other LiDAR scanners measure the distances using a pulsing beam of light performing the called pulsed time offlight technique [2]. In this case, the scanner emits short groups of light beam and measure their returning time to itself, so as to acquire the distances. This kind of scanner can measures up to 50,000 points per second with precision ranging from 3 to 6 millimeters.

1.1 Point Cloud Capture

When using the LiDAR technology we must well define the job goals to properly choose the scanner and the method to acquire the 3D points. In a simple way, there are two types of scanners, the called Terrestrial LiDAR scanner(TLS) which works in static mode in certain positions and the Mobile LiDAR scanner (MLS) that works in a kinematic mode, being transported by any kind of moving vehicle, like car, plane or boat.

Different methods offer different ways [3] to do the measurements that best suit specific and different tasks. The type of scanner that uses the phase shift technique is indicated to be used in indoor tasks, or in small areas due to the range limitations and the generation of multiple capture files necessary to cover the area without occlusion zones. Several files produced in the same job must be digitally linked to each other, so as to connect them, and to do that, it is common to use spheres or other kind of targets that must appear in at least two adjacent capturedscans, which demands a previous study over the place to be captured to define their positions. This type of scanner is better suited for tasks where the capture of details is more important than the covering speed.

When working in a job where the quick covering of large areas is necessary and the detail accuracy is less important, the the pulsing beam of lightscanner type is more indicated.

1.2 3D Environment

The knowledge about the environment has always been an important and fundamental support for the engineering tasks, but it is very hard to be produced. Even using advanced techniques such as topography of precision, that uses the top model instruments, like the robotic total station and the GNSS real time kinematic method (RTK), the production of digital terrain model (DTM), for example, is a costly task, and require long period of measurements.

With the advent of LiDAR scanners that can be carried by hand or in small vehicles the capture of the environment details has become simpler and faster.

The Faro X130, a TLS that uses phase shift technique to perform the point cloud capture, is being able to measure from 122,000 to 976,000 points per second and achieving \pm 2 mm precision for each measured point[4]. It has an integrated GPS receiver that works in real time. When linked to a GNSS external network, it gives a coordinate system to be used by the scanner. Due to its limitation in range, up to 130 meters, the scanner must be moved to different scan positions to insure a full coverage of an area that is bigger than its range limitations.Figure 1 shows two locations, one indoor and the other outdoor, where the Faro X130 TLS scanner was used.



Fig.1: Faro X130 TLS Scanner

The files produced in each scanner's position denote a session of capture or scan, and one job can have several scans if the area to cover is too big.

The Trimble MX2 is a Mobile LiDAR scanner that allows the acquisition of point clouds on a moving platform. It has one rotating head connected to two GNSS antennas, one inertial navigation system (INS) and one high resolution panoramic camera, forming a complex navigation system [5] that can be assembled ontop of a sport utility vehicle (SUV). Figure 2 shows a single-head MX2 MLS system.



Fig.2: Trimble MX2 MLS Scanner

The GNSS receiver and the INSunit are controlled by a robust laptop inside the vehicle to constantly acquire data using the LV-PosView software[6].

II. MATERIALS: STUDY AREA AND DATA-SEIS

The creation of a sample data-set that would allow the comparison of two or more point clouds acquired with the use of a Terrestrial LiDAR Scanner (TLS) anda Mobile LiDAR Scanner (MLS) was carried out. In addition to the compatibility analysis done by comparing point clouds acquired by both LiDAR technologies we also used a reliable conventional measurement technology well recognized in engineering jobs, the RTK GNSS, to measure several points in the same surface.

Some field activities were carried out on Laval University campus where an area with sufficient relief to be analyzed is present.



Fig.3: Chosen site for the Case Study.

That area shows enough vertical variations to be studied and to facilitate the operation of both TLS and MLS LiDAR scanners.

The selected area should offer the vehicle which carries the MLS scanner, a path to cover thefull area. The area should not be too large to be surveyed by the TLS using a reasonable number of scans consideringits range limitations of around 130 meters.

The vegetation over the surface has also been taken into account by the point cloud processing software in order to classify points on the ground and the points in the trees to separate classes before computing the volume.

After a field inspection we found an area that fulfills the predefined conditions. It is located in front of the Pavillon Louis-Jacques-Casault, along the bikeway, as shown in Figure 3.

This area is around 100 meters long, 30 meters wide and 3 meters high. Because it is surrounded by paved streets and its limits are well defined by sidewalks and gutters, the MLS can easily circulate around this area. The first dataset was acquired with the Faro X130 TLS. This scanner produces point clouds with high density which means that more measured points per volume unit considered. To cover the chosen area of this project using this TLSscanner, four scanning sessions were necessary as shown in Figure 4.



Figure 4: Terrestrial Faro X130 scanner Capture Stations.

The positions where the TLS was installed were carefully chosen to avoid occlusions, areas produced by objects that block the laser beam, forcing its return to scanner and hiding what is behind that object.

After the scanning process, each point cloud is an independent file with its own coordinates system. Because of that, they had to be assembled into one point cloud representing the total scanned area in the same coordinate system, as seen in Figure 5. Thisadjustment process, called registration, uses points clearly identified that appear in two or more point clouds. In this project, 10 spheres of 139 millimeter diameter were used. These spheres are white to enhance the laser beam reflection and to provide its clear identification in different point clouds. The spheres were properly positioned in the field between two consecutives stations, at different elevations to avoid the coplanar condition that would make adjustment to fail.



Fig.5: TLM Point Cloud Generated.

Although the TLS has an integrated GPS receiver, it was disable because it is not necessary to perform the "cloud to cloud" registration that allows one point cloud to be aligned using other geo referenced point cloud as reference. The second capture of the same area was made using the MX2 MLS carried by a SUV vehicle.

The collected point cloud of the project area and its neighborhoodis shown in the Figure 6. The wide scanning range of MX2 scanner can capture points farther from the interest area while the vehicle was moving on the Avenue du Séminaire and the Rue des Arts covering the façades of the Pavillon Louis Jacques Casault and the Pavillon Félix-Antoine Savard located about 200 m apart.



Fig.6: MLS Point Cloud Generated.

Both TLS and MLS scanners are able to define a georeferenced coordinate system to support the collected point clouds. However, point clouds acquired with the TLS scanner were referred to a intern local system of coordinates and further converted to the geo referenced coordinate system of the MLS data.

The TLS point cloud was aligned to the MLS point cloud using well defined common points and was integrated to the MLS geo referenced coordinate system to assure that the segmentation process produces two surfaces with the same limits.

After the data acquisition using the both LiDAR technologies, the same area was available in two different point clouds of different density. The TLS scanner produced four point cloud files and a total of 73,779,252 points and the MLS scanner generated one file with 3,773,500 points. The covered area and the point density being different in point clouds collected by both systems, some editing tasks must be carried out to prepare and isolate the surface of interest on which we need to estimate the volume.

To balance the density of both point clouds, the TLS points were subsampled by reducing its number of points while retaining a representative content of the original cloud. In addition to the resolution, each point cloud had to be analyzed before comparing them.

For instance, the common area of interest must be extracted from the original point clouds. The segmentation tool, available in most LiDAR processing software is normally is used to carry out some cuts in the point cloud and extract the area of interest. It is a tool similar to the cropping tool available in image processing software (e.g. Photoshop) with the fundamental difference that the point cloud segmentation tool works in the tridimensional space.

After subsampling and segmenting both clouds, the TLS interest area was reduced to 7,563,870 points and the corresponding MLS one to295,627 points as shown in Figure 7.



Fig.7: Point Clouds Edition.

The software ability to discern multiple return pulses [7] not always is a hundred percent achieved and because of that another task that needed to be done before calculating the volume of the interest surface area. The removal of noise features like trees, traffic signs and electrical power poles, for example must be done. This kind of cleaning can be manually done which takes a considerable amount of time and presents some risks of affecting the surface coverage. Another way to clean the surface is to use filters available within the point cloud processing software. In this study, the Cloth Simulation Filter (CSF) [8], available in the Cloud Compare software was applied and produced a good result, as can be seen in Figure7. The two images at the top contain point clouds with the aforementioned noise features and the two bottom images the cleaned point clouds. The CSF is a computer graphics algorithm that identifies a surface that is under a vegetation coverage by inverting the point cloud and analyzing the points that represent the ground. As a result, the CSF can separate point clouds into ground and non-ground points. To execute this task the original point cloud should be exported to LAS file [9].

Once both surfaces have been well aligned and correctly segmented, meaning to say with the same limits and free of noises, like trees, traffic signs and other features, their volumes were calculated above the reference plane estimate dat the altitude of 85.013m, passing through the lowest altimetric point in the cloud. Two point clouds software packages were used to calculate the volumes that are presented in table 1.

Table 1: Calculated Volumes				
LIDAR	RealWorks	CloudCompare		
Scanner	(m ³)	(m ³)		
TLS	2,312	2,337		
MLS	2,284	994		

The comparison between the volumes calculated using the TLS data by these two software show adifference of 1.08%, what can be considered as a compatible result. However the MLS volumes calculated with the MLS data could not be compared because of a remarkable difference obtained with *Cloud Compare* software probably produced by in the presence of outliers. The volume calculated by *Real Works* with th MLS data resulted different in 1.20%.

Therefore, these results would need to be validated outside the LiDAR universe, using a conventional and recognized technology to assure the reliability of the result.

III. VOLUME VALIDATION

To validate the volumes obtained using the point clouds measured with TLS and MLS scanners, the selected surface was also measured using a GNSS-RTK receiver providing a classical and reliable measurement solution. The volume measurement using the Real Time Kinematic (RTK) method[10] was actually taken as reference to do the final analyses and comparison with respect to the volumes obtained with point clouds collected using the LiDAR technologies presented in the previous section.

The perimeter and all interest points inside this area necessary to properly model the surface were measured using Trimble R8S GNSS-RTK receiver. A total amount of 381 3D points were measured with this technology in order to cover the full surface of the interest area.

Three volume calculation methods that use the points measured inside the area and on its perimeter were tested.



Fig.8: Volumes using GNSS - RTK

The first method of volume calculation was to use the Bentley Topograph software that generates the Digital Terrain Model (DTM) from the RTK points[11]. The horizontal reference plane was considered passing through the same vertical point adopted in point cloud calculations, meaning to say at the altitude 85.013 m. The calculated volume between the generated surface and the horizontal reference plane was 2,392 m³.

The second method of volume calculation was to use the weighted heights method that subdivides the surface into several prisms of regular areato calculate the volume inside them using the mean height of its vertices, with the following equation:

$$V = \frac{1}{4} \times (\Sigma_1 + 2 \times \Sigma_2 + 3 \times \Sigma_3 + 4 \times \Sigma_4) \times Q$$

In this equation the sum indexes (1, 2, 3 and 4) indicate how many times each vertexis connected to adjacent prisms and Q represents the area of the prism.

In this equation, the total volume is given by the sum of the individual volume for each prism. In this case, the RTK points were used to assemble the rectangular network with 122 quadricules (or prisms), necessary to apply the method. Mostof these quadricules were regularly squared (5m x 5m). Some irregular quadricules (fractional) followed the same method, but were calculated individually. The horizontal reference to calculate the heights was also the same plane used before, at an altitude of 85.013 m, going through the lowest point in the surface. Each prism above that plane was calculated using the Microsoft Excel software by applying the Gauss method to determine the quadricule area and the mean height from the involved points to calculate the volume. The obtained volume with this process was 2,284 m³. The third method was calculated from the contour lines, where the area (S) inside each contour line is multiplied by the vertical spacing (d) between them to get the volume, as follow:

$$V=\left(\frac{S1}{2}+S2+S3+\dots+\frac{Sn}{2}\right)\times d$$

The contour lines used in this method were generated from a DTM created in the first method, spaced by 10 cm (d= 0.10m). The total vertical distance from the lowest point to the highest in the areais 3.08 meters, from 85.013 m to 88.061m altitude, in which interval 30 contour lines were inserted. The volumes obtained in each method are presented below.

Table 2: Volumes using	Conventional	Technology
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	Area	Volume
Method	(m ²)	(m ³)
1. DTM	2,178	2,392
2. MeanHeight	2,178	2,284
3. ContourLines	2,178	2,298

In function of these results we assumed the mean volume equal to $2,325 \text{ m}^3$ as reference to validate the four volumes previously calculated using the point clouds, and, to produce the differences as seen in the table 3.

	Real	Cloud		
LiDAR	Works	Compare	Differ	rences
Scanner	(m ³)	(m ³)	(%)	
TLS	-13.29	11.68	+0.88	+ 1.97
MLS	-41.06	N/A	- 0,33	N/A

The LiDAR estimated volumes are comparable to the volumes computed using the conventional RTK technology. As mentioned in the previous section, the volume calculated with MLS data using the *Cloud Compare* software was different than the volume calculated with the same data using *Real Works* and the volumes computed by the TLS data. That very large difference deserves an extra analysis in order to understand the reason of the problem.

IV. CONCLUSIONS

The above experiment has demonstrated that the LiDAR technology is reliable to carry out volume calculation for engineering purposes.

After a careful preparation of point clouds collected with a TLS and a MLS scanners to isolate the same interest surface, *RealWorks* and *Cloud Compare* softwares packages have been used to estimate volumes with both software and evaluate the reliability of the results.

However, the volume computed by the processing of the MLS data with *CloudCompare* software was different than volumes computed by other techniques and datasets. A deeper analysis must be carried out to evaluate the cause of this problem.

The lower density of point cloud collected with MLS with respect to those collected with TLS is not the main cause because a reliable volume value was obtained by the *RealWorks* software. Therefore, we must investigate how *CloudCompare* is handling the point cloud to obtain the volume. Finally, this case study is probable not enough to definitively make final conclusions. It is necessary to increase the number of case studies that would consider larger areas, bigger vertical distances and more irregular terrains.

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Biological Risk Analysis in a Waste Treatment Company in Manaus-AM

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Abstract— Biological Risks are defined by the existence of the probability of occupational exposure to Biological agents in functions that involve the use or manipulation of the biological agent as the main object of the work. This exposure without adequate protection causes health hazards, such as acquiring some occupational disease due to microorganisms present in the workplace. Thus, this work aims to conduct a descriptive research of the environment of the effluent treatment plant unit in Manaus-AM to verify which agents are present and which preventive measures are taken to eliminate or reduce these risks, ensuring a healthy environment. to the employee. The obtained result fits within the acceptable standards, being in agreement with the theoretical reference present in this work, but it needs a deeper analysis in the subject to prove that these biological agents do not cause more serious health damages.

Keywords—Biological Hazards, Wastewater Treatment Plant, Biological Agents.

I. INTRODUCTION

Work activities that involve the use or manipulation of biological agents as the main object of the work are considered biological risks, characterized as occupational exposure to biological agents. Microorganisms in an effluent treatment plant TEE are present in various sectors of the unit, these microorganisms are part of the acceleration of the effluent treatment process that operators are exposed to during the working period and may contract diseases caused by these agents. This exposure is known as deliberate intent, meaning that the presence of the agent is known and determined. In this way the risk recognition is simple and the handling and exposure procedure is well determined.

However, not all companies demonstrate proper importance for occupational exposure care, ignoring correct prophylaxis procedures, such as not using both collective and individual safety equipment or even not performing proper day-to-day inspections or training by putting in place. risk to workers' health.

According to [1] biological hazards are classified as occupational accidents, provided the respective causal link is established as allergic reactions, acute or chronic infections caused by bacteria, viruses, chlamydia, fungi, helminth and arthropod parasites and plant poisoning. or animals.

Senior management of a small industry or company should pay particular attention to biological hazards, even if the company has a low degree of risk, because when an operator is absent from work for a short time with respiratory, allergic, unwell among other reasons, the likelihood of being related to the work environment is high. These absences rarely generate CAT (occupational accident report), and consequently are not associated with biological agents. In addition to the lack of interest from employers and occupational safety professionals to do an in-depth investigation into the cause of leave so as not to generate the same or more aggravating cases, this fact increases the absenteeism rate in the establishments which represents a problem for workers, company or industry to the government segments, and causing financial losses, because they are repetitive facts [2].

Biological hazards are of most concern in the general health field. However, any professional category may be at this risk from the moment they have direct contact with potentially contaminated fluids, and may occur in different ways: Cutaneous or percutaneous route, with or without skin lesion; airway (aerosols) and oral [3].

As it is a problem for all categories of work, the biological risk, even with a low degree, should have its importance in relation to care, since they are transmitted in different ways, as [4] cited in this way. types of biological agents that are exposed to the operators at Alpha Company who work with wastewater treatment in the aerobic biological process. Verify by document and on-site visit which standard procedure the company adopts to prevent its employees from occupational diseases caused by these agents.

II. LITERATURE REVIEW

In this topic, the concepts on Effluents, wastewater treatment, biological hazards, associated diseases and safety measures will be presented.

2.1. Effluents

Effluents and treatment are addressed by [5] define effluents as liquid discharges. Can be identified by industrial process derivatives, ie effluents from the production process and cleaning operation wash waters, including cooling waters, which are proven to be contaminated by products used or produced in the establishment; stormwater from storage or transhipment areas; domestic sewage resulting from physiological activities and hygienic habits originated from man; and sanitary sewage consisting of industrial, domestic sewage, sewage water and rainwater contribution.

Effluents, also called industrial discharges or wastewater, are defined as liquid streams or suspensions originating from processes, operations and utilities that may be accompanied by contaminated water from sanitary sewage. Emphasizing that industrial dumping has quite diverse biochemical and physicochemical characteristics [6]. And domestic waste is characterized by microbial activity factors and chemical reactions having a light gray to dark gray color, a strong odor due to hydrogen sulfide and other decomposing waste and its turbidity is caused by the high concentration of suspended solids [6].

2.2 Wastewater treatment

Based on [7], contaminants in water can be eliminated by physical, chemical and biological processes or by a combination thereof.

Wastewater treatment is basically classified into efficiency levels: Since primary and primary treatment refers to physical processes, secondary treatment is biological process and tertiary treatment concerns chemical processes [8]. The Ministry of Environment describes the processes

The purpose of wastewater treatment is the removal of pollutants which would cause a deterioration of the quality of water bodies. Hence the importance of an effluent treatment plant [9].

2.3 Biological Risks

According to [10] "biological risk is the probability of occupational exposure to biological agents". According to

[11] the biological agents consist of bacilli, fungi, bacteria, viruses, protozoa, parasites, among others. Regarding the effluent treatment unit the risks occur in the exposure to microorganisms present in the effluents that are generated from domestic and industrial sewage and especially when the aeration system treatment is used the microorganisms may be dispersed in the air representing source of contamination and cause acute or chronic diseases in exposed operators.

According to [12] the term microorganism congregates varied taxa of microscopic unicellular organisms that live as isolated or aggregated cells. Since these microorganisms have two types of lives: aerobic, that is, they need oxygen to breathe consequently, proliferate and anaerobic proliferate in environments with little or no oxygen.

2.4 Associated Diseases

In the secondary treatment process live microorganisms are used. Therefore, the operator who is exercising some degree of control is exposed to these pathogenic organisms such as bacteria, viruses and protozoa, being the main causes of waterborne diseases and appearing in water, usually in low concentration and intermittently [13].

Treatment plant workers are potentially exposed to a wide variety of pollutants and may contain biological agents. In addition, these workers may develop respiratory, gastrointestinal, flu, and other symptoms that may be associated with exposure to non-infectious microorganisms and specific microbial toxins [14].

2.5 Safety Measures

According to [15] the safety measures for the operator are: always use appropriate PPE's for each activity to be performed; wear boots and uniform in effluent management areas; In tasks that require contact or handling with sewers, always wear appropriate mask and impervious gloves; in the interval between risky activities, wash gloves with detergent, remove them and wash hands; Always wash your hands with detergent before eating or handling food; never leave dirty or watery soap, which represents a focus of contamination; All PPE, other equipment, tools and materials used at the stations should be washed with detergent after use and kept strictly clean. do not reuse PPE that is already contaminated, especially gloves; Every work environment should have an absorbent paper towel and liquid hand wash; All employees should take over activities only after training. Employees must undergo periodic and admission medical examinations; Company employees dealing with effluent should be immunized as recommended by the

company's Social Work and Occupational Safety and Health Management.

[16] recommends that a shower be installed for every ten workers in unhealthy operations or activities, or work that has exposure to infectious, toxic, allergenizing, irritating, dusty or dirty substances, and where exposed. in intense heat. In establishments and workplaces with less than thirty workers, at the discretion of the competent authority, in matters of occupational safety and medicine, workers should be provided with sufficient comfort for meals in a place that meets the requirements of cleaning, aeration, lighting and drinking water supply.

According to [17] should identify the risks of the work process, and prepare the risk map, with the participation of the largest number of workers, with advice from SESMT, where there is; developing a work plan that enables preventive action to solve occupational safety and health problems; participate in the implementation and quality control of the necessary preventive measures, as well as in the evaluation of action priorities in the workplace in order to identify situations that may bring risks to the safety and health of workers; Conduct at each meeting an assessment of the achievement of the goals set in its work plan and discuss the risk situations that have been identified.

According to [11] on the Environmental Risk Prevention Program - PPRA preventive measures eliminate or reduce the use or formation of agents harmful to health. These measures prevent the release or spread of agents in the workplace, reducing levels or concentration. The implementation of collective measures should be presented in the training of workers and how the PPE should be used.

III. STUDY METHODOLOGY

Data collection was performed at Alpha Company to obtain information on what type of process is used in the treatment unit, which effluents are treated and the biological agents that operators are exposed to.

It was adopted in the methodology four types of research to elaborate the work, following exactly this order: bibliographic research, documentary research and field research along with descriptive research.

In the bibliographic research were analyzed books, scientific article, manuals, guides, theses and monographs. This stage of the research aimed to make a comparison between companies that were studied in relation to biological risks and the company Alpha.

The second step was an analysis of the Environmental Risk Prevention Program (PPRA) and the PCMSO Occupational Health Medical Control Program to verify what degree of biological risk workers are exposed to, what procedures are taken to eliminate or eliminate reduce these risks, and preventive measures for health promotion of operators.

In the on-site research the objective was to learn about the station's operation by collecting information about the problem in question and describing the facts without interfering with the process, the field research served to make the records just describing the situations. Observe how operators behave without the supervision of a work safety technologist if PPE is used in accordance with the establishment rule. Analysis of the treatment plant.

An analysis was made, through observation and photographic record, in the structures of the treatment plant during the field visit.

3.1 Data Collection

Alpha has been operating in seven Brazilian states for three years and has the competence and differential for complete solutions in the treatment of domestic and industrial wastewater. As a result of the data collection it was observed that, according to the PPRA, the activities performed are in open and closed places with natural and artificial light, the analysis to make the risk recognition was qualitative, the risk classification is class 2, that is, the risk is easily controlled. Danger of contamination may occur at the time the operator performs wastewater collection tasks for analysis, inspection, tank cleaning through treatment aeration, airway and epidermis.

The PCMSO provides data on the exams that are taken for employees and the training offered by the company.

IV. STUDY APPLICATION

The study application will be presented, showing the analysis of the treatment station, identification of biological agents and the preventive measures.

4.1 Treatment Plant Analysis

At the Manaus treatment plant branch, effluents are treated in the batch aerobic biological process. In this process a certain volume is treated in a certain period of time, for example, 14 m³ of effluent is treated in approximately 10 to 12 hours of continuous aeration in the biological reactor.

After this time the aeration is turned off and decantation occurs and then the semi-treated effluent is directed to the tertiary treatment where it will receive chlorination and then destined to the recipient body.

The effluents arrive separately in the treatment unit, where there are two pipes of domestic effluent and industrial effluent, in this step is performed the operation of separation of fat Figure 1.



Fig. 1: Separation Railing

Subsequently, they form a mixture, following the grating process at this stage. The effluent passes through two grids of different particle size.

Grating: Large solid waste is retained by grids with spacings of five to ten centimeters, serving as a first filtration to facilitate the conduction of sewage through pumps and pipes.

Desaneration: It is the separation of smaller organisms from larger organisms. The sand goes to the bottom of a tank and the organic material remains on the surface.

Primary decanter: These are tanks that mix solid organic material to settle it to the bottom of the tank until it takes the form of sludge.

Rotary Sieve: Solid material is subjected to a sort of sieve that serves as a new filtration and separation so that the liquid is stored in buckets.

Aeration Tank: This is where matter is fed to microorganisms through a chemical process that converts organic waste into carbon dioxide.

Secondary Decanter: Tanks separate suspended solids through sedimentation and reduce more sludge solids.

Sludge Density: Sludge is filtered to reduce the volume of water to show solid material, which in turn undergoes other filtering processes.

Anaerobic Digestion: All sludge-shaped matter is stabilized by chemical process, including the elimination of harmful bacteria and gases, and is also reused as fertilizer.

Chemical Sludge Conditioning: The matter goes through a process of coagulation and dehydration.

Plate Press Filter: The sludge is filtered through pressed plates which cause all remaining liquid to be removed.

Thermal Dryer: Finally, the remaining sludge is evaporated at high temperatures, eliminating significantly more liquid.

Subsequently they form a mixture, following the grating process at this stage the effluent passes through two grids of different particle sizes shown in Figure 2.



Fig. 2: Separation Boxes

After the removal of all pollutants through a chemical, physical and biological process, treated water can finally be reused for industrial or agricultural purposes and is not yet potable water.

Thus removing the thick solids and follow the parchall gutter Figure 3, where it is possible to perform the volume measurement.



Fig. 3: Parchall trough with volume meter

Still in the preliminary treatment the effluent falls in a lift where it is pumped to a static sieve Figure 4 of smaller particle size to remove fine solids and then go to receiving tanks where they receive aeration.



Fig. 4: Static sieve

Then begins the primary treatment or physicochemical treatment, the effluent receives chemicals to remove solids, these solids clump together forming denser flakes, allowing the effluent to decant and clear, which proceed to a decantate where the separation of the effluent occurs. clarified effluent and sludge resulting from the physical chemical process.

This sludge resulting from the physicochemical process goes to a device called filter press that has the purpose of removing the liquid existing in the sludge and thus reducing its volume. This liquid returns to the process and the dried sludge is removed by trucks and composted to produce organic fertilizers.

The clarified effluent goes to equalizing tanks where they receive aeration, pass a rotary filter and go to the secondary treatment that is performed by the activated sludge. In this stage, biological reactors that control aeration mechanically by blowers are used so that the bacteria perform their process, they feed on organic matter excreting water and carbon dioxide.



Fig. 5: Effluent analysis and treated effluent discharge

Finally the effluent goes to the tertiary treatment or polishing, where it will receive chlorination and then after analysis Figure 5 to verify if its characteristics are suitable to be released to the receiving body.

Figure 6 shows the whole process in the step-by-step flowchart as outlined above:



Fig. 5: Effluent Treatment Flowchart in the company

In short, industry-supplied effluent arrives at the station and undergoes preliminary operation separating greases, greases, oils in order not to damage any apparatus, after which the coarse and fine solids are removed from the liquid surface and deposited in a truck after that. Step o A physical - chemical process is carried out in order to remove as much liquid as possible from the sludge for volume reduction and to be taken together with the solids for proper disposal as preparation for composting. The biological process is initiated by blowers. In order for the bacteria to work to accelerate the treatment process, the chemical-analytical process is finally performed and as the results are treated effluents return to the receiving body.

4.2 Identification of biological agents

Through the risk map it can be observed that the biological risks are in every season, with more evidence in the effluent analysis laboratory, the biological agents present are fungi, viruses, parasites, bacteria, protozoa and bacilli. These microorganisms originate mainly from the aeration process, where biological treatment occurs, each tank has a nameplate and each sector of the unit has a specific risk map.

The identification of biological agents, specifically fungi and heterotrophic bacteria can be compared in the paper by [18]. According to the author, analyzes were performed to identify airborne microorganisms in the following locations: Outside (administrative sector, near aeration tanks, kitchen, panel room, solids laboratories, physicochemical laboratories, equipment room) indoors (engine control center, near the aeration tank).

To perform the analyzes [18] used the following method:Samplings were performed in triplicate using a Millipore Figure M Air T Microbiological Air Monitor Figure 6, with an active air sampling rate of $1 \text{ m}^3 / 7 \text{ min}$, which was coupled to a 44 cm² cassette. area containing specific culture medium Figure 7. Above this was added the M67 T perforated plate with 967 holes to optimize colony distribution and reduce overlap.



Fig. 7: Portable air monitor

The table in figure 8 shows the result of the analysis performed with the samples.

Grupo Meio de cultura		⊤ (°C)
1. Fungos		
Fungos Mesofílicos	Ágar Saboroud Dextrose Clorafenicol	25.0
2. Bactérias		
Estafilococos	Ágar Baird-Parker Base	35.0
Coliformes lecais	EcBroth	35.5
Pseudomonas aeruginosa	Agar Cetrimide Base	35,0
Bactérias heterotróficas	Casein-peptone Dextrose Yeast Agar	35,0

Fig. 8: Analyzed microorganisms and culture media

According to the author, the presence of mesophilic fungi (MF), fecal coliforms (FC), staphylococci (EF) and Pseudomonas aeruginosa (PA), as well as heterotrophic bacteria (HB) were found in the samples.

4.3 Preventive Measures

The procedures adopted by the company to prevent biological risks depend on each activity performed. Therefore, for each activity there is a preventive measure that is included in the JSA - Job Safety Analysis. In the area of the effluent treatment station, the use of boots, goggles and helmet is mandatory, and for activities where the effluent handling is required, the use of a procedure glove is indispensable, as well as the other mentioned PPE's.

It is essential to wash your hands thoroughly with soap and water, and the use of alcohol gel after each activity performed, because microorganisms are present in all parts of the TEE.

The use of other PPE, such as safety masks, is required when preparing chemical solutions.

In some situations where an intervention of cleaning of tanks or equipment where the presence of microorganisms is present, a disposable coverall is used. Inside the laboratory the analyst should always wear a safety boot, safety goggles, procedure glove and lab coat. It is strictly forbidden to feed on the premises of the wastewater treatment plant. Other preventive measures are vaccines, especially for hepatitis A and B. Care and attention in all activities are part of prevention measures.

V. CONCLUSION

According to research and document analysis of the company Alpha, conducted in the city of Manaus-AM, about biological risks found that the degree of risk is 2, considered low. This conclusion makes the workers not aware of the danger they are in, because when a disease associated with viruses, bacteria, protozoa do not associate with the work environment.

Finally, the study needs to have more analysis regarding worker exposure, since the literature is very poor in information about this area. And the committee that looks after employee health promotion should promote lectures to show what these dangers are, train them on the use of appropriate PPE's and make everyone aware of their use even if enforcement is not around.

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Analysis of Flood Discharges on Way Samal River in Moluccas Province

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Abstract— Way Samal river is one of the rivers in district of Central Maluku which is intended for agricultural activities. But when its rainy season, there are many problem caused by overflowing of river Way Samal. So, we need to find the right solution to overcome this problem. In general the best solution is technical engineering, by planning the building control and normalization of the river. It needs to be analyzed how much flood discharge that occurs in the Way Samal river flow. In this study a flood discharge planning analysis was conducted using annual maximum rainfall. This rainfall is analyzed for rainfall plans by using probability distributions Gumbel, Normal, Log-Normal, and Log-Pearson Type III. Furthermore, the distribution is tested for compatibility by using Chi-Square test and Kolmogorof Smirnov Test. After that based on the match test results, the design flood discharged was calculated by using the synthesis hydrograph method of Snyder and Nakayasu. Then these two synthesis methods are compared and select the closest to trend based on the linear average approach. Keywords— Rainfall, probability distribution, synthesis hydrograph.

I. INTRODUCTION

The river has an important role in improving the welfare of the Indonesian people in the areas it supports, in terms of irrigation and other uses. However, not in accordance with climatological characteristics, topography and the quality of the soil environment and vegetation of the catchment area, it can bring disaster [1].

One of them is SungaiWay Samal which is located in the central Maluku district administration. In the rainy season, the flow on the Samal River is very superior in other places in the Regency. Central Maluku.



Fig.1. Research Location Map

2.2 Rainfall Design Analysis

Rainfall analysis plan, using the probability distribution method ^[1]:

1. Gumbel Probability Distribution

The impact of this is material losses, until it is approved by the community. Therefore it is necessary to analyze the discharge in the Wai Samal river to be able to determine the effectiveness of the capacity of the river. Can be approved during the rainy season.

II. МЕГНО**D**

2.1. Research Location

The study location is in the Way Samal watershed in Central Maluku Regency.

$$X_T = X_{rt} + S x K$$

with:

- X_T = rain or discharge plan with a return period (T)
- X_{rt} = average of rain or discharge.
- S = standard deviation from rain or discharge data.
- K = gumbel reduction factor.
- 2. Normal Probability Distribution
 - $X_{T} = X_{rt} + S \times K_{T}$

With :

- X_T = rain or discharge plan with a return period (T)
- X_{rt} = average of rain or discharge.
- S = standard deviation from rain or discharge data.
- K_T = frequency factor, depends on return period (T)
- 3. Log Normal Probability Distribution

 $\text{Log } X_T$ = rain logarithmic value or discharge with return period (T).

 $Log X_{rt} = Average of Log X_T$

S Log X	= standard deviation of Log X_T :
S Log X	$= \sqrt{\frac{\sum_{j=4}^{n} (\log X_j - \overline{\log X})^2}{n-1}}$

KT = frequency factor, depends on return period (T)

4. Log Pearson Type III Probability Distribution $Log X_{T} = (Log X_{rata}) + K_T x (S.Log X)$ With:

Log X_T = rain logarithmic value or discharge with return period (T).

= Average of Log X_T Log X_{rata} = Standard variable, the amount KT depends on the coefficient of precision (Cs or G)

Conformity Test 2.3

Chi Square Test 1.

The chi-square test is intended to determine whether the opportunity distribution equation that has been chosen can represent the distribution of the statistical samples of the analyzed data. Taking this test decision uses the parameter χ^2 , therefore it is called the Chi-Square test [2]. The parameter χ^2 can be calculated by the equation:

	$\chi^2 = \sum_{n=1}^{n} \frac{(O_f)}{n}$	$(E_f)^2$
	I = 1	E _f
	with:	
	χ^2	= calculated of chi-square parameters
	n	= number of sib-groups
	O_{f}	= number of observations in sub group-i
	Ef	= number of theoretical values in the i-
	sub-grouop	
	Certain deg	rees of trust (α)= 5%
	Dk = K - (p	+ 1)
	Κ	= 1 + 3,3 Log n
	with:	
	Dk	= independent variables
	Р	= number of parameters, $=2$
	Κ	= number of distribution class
	Ν	= number of data
. 1	.1	1 1 1 1 2 1 2 1 2

Furthermore, the probability distribution used to determine the planned rainfall is a probability distribution which has the smallest maximum deviation and is smaller than the critical deviation. or formulated as follows:

$$\chi 2 < \chi 2 cr$$

 χ^2 = Calculated chi-square parameter $\chi^2 < \chi^2_{cr}$ = Critical chi-square parameter

Smirnov-Kolmogorof Test 2.

> The Smirnov - Kolmogorov suitability test, often also called a non parametric test, is because the test does not use a certain distribution function. The testing procedure is as follows:

With :

- X_1 $\rightarrow P(X_1)$
- X_2 $\rightarrow P(X_2)$
- Xm $\rightarrow P(X_m)$
- Xn $\rightarrow P(X_n)$

Determine the value of each theoretical opportunity from the description of the data (distribution equation):

- X_1 $\rightarrow P'(X_1)$
- X_2 $\rightarrow P'(X_2)$
- Xm $\rightarrow P'(X_m)$

 $\rightarrow P'(X_n)$ Xn

Determine whether $\Delta Pi < \Delta P$ is critical, to find out whether the distribution is rejected or accepted.

2.4. Flood design-discharge analysis

2.4.1. Snyder Unit Hydrograph

Calculation step of Snyder Unit Hydrograph ^[3]:



Fig.2. Synthetic Unit Hydrograph Model According to Snyde

Determine log-time:

Tp = 1.1 - 1.4(L.Lg)0.3 (hour)

Keterangan :

= Log time and center of rainfall are effective Tp

during tr to peak Hydrograph Unit in hours

= Distance from station to the upper limit of the L drainage area in km

= Distance from station to specific weight of the Lg drainage area in km.

Effective rain time : Tp1 = tp + 0.25(tr - te)

Rise to peak : Tp = tp + tr

Peak discharge (1/second), for effective rainfal at 1 km² :

$$qp = \frac{275.Cp}{tp}$$

Peak discharge for effective 1 inci (25.4 mm) rain in an area of A km²

$$Q_{\rm P} = qp \frac{25.4}{1000} A \quad ({\rm m}^{2/{\rm s}})$$

2.4.2. akayasu Unit Hydrograph

Calculation of design flood discharge using Nakayasu metade. The general equation of Nakaysu synthetic unit hydrograph is as follows [4]:

$$Qp = \frac{C \cdot A \cdot R_0}{3.6(0.3 \text{ Tp} + T_{0,3})}$$

 $\begin{array}{ll} Tp & = tg + 0.8 \ tr \\ tg & = 0.21 \ x \ L^{0.7} & (L < 15 \ km) \\ tg & = 0.4 + 0.058 \ x \ L \ (L > 15 \ km) \\ T_{0.3} & = \alpha \ x \ tg \\ \\ \text{with: Debit puncak banjir} \end{array}$

 $Qp = peak flood discharge (m^3/second)$

C = runoff coefficient

 $R_{0,3}$ = rain unit (mm)

- Tp = time period from the start of the rain to the peak of the flood (hour)
- $T_{0,3}$ = the time required for a decrease in discharge (m3/second)

A = watersheed area (km^2)

tg = time of concentration (hour)

Tr = rain unit, used 1 hour

 α = hydrograph parameters, between 1,5 - 3,5

L = river length (m)

Unit hydrograph equation:

• Rising curve

$$Q \leq t < Tp \quad Qt = \left(\frac{t}{\mathsf{Tp}}\right)^{2/4} x \ Q_p$$

• Downward curve

✓ Tp < t (Tp + T_{0,3})
✓ (Tp + T_{0,3}) ≤ t < (Tp + T_{0,3} + 1,5T_{0,3})
Qt = Qp x 0,3

$$\begin{bmatrix} t-Tp+0,5T_{0,3} \\ 1,5Y_{0,3} \end{bmatrix}$$

$$t > (Tp + T_{0,3} + 1,5 T_{0,3})$$
$$\begin{bmatrix} t - Tp + 0,5T_{0,3} \\ 1,5Y_{0,3} \end{bmatrix}$$
$$Qt = Qp \times 0,3$$

III. RESULT AND DISCUSSION

3.1. Rainfall Design Analysis

To calculating rainfall design, we use probability distribution namely Gumbel probability distribution, Normal probability distribution, Log Normal probability distribution, Log Pearson III probability distribution. The result can see on table 1-4.

Table 1	D	of Course of	Distribution	Dainfall	danian
Table 1.	Result	oj Gumbei	Distribution	катјан	aesign

Return Period	Gumbel
(Year)	
2	170.63
5	351.97
10	466.01
25	598.99
50	716.97
100	823.06
500	1068.44
1000	1173.61



Fig.3. Nakayasu Unit Hydrograph

Return Period	Normal
(Year)	
2	199.30
5	320.52
10	384.02
25	445.83
50	495.14
100	535.55
500	614.92
1000	645.22

Table 2. Result of Normal Distribution Rainfall design

Table 3. Result of Log-Normal Distribution Rainfall design

Return Period	Log Normal
(Year)	
2	166.25
5	278.32
10	364.55
25	474.10
50	584.65
100	694.22
500	972.80
1000	1106.55

Table 4. Result of Log-Pearson	n III Distribution	Rainfall	design
--------------------------------	--------------------	----------	--------

Return Period	Log Pearson Type III
(Year)	
2	158.45
5	273.28
10	373.91
25	533.79
50	680.32
100	853.21
. 500	1660.61
1000	2194.26

3.2. Conformity Test

After calculating the design rainfall, the next step is to test the suitability of the result. Using the Chi-square and Smirnov-Kolmogorof test method. (the result can be seen on tables 5 and tables 6)

	Tuble 5. Result of Chi Sqi	iure resi		
	Chi-Square			
Probability Distribution	X^2	\mathbf{v}^2	Posult	
	Calculate	Λ ⁻ cr	Kesult	
Gumbel	2.167	3.841	Accepted	
Normal	5.667	3.841	Rejected	
Log Normal	2.333	3.841	Accepted	
Log Pearson Type III	2.667	3.841	Accepted	

Tahle	5	Result o	f Chi	Sc	mare	Test
I uvie.	J.	Result 0	$\int C m$	su	Junie	1631

0 1				
	Smirnov Kolmogorof			
Probability Distribution	ΔP Maximum	ΔP critical	Result	
Gumbel	0.921	0.41	Rejected	
Normal	0.187	0.41	Accepted	
Log Normal	0.102	0.41	Accepted	
Log Pearson Type III	0.102	0.41	Accepted	

Table 6. Result Smirnov-Kolmogorof Test

In Table 5 and 6, there are two distributions received, namely normal log distribution and type II log pearson distribution.

Because the calculation of the chi-square test in the normal log distribution has x2 calculated smaller than the other methods, the normal log distribution is chosen.

3.3. Design Discharges Analysis

To estimate the design flood discharge, a hydrological analysis can be carried out using the Nakayasu Hydrograph Unit method, Snyder. Analysis of flood discharge was carried out at the return period of 2 years, 5 years, 10 years, 25 years, 50 years, 100 years, 500 years and 1000 years. This flood discharge is used in hydraulic analysis and water building planning.

Table 7. Result of Snyder Synthetic Unit Hydrograph and Nakayasu Synthetic Unit Hydrograph

Return Period	Design Rainfall	Flood Discharges (m ³ /second)	
(Year)	(mm)	Snyder	Nakayasu
2	166.25	447.79	307.15
5	278.32	749.66	514.22
10	364.55	981.94	673.55
25	474.10	1277.02	875.95
50	584.65	1574.80	1080.20
100	694.22	1869.91	1282.63
500	972.80	2620.28	1797.34
1000	1106.55	2980.54	2044.45



Fig.4. Way Samal Discharges Curves Analysis

Furthermore, from the recapitulation of the calculation of Snyder and Nakayasu Synthetic Unit Hydrograph, a comparison with graphical assistance was made to the mean with a linear approach. The results of these comparisons can be seen from Figure 4.

From the results of the comparison, it can be seen that the Snyder method is the closest, the design flood discharge chosen is the flood discharge design calculated by Snyder Synthetic Unit Hydrograph.

IV. CONCLUCIONS AND RECOMMENDATIONS

4.1. Conclusions

1. In calculating the design rainfall, the distribution chosen based on the compatibility test is the Log Normal distribution, because it has the following suitability values:

> Chi-Square Test $(X^2 \text{ calculated} < X^2_{\text{cr}})$ $(2.333 < 3.841) \rightarrow \text{accepted}$ Smirnov-Kolmogorof Test $\Delta \max < \Delta \text{cr}$ $(0.102 < 0.41) \rightarrow \text{accepted}$

2. For the calculation of the design flood discharge, by comparing the two methods of the Hydrograph Synthesis Unit, then the selected design flood discharge is the design flood discharge using Snyder Synthetic Unit Hydrograph.

V. REFERENCES

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Analysis of the European and Brazilian Rankings of Smart Cities: a case study of São José dos Campos and Toulouse

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Abstract—The concept of "smart city" has become more present in academic literature and public policy in recent years, due in large part to the growing importance of cities in the global context. For the first time in history, most of the global population lives in cities. Although they represent only 2% of the world's surface, urban areas consume more than 70% of the world's total resources. As a result of rapid population growth, cities are facing challenges that lead them to seek innovative approaches to management and organization. City managers need indicators to measure performance in providing services and improving the quality of life for the population, assessing the development of local public policies and benchmarking with other cities. It should be noted that to meet this need there was an expressive appearance of city rankings, but many of them focus only on the final result and do not present a clear methodology. In addition, the availability of open, standardized and up-to-date city data is a challenge. The objective of this article is to present a comparative analysis between two rankings of smart cities: the European ranking of European Smart Cities and the Brazilian ranking Connected Smart Cities. An exploratory study was carried out with bibliographical research on the theoretical concepts of intelligent cities, rankings and measures of city performance. A case study in the cities of São José dos Campos (Brazil) and Toulouse (France) was also carried out. The present study found that the analyzed rank ings show convergences in most of their indicators. The European ranking has more academic characteristics and provides a more indepth analysis of the data of the cities, and the choice of indicators for both rankings reflects the current situation of each region analyzed with regard to its development.

Keywords—Smart City, City Ranking, Quality, ISO 37120, Connected Smart Cities.

I. INTRODUCTION

In the last two decades, the concept of "smart city" has become increasingly popular in scientific literature and international politics. To understand this concept, it is important to recognize why cities are considered key elements for the future. Cities play a major role in social and economic aspects throughout the world and have a huge impact on the environment (ALBINO, 2015).

Mccarney (2015) reports that, for the first time in history, the majority of the global population lives in cities. According to the United Nations, in 2018 an estimated 55.3% of the world's population lived in urban settlements. By 2030, urban areas are designed to house 60% of the world's people and one in three people will live in cities with at least half a million people. Understanding the major trends in urbanization that are to develop over the next few years is crucial to the implementation of the Sustainable Development Agenda 2030, including the Sustainable Development Goal 11, to make cities and human settlements inclusive, safe, resilient and sustainable (UN, 2019). Although they account for only 2% of the world's surface, urban areas consume more than 70% of total world resources (BUHRKAL, 2012). According to de Halleux (2018), the concern with "intelligence" in city management is particularly obvious in Latin America because it is one of the most urbanized regions in the world. By 2050 urbanization rates are expected to reach 90% in this region. Dealing with the local consequences of rapid population growth, cities are facing changes that lead them to find innovative approaches to management and organization. Uneven economic growth, underemployment, crime and violence, rising poverty, climate change, increasingly binding fiscal constraints, corruption, or increasing political and governance complexity are some of the most obvious challenges that municipal managers face (DE HALLEUX, 2018; MCCARNEY, 2015).

Along with this demographic shift, a new set of challenges for city leaders around the world emerges. Due to radical economic and technological changes in the last decades, cities face increasing competition for investors, tourists, skilled labor or international events (BEGG, 1999). Thus, cities are challenged to introduce more strategic tools to concentrate relevant organizational capacities and identify priority strategic projects that effectively and competitively guide urban and metropolitan development (JESSOP et al., 2000; MAIER, 2000).

Gaining a comprehensive understanding of how cities can meet the challenges they face is not as simple as it may seem. Some cities can perform well in some dimensions, while doing poorly in others. One approach is to identify specific quantitative indicators for all relevant policy areas to measure performance against each dimension and at the same time highlight possible trade-offs. These indicators can be used to assess the city's performance for any specific problem. And they can also be used to produce a synthetic indicator, providing a global overview of the city's overall intelligence. Clearly, the robustness of the approach is very sensitive to the specific choice of indicators and this is linked to the availability of data (DE HALLEUX, 2018).

As one of several consequences of this, city rankings have experienced a notable boom: on the one hand, comparing cities can support investors in choosing the location; on the other hand, it can be an important guide for cities to judge their strengths and weaknesses and to define their objectives and strategies for future development and better positioning in the urban system. However, there is some evidence that the discussion of city rankings focuses mainly on the final results, totally neglecting (1) the methods and indicators used and (2) the purpose and effectiveness of strategic planning to be conquered (GIFFINGER; GUDRUN, 2010).

The earliest and best published documents on the subject were about European cities, internalizing the first insights on what drives their intelligence. There is also a more commercially oriented, but less analytically transparent, city classification produced by consulting firms. These generally have somewhat more specific measures than the more academic classifications. Unfortunately, there are few details about the analytical treatment of raw data in order to produce a detailed comparison (DE HALLEUX, 2018).

The objective of this article is to present a comparative analysis between two rankings of smart cities: the European ranking of European Smart Cities and the Brazilian ranking Connected Smart Cities. To achieve this goal, we performed an exploratory study of literature on the theoretical concepts and a case study in São José dos Campos (Brazil) and Toulouse (France), referring to local reports, federal and state agencies data. This article is divided into six sections. The introduction is the first section, which provides an overview of the topic of the article. In the second section is made a literature review on Smart Cities and Rankings for Smart Cities. In the third section, methodological procedures are presented. In the fourth section, the results are presented and discussed. In the fifth section there is a comparative between the cities studied and, finally, the conclusions are shown in section six.

II. BACKGROUND

2.1 Smart Cities

The technological development that characterizes the last decades of economic progress of Western societies has transformed the once industrial city into a city of information and knowledge (FERNANDES & FERNANDES, 2006). According to Amoêda (2013), society ceased to live in an environment determined by the spatiality of places, and began to inhabit a place determined by the spatiality of information flows. In this sense, urban space acquires a new role in nowadays society, an intense reflection of a new economy based on the power that comes from the possession of knowledge, generally viewed as a result of access to information and the internet, observed mainly in cities (Fernandes & Fernandes, 2006).

The term emerging smart city is introduced as synonymous with a city where everything is sensitive to an environment able to produce, consume and distribute a large number of information in real time. With such a feature, this intelligent processing serves as a reference for decisionmaking by companies, governments and citizens, with the aim of making urban activities more efficient and sustainable in the economic, social, ecological and political spheres. Consequently, the focus is on projects that aim to make the economy, urban mobility, environment, citizens and government smarter (LEMOS, 2013).

According to Albino (2015), the term smart city was first used in the 1990s and focused on communication and information technologies, so that the city defined itself as intelligent. To Komninos (2002), smart city is a place that combines the digital environment and real community, has a high level of knowledge, belongs to a geographic area that shares the knowledge; depends on a structure based on information and communication technology (ICT) and optimizes knowledge management.

Burgos (2014) defines a connected city as an environment that has electronic communication, to establish a space of digital connection between cities and communities. A sustainable city is classified by Campos (2006) as a place that minimizes the consumption of space and natural resources, which rationalizes and efficiently manages urban flows, protects the health of the urban population, ensures equal access to resources and services and maintains social and cultural diversity.

According to Giffinger (2007), there are six dimensions in a smart city: economy, mobility, governance, environment, socializing and people.

While systems in industrial cities were primarily purely physical structures, post-industrial cities are like organisms that develop an artificial nervous system, which allows them to behave in a coordinated and intelligent way. The new intelligence of cities, therefore, lies in the increasingly effective combination of digital telecommunications networks (nerves), ubiquitously embedded intelligence (brains), sensors and tags (sensory organs), and software (knowledge and cognitive competence) (CHOURABI et al., 2012).

Based on the exploration of a wide and extensive variety of literature from various disciplinary areas, Chourabi et al. (2012) identified eight critical factors of intelligent city initiatives: management and organization, technology, governance, political context, people and communities, economy, built infrastructure and natural environment. These factors form the basis of an integrative framework that can be used to examine how local governments target smart city initiatives, as illustrated in Figure 1.



Fig.1: Structure of smart city initiatives Source:Chourabi et al. (2012).

2.2 Rankings

As a consequence of strong economic and technological changes in the last decades, cities and regions face increasing competition for high-level economic activities. At the urban level, cities aim to improve their competitiveness and their position in relation to other cities around the world. This tendency increases the importance of specific local characteristics, which offer comparative advantages competing for multinational companies, investors, tourists and capital (GIFFINGER; GUDRUN, 2010).

To identify best practices, various tools can be identified, such as benchmarking and ranking of cities. Town classifications have become a central instrument for assessing the attractiveness of urban regions over the past 30 years. In these types of comparative studies, cities are evaluated and classified for different economic, social and geographical characteristics in order to reveal the best and worst places for certain activities (GIFFINGER et al., 2007).

As a consequence of this new trend, city rankings have experienced a remarkable growth in recent times, and so, the comparison of cities can support investors in the choice of location, on the other hand, can be an important guide for cities to analyze their strengths and weaknesses, and to set goals and strategies for future development (GIFFINGER; GUDRUN, 2010).

These authors define three distinct aspects by which a ranking can be compared and classified:

- **Objective:** it is specified by the goal of the ranking, the target public, its spatial reach and by the desired factors and indicators.

- **Methodology:** which includes not only the form of data collection and processing, but, in a first phase also to the limitation of the cities examined in the ranking. The availability of data for the ranking also plays an important role in the selection of cities if resources are limited.

- **Dissemination:** how the results are evaluated, interpreted and presented is crucial to the impact of the ranking. A general list of classified cities is the typical result of city classifications, but some studies also include more differentiated results. Another aspect of the disclosure is the final availability of results. The general city list is available for free. Partial results, interpretations and deeper insights are often not available for free.

Giffinger and Gudrun (2010) also establish four types of city rankings:

- Type 1: consultancy-oriented rankings with lack of transparency and documentation;
- Type 2: contracted rankings with insufficient transparency created by panels of experts or other private research institutes. A list of indicators is published, but rankings rarely provide information on the method of calculation. Sponsors of these rankings are financial institutions, magazines or real estate agencies;
- Type 3: rankings compiled by magazines or NGOs (non-governmental organization) without sponsorship;

 Type 4: well documented and methodically advanced rankings by universities or research institutes with sponsors in different areas (financial institutions, magazines, real estate agencies, etc.).

Thus, according to Giffinger and Gudrun (2010), the constituent elements of a city ranking require that at least two cities be included, the structuring of cities is in an ascending / descending order arranged in a hierarchy and the use of at least two indicators to build the order or hierarchy.

For Giffinger et al. (2007), as benefits, rankings attract attention in general and draw attention to regional science issues. The dissemination of the results of a new ranking encourages a broad discussion on regional development strategies. Rankings are also a competitive tool as the positive characteristics of cities are made public.

City rankings can also initiate learning effects, since regional actors are required to make their decisions transparent and understandable (GIFFINGER; GUDRUN, 2010).

As limitations, Giffinger et al. (2007) consider that the discussion of city classification results generally focuses on the final classifications and, consequently, the analysis of complex interrelationships and causalities are neglected. The attention of the public is mainly focused on the final ranking, without considering the methodological aspects behind the classifications, which can be observed in the conception of many rankings.

From a more strategic point of view, city rankings can threaten long-term development strategies as rankings strengthen competition between cities, what may have negative consequences, such as deregulation, structural and spatial problems, the risk of socially unacceptable urban development, etc. Moreover, the narrow treatment of ranking results is counterproductive to balanced city development strategies, as rankings are overly acclaimed by "winners" and ignored by "losers." In addition, cities (mostly poorly ranked cities) are opposed to comparisons with others, and rankings tend to follow a generalist approach, as many funders seek clear results, which can easily be reported in public, and therefore, most of the classifications aim to find the city better or more attractive, totally ignoring the fact that diverse activities need different conditions (GIFFINGER; GUDRUN, 2010).

2.3 Measures of Performance

Different measurement methods and indexes have been developed up to now according to the various meanings of the concept of smart city. Classification systems through synthetic quantitative indicators are receiving increasing attention among municipal managers and policy makers to decide where to focus time and resources as well as to communicate city performance to citizens, visitors and investors (BERARDI, 2013a, 2013b). According to Albino (2015) one of the values of these systems is the ability to represent a comparison metric, which surpasses the self-proclamations of being an smart city.

The University of Vienna developed an evaluation metric to classify 70 European medium-sized cities (Giffinger et al., 2007). This metric uses specific metrics for each of the six identified dimensions of a smart city.

Another evaluation system was developed by the Intelligent Community Forum, which annually announces award-winning cities such as Smart 21 Communities. This metric is based on five factors: broadband connectivity, a skilled workforce, innovation and marketing,digital inclusion and advocacy (ALBINO, 2015).

Zygiaris (2013) developed a measurement system identifying six layers of an intelligent city: the city layer, emphasizing that notions of smart cities should be based on the context of a city; the green layer of the city, inspired by new theories of urbanization of urban environmental sustainability; the interconnection layer, corresponding to the diffusion of green economies throughout the city; the instrumentation layer, emphasizing that smart cities require real-time system responses made by smart meters and infrastructure sensors; the open integration layer, noting that smart cities applications must be able to communicate and share data, content, services and information; the application layer, useful for smart cities to mirror the city's operations in real-time into new levels of intelligently responsive operation; and the innovation layer, emphasizing that smart cities create a fertile innovation environment for new business opportunities.

A methodology for assessing "the smart city index" was proposed by Lazaroiu and Roscia (2012). The index helped to distribute European funds in the 2020 strategic plan. The indicators that contributed to this index are not homogenous and require a great deal of information. The problem of information availability and the difficulty in assigning weights to add the indicators considered are among the limits of this method. The proposed approach uses a fuzzy procedure that allows to define a set of weights to combine the different indicators according to their relative importance.

A more sophisticated system for measuring the intelligence of a city was proposed by Lombardi et al. (2012). These authors used a modified version of the triple helix model, a framework for analyzing knowledge-based innovation systems that links the three main knowledge creation agencies: universities, industry and government (Leydesdorff and Deakin, 2011). The authors added a new
agent of knowledge creation to the previous three, the civil society, determining a model of four propellers. For each of the four innovation drivers, they propose indicators of an intelligent city according to five clusters (Lombardi et al., 2012). This analytical framework is composed of 60 selected indicators following a literature review which included EU (European Union) project reports, Urban Audit data set, European Commission statistics, European Green Cities Index, TISSUE, Trends and Indicators for Monitoring the EU Thematic Strategy on Sustainability. Development of the Urban Environment and the ranking of smart cities of the European average cities. Surprisingly, they excluded the dimension of intelligent mobility (Lombardi et al., 2012).

Table 1 presents the complete list of indicators proposed by Lombardi et al. (2012) and Lazaroiu and Roscia (2012).

Source	Number of	Indicators of a smart city		
	indicators			
Lombardi et	60	Smart economy:Public expenditure on R&D, Public expenditure on education, GDP		
al.		per capita of the population of the city, Unemployment rate.		
(2012)				
		Smart people: Percentage of population with secondary education, Foreign language		
		skills, Participation in lifelong learning, Individual level of computer skills, Patent applications per inhabitant.		
		Intelligent governance: number of universities and research centers in the city, e-		
		Government online availability, percentage of households with Internet access at home,		
		e-government use by people.		
		Environment: ambition of CO ₂ emission reduction strategy, efficient use of electricity,		
		efficient use of water, green space area, greenhouse gas emission, intensity of energy		
		consumption, policies to contain urban sprawl, proportion of recycled waste.		
		Intelligent life: Proportion of area for recreational sports and leisure use, Number of		
		public libraries, Total loans and other means of communication, Visits to museums,		
		Cinema and theater attendance.		
Lazaroiu and	18	Pollution, Innovative spirits, CO ₂ , Transparent governance, Sustainable resources		
Roscia		management, Educational facilities, Health conditions, Sustainable and innovative		
(2012)		public transport, Pedestrian areas, Cycle routes, Green areas, Solid urban waste		
		generation, Domestic GWh, Fuels, Strategies policies and perspectives, Availability of		
		ICT infrastructure, Labor market flexibility.		

Table 1: List of indicators for evaluation of smart cities in some classification systems.

Carli et al. (2013) have recently proposed a framework for analyzing and comparing measurement systems for smart cities. They suggest dividing measurement indicators into two categories: objective and subjective, and considering physical infrastructures and context data, along with citizens' satisfaction and well-being perception. These authors also focused on how indicators are measured and revealed that, along with traditional tools, new indicators of well-being are increasingly assessed through the detection of real-time data such as social networking messages.

The world of international standards has only recently begun to address the need for standardization in cities. International standardization bodies, such as the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO) and the International Telecommunication Union (ITU) have begun to address the urgent agenda of cities with new jobs, from smart grids to infrastructure, to international telecommunication and management systems. As part of a new series of international standards is being developed for a holistic and integrated approach to sustainable development and resilience in the committee ISO TC268 -Sustainable Community Development, and a new international standard was published on May 15, 2014 by ISO, ISO 37120 Sustainable Community Development -Indicators for Municipal Services and Quality of Life (MCCARNEY, 2015).

This new international standard has been developed using the Global City Indicators Facility (GCIF) framework and includes a comprehensive set of 100 indicators, of which 46 are required for compliance, that measure the social, economic and environmental performance of a city. ISO 37120 is now part of a new series of International Standards that is being developed for a holistic and integrated approach to sustainable development and resilience. The 100 indicators with definitions and methodologies published in ISO 37120 are divided into 17 themes shown in Table 2 that represent the main areas of performance management in city services and quality of life (MCCARNEY, 2015).

Table 2 - Schematic	Themes for ISO 37120
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Economy	Safety	
Education	Shelter	
Energy	Solid waste	
Environment	Telecommunications and	
Finance	innovation	
Fire and Emergency	Transport	
Response	Urban planning	
Governance	Residual waters	
Health	Water and sanitation	
Recreation		

The World Council on City Data (WCCD) portal is available with data from all cities that adhere to ISO 37120 and is motivated to provide cities with a reliable database of globally standardized data that will assist in the development of basic knowledge for decision making through global comparisons (WWCD, 2017).

In Brazil, the Brazilian Network of Intelligent and Human Cities (RBCIH) initiative is dedicated to the creation of the Brazilian Index of Intelligent and Human Cities and the Certifying Seal, with indicators that reflect whether the municipality is following the step-by-step list of actions with ISO 37120 (RBCIH, 2017) as the basis.

In addition, a key initiative of the European Commission (EC) EUROCITIES called CITYkeys (citykeysproject.eu), a project funded by the HORIZONTE 2020 program, aims to develop valid performance measurement frameworks, key performance indicators (KPIs) and standardized data collection to accelerate the diffusion of intelligent city solutions by supporting comparable, scalable and replicable smart city solutions (BOSCH et al., 2017).

Albino (2015) points out that many classifications are currently used to determine the intelligence of cities in terms of comparing practices with other cities. The Global Power City Index was created by the Japanese Institute of Urban Strategies, and is based on a collection of observed data, complemented with information on the perception of various stakeholders. This index maps the strengths and weaknesses of cities and classifies them into a broadlybased comparative analysis, according to their broad socioeconomic potential to attract creative people and excellent companies. Meanwhile, in the United States, the Natural Resources Defense Council has developed the Intelligent Cities Ranking, which is characterized by a strong bias towards environmental criteria. Forbes, with the support of scientist Joel Kotkin, has published a list of the world's smartest cities. This ranking considers a city that is compact and efficient and provides favorable economic conditions. Considering that this ranking encourages the city to be an economic pole, an international trade and a global city, it is not surprising that Singapore was considered the smartest city in that ranking. Urban classifications, such as the IBM Smart City or McKinsey Global Institute classifications, periodically compare and classify areas.

III. METHODOLOGY

The study is considered to be exploratory descriptive (GIL, 2002) and seeks to analyze two rankings of intelligent cities in order to identify convergence between indicators. Initially, the concepts of smart cities and rankings are defined. The present work analyzed one of the best known rankings dedicated to classifying smart cities, European Smart Cities, and also the best-known Brazilian ranking of smart cities, the Connected Smart Cities, in order to understand each dimension and indicator considered by these rankings.

Thus, the relationships between the rankings was studied and two cities were chosen to compare their classifications according to each ranking. The chosen cities were São José dos Campos in Brazil and Toulouse in France because both are similar in various aspects, in particular for having as their main industrial activity the aeronautical. The analyses were carried out in a qualitative way, organizing the indicators of the rankings with the purpose of identifying similar measures in the same set of analysis.

IV. RESULTS

4.1 European Smart Cities Ranking

Through a collaborative work between the Regional Science Center of the Vienna University of Technology, the Department of Geography of the University of Ljubljana and the Research Institute for Housing, Urban Planning and Mobility Studies of the Delft University of Technology, a methodology to verify the performance of cities (GASPAR; AZEVEDO; TEIXEIRA, 2016).

Given the variety of rankings, the group studied the basic characteristics of national and international rankings, such as indicators, evaluation methods and potential benefits, and developed the ranking itself, the European Smart Cities. The purpose of this initiative is to show the characteristics of cities as a basis for strategic discussion, showing that rankings are a significant and efficient tool for economic, social and city processes (FLORES; TEIXEIRA, 2017).

Giffinger and Gudrun (2010) explain that the approach of the European Smart Cities ranking was developed according to the following objectives:

- 1. Transparent classification of a selected group of cities;
- 2. Elaboration and illustration of characteristics and profiles specific to each city;
- 3. Encouraging benchmarking among selected cities;
- 4. Identification of strengths and weaknesses for strategic discussion and policy orientation.

This classification approach was published in 2007 (Giffinger, et al., 2010) and explicitly addresses to medium-sized cities in Europe, taking into account their perspectives and development challenges. Basically, midsize cities, which have to deal with competition from large metropolises on corresponding issues, appear to be less well-equipped in terms of critical mass, resources and organizational capacity. Even though the vast majority of the urban population lives in such cities, the main focus of urban research has been on "global" metropolises, neglecting the importance and specific challenges of medium-sized cities.

To implement this approach, the European Smart Cities ranking considers a smart city as one that operates in six key urban development domains, built on the "smart" combination of self-determined, independent and conscious citizens' donations and activities.

According to Giffinger and Gudrun (2010), through consultation of specialized literature and a round table, the six "intelligent" relevant identified characteristics are: economy, people, governance, mobility, environment and life. These six characteristics, or key fields, were considered as the relevant group that characterizes an intelligent city. They can be broken down into 31 factors that reflect the most important aspects of all smart features. Finally, each factor of an intelligent characteristic was defined empirically through a group of corresponding indicators. In total, 74 indicators were defined and used to operationalize and aggregate the relevant factors. Figure 2 shows this description of Smart City and Table 3 presents the list of characteristics, factors and indicators for the European Smart Cities ranking.



Source: http://www.smart-cities.eu/?cid=2&ver=3

Table 3. List of domains and components

	Factor	Indicator
	Innovative spirit	R&D expenditure in % of GDP
	Innovative spirit	Employment rate in knowledge-intensive sectors
	Innovative spirit	Patent applications per inhabitant
	Entrepreneurship	Self-employment rate
nomy	Entrepreneurship	New businesses registered
	Economic image and trademarks	Importance as decision-making centre (HQ etc.)
Есо	Productivity	GDP per employed person
art l	Flexibility of labour market	Unemployment rate
Sma	Flexibility of labour market	Proportion in part-time employment
		Companies with HQ in the city quoted on national
	Internationalembeddedness	stock market
	Internationalembeddedness	Air transport of passengers
	Internationalembeddedness	Air transport of freight
		Importance as knowledge centre (top research centres,top universities
	Level ofqualification	etc.)
	Level ofqualification	Population qualified at levels 5-6 ISCED
	Level ofqualification	Foreign language skills
	Affinity to lifelong learning	Book loans per resident
	Affinity to lifelong learning	Participation in life-long-learning in %
e	Affinity to lifelong learning	Participation in language courses
opl	Social and ethnic plurality	Share of foreigners
Pe	Social and ethnic plurality	Share of nationals born abroad
nart	Flexibility	Perception of getting a new job
Sr	Creativity	Share of people working in creative industries
	Cosmopolitanism/ Open-mindedness	Voters turnout at European elections
		Immigration-friendly environment (attitude towards
	Cosmopolitanism/ Open-mindedness	immigration)
	Cosmopolitanism/ Open-mindedness	Knowledge about the EU
	Participation in public life	Voters turnout at city elections
	Participation in public life	Participation in voluntary work
	Participation indecision-making	City representatives per resident
	Participation indecision-making	Political activity of inhabitants
	Participation indecision-making	Importance of politics for inhabitants
lce	Participation indecision-making	Share of female city representatives
nar	Public and socialservices	Expenditure of the municipal per resident in PPS
Iovei	Public and socialservices	Share of children in day care
ŭ	Public and socialservices	Satisfaction with quality of schools
nart	Transparentgovernance	Satisfaction with transparency of bureaucracy
Sr	Transparentgovernance	Satisfaction with fight against corruption
	Localaccessibility	Public transport network per inhabitant
	Localaccessibility	Satisfaction with access to public transport
~	Localaccessibility	Satisfaction with quality of public transport
ility	(Inter-)nationalaccessibility	International accessibility
lob	Availability of ICT-infrastructure	Computers in households
t M	Availability of ICT-infrastructure	Broadband internet access in households
mar	Sustainable, innovative and safe transport	
S	systems	Green mobility share (non-motorized individual traffic)
	Sustainable, innovative and safe transport	
	systems	Traffic safety

	Sustainable, innovative and safe transport	
	systems	Use of economical cars
	Attractivity of natural conditions	Sunshine hours
nent	Attractivity of natural conditions	Green space share
	Pollution	Summer smog (Ozon)
rom	Pollution	Particulate matter
nvir	Pollution	Fatal chronic lower respiratory diseases per inhabitant
μE	Environmental protection	Individual efforts on protecting nature
Sma	Environmental protection	Opinion on nature protection
•1	Sustainable resource management	Efficient use of water (use per GDP)
	Sustainable resource management	Efficient use of electricity (use per GDP)
	Cultural facilities	Cinema attendance per inhabitant
	Cultural facilities	Museums visits per inhabitant
	Cultural facilities	Theatre attendance per inhabitant
	Health conditions	Life expectancy
	Health conditions	Hospital beds per inhabitant
	Health conditions	Doctors per inhabitant
Living	Health conditions	Satisfaction with quality of health system
	Individual safety	Crime rate
	Individual safety	Death rate by assault
	Individual safety	Satisfaction with personal safety
art	Housing quality	Share of housing fulfilling minimal standards
Sm	Housing quality	Average living area per inhabitant
	Housing quality	Satisfaction with personal housing situation
	Educationfacilities	Students per inhabitant
	Educationfacilities	Satisfaction with access to educational system
	Educationfacilities	Satisfaction with quality of educational system
	Touristic attractivity	Importance as tourist location (overnights, sights)
	Touristic attractivity	Overnights per year per resident
	Social cohesion	Perception on personal risk of poverty
	Social cohesion	Poverty rate

Source: http://www.smart-cities.eu/?cid=2&ver=3

According to Giffinger and Gudrun (2010), questions concerning the criteria for city selection as well as the aggregation procedure were treated from a methodological point of view: to make the classification approach more transparent, to define the sample of cities is essential. For the European Smart Cities (2007) ranking, a viable sample was defined according to two criteria: cities should be medium size and should be covered by accessible and relevant databases. The most comprehensive list of cities in Europe is provided by the Espon 1.1.1 project. It covers almost 1,600 cities in the Espon space (EU27 + NO + CH) with information on population and some functional data. According to Dühr (2005), the ESPON 1.1.1 project on "Potentials for polycentric development in Europe", based on the definition of the European Spatial Development Perspective (ESDP), aims to provide a basis for a more enlightened discussion of polycentric development in

Europe . In order to support the analysis of the level and potential of polycentric development in Europe, the report identifies two complementary aspects of polycentricity: morphology (ie distribution of urban areas in a given territory); and relations between urban areas (ie networks of flows and cooperation). The concept of polycentric and balanced spatial development of European territory has been promoted. The ESDP presented policy options to strengthen areas of global economic integration, support a polycentric system of metropolitan regions, urban settlements and urban networks through closer cooperation between structural and transport policy, and encouraging co-operation on topics space development through cross-border and transnational networks. The concept of polycentricity in ESDP is thus used as a guiding principle to achieve two arguably contradictory objectives: to strengthen the EU's economic competitiveness on the

world market and to achieve better social cohesion in the EU by reducing regional disparities.

For these reasons, criteria were developed based on these 1,600 cities:

- Urban population between 100,000 and 500,000 (to obtain medium-sized cities);

- At least one University (to exclude cities with a low knowledge base);

- Capture area of less than 1,500,000 inhabitants (to exclude cities that are influenced by a larger city);

In addition, the fact that a city is covered by the Urban Audit database, an European city database is decisive for benchmarking, as for reasons of data availability. Thus, 94 cities remained and, after a later adaptation and elaboration of the cities and accessibility and data quality, 70 cities were chosen for the sample.

To compare the different indicators, it is necessary to standardize the values. A method to standardize is by ztransformation, as shown in Figure 3. This method transforms all values of the indicators into standardized values with a mean of "0" and a standard deviation "1", with the advantage of considering heterogeneity within the groups and keep their metric information. In addition, a high sensitivity to change is achieved.

Expression (a). Z-transformation

$$Z_i = \frac{X_i - \bar{X}}{S} \qquad (a)$$

Source: http://www.smart-cities.eu/?cid=2&ver=3

According to Giffinger and Gudrun (2010), the results were disseminated through two activities: (1) a press conference organized at the EXPO REAL International Fair in Munich, Germany, in 2007; (2) an own internet site made available (http://www.smart-cities.eu/).

4.2 Connected Smart Cities Ranking

As a new strategy model, the smart city has a number of concepts, from the ones that are most supported in technology, to those that are more related to the environment and sustainability. Given this framework, was developed by Urban Systems, a company that offers strategic and competitive solutions that support the decision-making process and the planning of real estate projects, in partnership with Sator, the company that organizes the eponymous event, the ranking named Connected Smart Cities, with the objective of mapping the cities with the greatest potential for development in Brazil through indicators that portray intelligence, connection and sustainability (GASPAR; AZEVEDO; TEIXEIRA, 2016).

Thus, for the elaboration of the Connected Smart Cities Ranking were considered (CONNECTED SMART CITIES, 2018):

- The concept of connectivity as the relationship between the various sectors analyzed;

- The concept of Smart City considering that development is only achieved when the city's development agents understand the power of connectivity across all sectors;

- Awareness that investments in sanitation are linked not only to environmental gains, but also to health gains, which will in the long term reduce investments in the area (basic health care), consequently impact on governance issues and even economy;

- The importance of education, not only as basic indices of service and quality of teaching, but the power it has in the formation and reproduction of the potential of each city;

- The understanding of local and regional potential allows the attraction of investors and the creation of courses linked to the productive chains of the region, which will have repercussions in attracting companies and expanding clusters, as well as enabling an improvement in the social condition, which will have an impact on all other sectors; - The importance of economic sustainability as the basis of environmental and social sustainability, since it is understood that it is not possible for municipalities to achieve environmental or social sustainability without the basis of an economic development that will guarantee a reproduction of the gains in other spheres.

Therefore, a union was established among service companies and leading technology, specialists, city halls and people engaged in the optimization of cities in Brazil, with the objective of promoting discussion, information exchange and the diffusion of ideas between government and companies focusing on meeting the needs of the conscious citizen, aiming that the Brazilian cities can become more intelligent and connected, and so that in the next 10 years it is possible that they increase the scale of their development, approaching the indexes of the models of the smart cities of the world, to seek inspiration in solutions implanted in those considered as more intelligent (GASPAR; AZEVEDO; TEIXEIRA, 2016).

For the creation of the Connected Smart Cities ranking, teams from Urban Systems and Sator mapped the main international and national publications on smart cities, connected cities, sustainable cities and other related issues in 2014, among them: "Sustainable Cities, Sustainable Cities Program"; "Brazil Transparency Scale, General Comptroller of the Union"; "Brazil Competitiveness Profile, Getúlio Vargas Foundation"; "IESE Cities in Motion, IESE Business School"; "Innovation Cities, Innovation Cities Program"; "Biggest and Best Cities in Brazil"; "Smart Cities Mapping in the European Union"; "ARCADIS Sustainable Cities Index, Yale Center for Environmental Law & Policy" (CONNECTED SMART CITIES, 2018).

Because of the breadth of information and connectivity between the sectors covered in the Connected Smart Cities ranking, the indicators used were designed and studied to meet the principle of a smart city being one that grows in a planned way through analysis of the development of 11 sectors, which are: Mobility, Urbanism, Environment, Energy, Technology and Innovation, Economy, Education, Health, Safety, Entrepreneurship and Governance. Table 4 presents each sector and its respective function (CONNECTED SMART CITIES, 2018).

Tuble. 1. Sectors and mateurors of	fine connected smart enres hanning	
MOBILITY	URBANISM	
Proportion of cars per inhabitant	Law on zoning or land use and occupation	
Ratio of car per bus	Law on consortium urban operation	
Average age of vehicle fleet	Municipal strategic master plan law	
Other modes of collective transport	Issuance of negative debit certificate and permit on the	
Bicycle paths	city's website	
Wheelchair ramp	Paved roads	
No. of weekly flights	Municipal expenditure with urban planning	
Road transport		
ENVIRONMENT	ENERGY	
Index of urban water service	Average rate	
Stopping supply	Households with existence of electricity from another	
Index of losses in water distribution	source other than distribution company	
Urban sewage service index	Power generation in wind power plants	
Urban sewage treatment	Energy production in UFV (Photovoltaic Solar Generating	
Recovery rate of recyclable materials	Center) plants	
Rate of coverage of the domestic waste collection	Energy production in biomass plants	
service	Street lighting	
Afforestation	Households with existence of electric energy	
Monitoring of risk areas		
TECHNOLOGY AND INOVATION	EDUCATION	
Broadband connections with more than 34 Mb	Online school enrollment	
Municipalities with fiber optic backhaul	Public university jobs	
4G Coverage	Note ENEM	
Workers with higher education	Teachers with higher education	
Accesses in the multimedia communication service	IDEB - final years	
Patents	Abandonment rate	
CNPQ (National Council for Scientific and	Average class size per class	
Technological Development) Scholarships	Municipal Expenditure with Education	
	Average daily class time	
HEALTH	SAFETY	
Beds by inhabitants	Homicides	
Doctors by inhabitants	Traffic-accidents	
Population coverage of the family health team	Municipal Expenditures with Security	
Municipal health expenditure	Police officers, municipal civil guards and transit agents	
Child mortality		
ENTREPRENEURSHIP	ECONOMY	
New technology companies	GDP per capita	
Technological poles	Average income of workers	
Growth of creative economy companies	Business growth	
Incubators	Growth of formal jobs	
Micro individual companies - MEI	Independent public sector jobs	
Sebrae	Employability	

Table.4. Sectors and Indicators of the Connected Smart Cities Ranking

	Non-Revenue from Transfers
GOVE	ERNANCE
Education	n of the mayor
FIRJAN Municipal Development Index	
Brazil Tra	nsparent Scale
City	Councils
Source: Connecte	ed Smart Cities (2018)

In addition to the Connected Smart Cities ranking, with the best cities in the 70 indicators, thematic rankings are generated for each of the 11 sectors covered. In order to present a regionalization of the results, the best ones are also presented by geographic region: North, Northeast, Midwest, Southeast and South. Also, city rankings by size are presented so that cities can be inspired by actions existing in municipalities of the same size, evidencing that many actions that lead to the best performance of a city are not tied to its economic power. The cut presented is: cities up to 100 thousand inhabitants; cities of 100 to 500 thousand inhabitants and cities of more than 500 thousand inhabitants. The Connected Smart Cities ranking is made up of 100 cities, while the industry rankings show results up to the 50th position (CONNECTED SMART CITIES, 2018).

4.3 Relationship between rankings

Considering the dimensions of the smart cities analyzed by the rankings, it is observed that the European Smart Cities presents six characteristics, all with the prefix "Smart": Economy, Mobility, Environment, People, Living and Governance. The Connected Smart Cities ranking analyzes 11 characteristics (sectors), which are: Mobility, Urbanism, Environment, Energy, Technology and Innovation, Economy, Education, Health, Safety, Entrepreneurship and Governance. The dimensions of the two rankings are aligned with the major smart cities definitions found in the literature.

When the indicators of the two rankings are analyzed, the number is very close. The European Smart Cities ranking has 74 indicators and the Connected Smart Cities ranking has 71 indicators. Even while analyzing fewer features of an intelligent city (six), the European ranking has three more indicators. Table 5 illustrates the comparative analysis of the European Smart Cities and Connected Smart Cities rankings.

Analysis	European Smart Cities	Connected Smart Cities
RankingProposal	Transparent classification of a selected group of cities; Elaboration and illustration of characteristics and profiles specific to each city; Encouraging benchmarking among selected cities; Identification of strengths and weaknesses for strategic discussion and policy orientation.	Map the cities with the greatest potential for development in Brazil through indicators that portray intelligence, connection and sustainability.
Dimensions	Economy, People, Governance, Mobility, Environment and Life.	Mobility, Urbanism, Environment, Energy, Technology and Innovation, Economy, Education, Health, Safety, Entrepreneurship and Governance.
Indicators	74	70
Number of cities analyzed	70	More than 500
Release year	2007	2015
Methodology disclosed	Yes	No
Means of Disclosure	Fair and website	Fair and website
Typology	Type 4	Type 2

Source: prepared by the authors.

In the analysis of the convergences, Table 6 presents the comparison between the indicators that present similar data in their compositions. This table lists only the indicators that have a more direct relationship. The analysis showed that there is no correlation between the analyzed indicators of the characteristics of the European ranking and the indicators of the Education, Urbanism and Energy sectors,

analyzed by the national ranking. In the Education sector, the indicators refer to data that makes sense only in the Brazilian context. In the Urbanism and Energy sector there is no correlation of indicators in the European ranking. That is, the Brazilian ranking brings indicators of areas not included in the European ranking.

European Smart Cities		Connected Smart Cities		
Characteristic Factor		Indicators	Sectors	
		New technology companies		
		Technological Poles		
		Growth Companies of Creative	Entrepreneurship	
	Innovative spirit	Economy		
		Incubators		
Successf Examples		Patents	Technology and	
(Compatitiveness)		CNPQ scholarship	inovation	
(Competitiveness)	Entropropourship	Micro Single Companies - MEI	Entrepreneurship	
	Entrepreneursmp	Business Growth		
	Dro du stivity	GDP per capita	F	
	Productivity	Average Income of Workers	Economy	
		Growth formal jobs		
	Flexibility of the labor market	Employability		
Smart people (social and	Level of qualification	Workers with higher education	Technology and	
human capital)			inovation	
	Participation in decision-making		Governance	
	Transparent governance	TBS - Transparent Brazil Scale		
Smart Governance	Public and social services	Municipal Expenditures with	Safety	
(Participation)		Safety	II 1/1	
_		Municipal Health Expenditure	Health	
		Municipal Expenditure with	Education	
		Education		
		Proportion of buses per car	Mobility and Accessibility	
	Local Accessibility	Middle Ages Fleet		
		Proportion of cars per		
	(Inter-)national	Number of weekly flights		
		(connectivity)		
Smart Mobility (Transport	Sustainable, innovative and safe	Bicycle paths		
and ICT)	transport systems			
		Broadband Connections with +		
		34 mb		
		Municipalities with Fiber Optic	Technology and	
	Availability of ICT infrastructure	Backhaul	inovation	
		Cobertura 4G		
		Multimedia Communication		
		Service Access		
Smart Environment (Natural		Attorestation		
Resources)	Attractivity of natural conditions	Energy Production in UFV	Environment	
· · · · · · · · · · · · · · · · · · ·		Power Plants		

Table 6.	Comparative	analysis	ofindicators
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		Urban water service	
	Sustainable Resource Management	Losses in distribution	
		Urban sewage service	
		Stopping supply	
		Urban sewage treatment	
		Beds by Inhabitants	
Smart Living (Quality of Life)	Health conditions	Doctors by inhabitants	Health
	Individual safety	Homicide	Safety

Source: prepared by the authors.

The sectors of a smart city analyzed by the Connected Smart Cities ranking have a breakdown greater than the European ranking for this reason more than one analyzed by the brazilian ranking sector is included within a feature of smart city considered by the European ranking. Of particular note is the "Technology and Innovation" sector, which is related to the characteristics "Intelligent Economy" and "Intelligent Mobility". Table 7 presents the relationship between the dimensions of the intelligent city analyzed by each of the rankings.

Table 7. Comparative analysis of the dimensions of an intelligent city

European Smart Cities	Connected Smart Cities		
Characteristics	Sector		
	Economy		
Smart Economy (Competitiveness)	Entrepreneurship		
	Technology and Inovation		
Smart people (Social and Human capital)	Education		
Smort Covernance (Participation)	Governance		
	Urbanism		
Smort Mahility (Transport and ICT)	Mobility and Accessibility		
Smart Mobility (Transport and ICT)	Technology and Inovation		
Smort Environment (Natural Pasources)	Environment		
Shart Environment (Ivaturar Resources)	Energy		
Smart Living (Quality of Life)	Health		
Smart Living (Quality of Life)	Safety		

Source: prepared by the authors.

V. CITY COMPARISON

Over the last four decades, regions such as the Silicon Valley in the United States, Sophia-Antipolis and the Grenoble and Toulouse complexes in France, and Tsukuba in Japan have emerged that spontaneously or from state planning as constituting spaces of scientific research, technological innovation and industrial development. In the same period, due to state incentives, in the region of Paraíba River Valley, especially in the city of São José dos Campos, structures were created that are characteristic of technological poles. Studies by the Institute of Applied Economic Research (IPEA) compared São José dos Campos to cities such as Seattle, in the United States, and Toulouse, France, in terms of the level of regional and international projection they have due to their productive specialization, coincidently "aeronautical poles" and to the level of influence they exert on places located beyond the

limits of their geographic domains (SOUZA; COSTA, 2012).

5.1 São José dos Campos

The municipality of São José dos Campos integrates Sub-Region 1 of the Metropolitan Region of the Paraiba Valley and North Coast (MRPVNC). According to the Brazilian Institute of Geography and Statistics (IBGE), the estimated population of the municipality in 2018 is around 713,943 inhabitants. The territorial data show a population density of 649.39 inhab / km² and an area of 1,099,409 km² (IBGE, 2018).

The MRPVNC was created in 2012 and is made up of 39 municipalities, divided into five sub-regions. Extensive, the region concentrates 2.5 million inhabitants, according to IBGE estimates for 2017. The MRPVNC is located between the two most important Metropolitan Regions of the country: São Paulo and Rio de Janeiro. It stands out

nationally for intense and diversified economic activity. Industrial production is highly developed, with the automotive, aeronautical, aerospace and military sectors predominating in the municipalities located along the axis of the Presidente Dutra Highway. Also noteworthy are the port and oil activities in the North Coast and tourism in the Serra da Mantiqueira, coast and historic cities. The region is also characterized by important environmental heritage of national relevance, such as the Mantiqueira, Bocaina and Mar Sierras, and farms of historical and architectural value (EMPLASA, 2018). Figure 3 shows the MRPVNC.



Fig.3: Metropolitan Region of the Paraíba River Valley and North Coast Source: FNEM, 2019

The municipality of São José dos Campos concentrates 5.8% of the exports of the entire State of São Paulo, being the fifth largest exporter in the state and the twelfth largest exporter in the country (MDIC, 2018). Its GDP represents 1.83% of state GDP (SEADE, 2018).

Headquarters of the largest aerospace hub in Latin America, São José dos Campos brings together high technology companies and important research and teaching centers. The city is the only one to have in its Technology Park the three largest aircraft manufacturers in the world: Embraer (Brazilian Aircraft Company), Boeing and Airbus. The main companies are: General Motors (automotive), Petrobras and Ericsson (oil gas), (telecommunications), Johnson & Johnson (pharmaceutical) and Panasonic (electronics) (PREFEITURA, 2018).

Institutions of teaching and research are also present in São José dos Campos, such as the ITA (Technological Institute of Aeronautics), UNIFESP (Federal University of São Paulo), UNESP (Paulista State University), UNIVAP (University of Paraíba Valley) and FATEC (Faculty of Technology of the State of São Paulo) (PREFEIT URA, 2018).

The city has the Technological Park of São José dos Campos, which houses three business incubators, four business centers, two Local Productive Arrangements (LPA), four technological development centers, three multi-user laboratories, a business office, six partner universities and three entrepreneurial galleries. Altogether there are more than 300 companies linked to the organization (PARQUE TECNOLÓGICO, 2018).

The Local Productive Arrangement of Information Technology and Communication (LPA TIC Vale) was created in 2011 and today brings together 67 companies that work in the development of hardware, software and IT services, focusing on retail, smart cities and industry 4.0. The Brazilian Aeroespace Cluster, with a Local Productive Arrangement (LPA) format, was formed in 2009 and brings together 94 companies from the aerospace and defense chains. Its anchor company is Embraer. In all, there are 23 thousand jobs and annual turnover of \in 5,920,950 (TECNOLOGICAL PARK, 2018).

The city council of the city of São José dos Campos has invested in technology to improve the life of the residents. The concept of 'Smart Cities' is present in the municipality in areas such as health, education, urban planning, public safety, sport and culture. Among the actions are Internet medicine consultation, incentive to entrepreneurship in municipal schools, IOC (Integrated Operations Center), use of LED technology lamps in public roads, electric Municipal Guard vehicles, among others (PREFEITURA, 2018).

The municipality also has an innovation law, law 9563/2017 wich establishes a legal framework what it was established the "Incentive Program for Scientific, Technological and Sustainable Innovation of São José dos Campos" aiming at receiving innovative projects for evaluation provided they can improve public works and services for the benefit of the population (PREFEIT URA, 2018).

In addition, the municipality has the "São José in the Palm of the Hand ", a set of ten free applications for smartphones and tablets in the areas of health, urban mobility, sports, public safety and maintenance of the city, whose objective is to provide transparency and ease to citizens. Figure 4 shows the logos of the mobile apps of "São José in the Palm of the Hand" (PREFEITURA, 2018).



Fig.4: Mobile apps of "São José in the Palm of the Hand" Source: Prefeitura, 2018.

São José dos Campos is among the Brazilian cities considered to be smart, according to the Connected Smart Cities Ranking. Table 8 shows the evolution of the city in the general ranking composed of one hundred municipalities. It is observed that the city fell from 12th place in 2015 to 34th place in the ranking in 2018. Despite the fall of positions, the city's score remained within an average of 26 points. For comparison purposes, the city of Curitiba (PR), which ranks first in the ranking, obtained 31,782 points. The city of Maceió (AL), ranked in the ranking as the hundredth most intelligent city in the country, obtained 24,083 points.

Table 8. Evolution of São José dos Campos in theConnected Smart Cities ranking.

	2015	2016	2017	2018
Position	12ª	24ª	37 ^a	34 ^a
Score	25,150	29,094	25,669	26,147
Source: prepared by the authors.				

Table 9 shows the evolution of the city in the Connected Smart Cities ranking by sector analyzed. The sectoral ranking analyzes the fifty best cities in the respective sector. It is noticed that the city was never among the fifty best placed in the sectors of Environment, Energy, Health, Safety and Governance. The city presented better performance in the sectors of Urbanism, Technology and Innovation and Entrepreneurship. It is important to note that, in the year 2018, in the Entrepreneurship sector, the municipality was not ranked among the top fifty positions. This is surprising given that the city is nationally recognized as an entrepreneurial one. The city was the tenth place in the ranking "Entrepreneurial Cities Index" prepared by Endeavor Brasil in 2017 (ENDEAVOR, 2018). Already in the period between 2015 to 2017, the city was among the fifty first evaluated. There is a fall on performance in the sectors analyzed, with the exception of the Mobility and Accessibility sector in which it was first classified in 2018.

	2015		2016		2017		2018	
Sector	Position	Score	Position	Score	Position	Score	Position	Score
Mobility and Accessibility	-	-	-	-	-	-	38ª	3,125
Urbanism	3ª	7,68	8 ^a	7,619	-	-	44 ^a	5,451
Environment	-	-	-	-	-	-	-	-
Energy	-	-	-	-	-	-	-	-
Technology and inovation	-	-	16ª	3,585	14ª	3,875	19ª	3,813
Education	-	-	35ª	3,791	38ª	4,131	-	-
Health	-	-	-	-	-	-	-	-
Safety	-	-	-	-	-	-	-	-
Entrepreneurship	7 ^a	2,140	14 ^a	2,592	46 ^a	2,390	-	-
Economy	-	-	-	-	29ª	5,079	-	-
Governance	-	-	-	-	-	-	-	-

Table O Evelution	has a set a min the	· Commonto	I Comment Citi an		fra Inc	á don Cama on
Table 9. Evolution	by sector in in	e Conneciea	i smari Cilles	ranking o	y sao jos	se aos Campos.

Source: prepared by the authors.

Another fact to be observed is that cities with less than 100 thousand inhabitants, such as Viçosa (MG) (26 th position) and Vinhedo (SP) (32 th position), are considered by the ranking to be more intelligent than São José dos Campos and other cities of greater bearing. According to Giffinger and Gudrun (2010), questions regarding the criteria for city selection as well as the aggregation procedure should be treated from a methodological point of view: to make the classification approach more transparent, the definition of the sample of cities is essential. For the European Smart Cities ranking (2007) the cities must be of medium size, that is, urban population between 100 thousand and 500 thousand. As for the Connected Smart Cities ranking, cities with a minimum of 50 thousand inhabitants are considered in the final list. This allows situations such as that of the two municipalities mentioned to occur.

Giffinger and Gudrun (2010) emphasize that many funders seek clear results, which can be easily communicated in public, and therefore, most classifications aim to find the city better or more attractive. Placing in the final list cities with different sizes may cause misinterpretations because, according to Giffinger et al. (2007), the focus of the public is mainly on the final ranking.

The authors of this study point out, in view of the considerations regarding the observed values, that process of drawing up rankings of cities should be improvement whit the object to reduce random variations and provide more consistency to the results.

It is important to note that the Connected Smart Cities ranking has undergone changes in the list of indicators, increase in the number of cities and methodology for calculating some indicators since the first edition. But it is not possible to discuss in more depth the causes of this performance, since, as Giffinger et al. (2007) say the general city list is made available for free, but deeper insights and results are often not available, as is the Connected Smart Cities ranking. This finding may be related with the fact that the ranking is type 2 in the classification proposed by Giffinger and Gudrun (2010).

The authors suggest that future studies should be carried out to verify and analyze in more depth the results of the municipality indicators, since with the data provided by the Connected Smart Cities ranking it is not possible to reach a conclusion on the causes of the fall in performance in the general ranking and in the sectors of a city as of São José dos Campos.

5.2 Toulouse

The city of Toulouse is the fourth largest city in France after Paris, Marseille and Lyon, with 471,941 inhabitants (INSEE, 2018). Toulouse Métropole is a public institution of inter-municipal cooperation (EPCI - Établissement Public de Coopération Intercommunale) created in January 2015. In 1992, the first intercommunal entity called the District of Greater Toulouse was created with 13 municipalities. Now it brings together 37 municipalities that join forces in an area of solidarity to develop and lead together a common space planning project. The metropolitan region, as shown in Figure 5, has 746,919 inhabitants (TOULOUSE MÉTROPOLE, 2018).



Fig.5: City of Toulouse in the metropolitan area. Source: https://www.toulouse-metropole.fr

According to Lucena and Vicente (2017), the Greater Toulouse is a leading and historic place for the aeronautics and space industries in Europe. The main companies of these two industries and some of their factories are located in Toulouse, for example: Airbus, Airbus Defense and Space, ATR Aircraft, Thales Alenia Space, Safran, among others. The city houses the main schools of engineering and research in this technological field: Sup'Aero, ONERA, Federal University of Toulouse, among others. The city is home to the National Center for Space Studies (CNES). This cluster has three main characteristics: (i) its maturity, since it leads the European aeronautical and space industries, (ii) its centrality, since it is at the center of all European industrial and innovation networks in the technologicalfield; (iii) its diversification in development, as it faces challenges related to environmental constraints and new balances between military and civil market opportunities, in particular in the cross-sectoral domain of embedded systems, leading to the emergence of new industries such as GNSS (Global Navigation Satellite Systems), drones and other related industries.

The city has the Smart City 2015-2020 project, which aims to build tomorrow's smart city with citizens: more fluid, friendly, innovative, dynamic, attractive, responsible and sustainable. The Smart City Master Plan was adopted in December 2015 and has up to 500 million euros of public investment by 2020 to transform Toulouse into "Open Metropolis". The metropolis also has private companies in this project. The leverage effect in terms of private investment is estimated at \in 200 million (TOULOUSE MÉTROPOLE, 2018).

A master plan and a strategy based on three principles and five ambitions were defined in 2015:

- Principles:

- 1. The citizen placed at the center of the proceedings;
- 2. Shared public data as a basis for Smart City;
- 3. A public-private co-construction.

- Ambições:

- 1. A metropolis open to an adaptable, efficient and breathable city.
- 2. A metropolis open for simpler and more fluid mobility.
- 3. An international metropolis open and concerned with its roots.
- 4. A metropolis open to an even more warm and intergenerational city of well-being.
- 5. A metropolis opened to make Toulouse more beautiful, clean and safe.

Project Results:

- More than 350 associated citizens;
- 80 companies, clusters and groups mobilized;
- 30 companies involved in projects;
- Public investment target of € 500 million by 2020 (excluding large mobility projects);
- 2 international awards of "Smart City" (Smart Mobility City Award - Hong Kong; Access City Award - Brussels);
- 10 startup experiences;
- 15 iconic projects.

5.3 Comparison of indicators of the two cities

Seven European Smart Cities indicators were selected to compare the two cities. The choice of indicators was for convenience and ease of data collection. Chart 10 shows the values of the respective indicators.

Table 10. Comparison of Smart Economy indicators for cities.

	São José dos	Toulouse
	Campos	
Economically active	217,903 people	316,357
population		people
GDP per capita (€)	10,169.16	7,083.77
Number of patent applications	50	255
Unemployment rate (%)	13.70	9.40
Number of enrollments in day care	18,056	14,588
Number of private cars registered	300,781	306,847
Cycle paths (meters)	96,180	314,000

Source: prepared by the authors.

For the indicator "economically active population", the São José dos Campos data comes from the IBGE Cities platform for the year 2016 (IBGE, 2018). The Eurostat Toulouse data for the year 2015 (EUROSTAT, 2018).

In the "GDP per capita" indicator, data referring to the year 2015 were used. The São José dos Campos data comes from the Seade Foundation (SEADE, 2018). Toulouse data from Eurostat (EUROSTAT, 2018). The data refer to the metropolitan regions of São José dos Campos and Toulouse. To analyze the result in a holistic way, it is necessary consider the distribution of wealth produced in the region. For this, it may be used the Gini index, an indicator used to measure the degree of concentration of income. The indicator varies from 0 to 1, with zero representing the situation of total equality, that is, all have the same income, and the value 1 means complete income inequality, that is, if a single person owns all the income of the place . Although the city of São José dos Campos presents a GDP per capita higher than that of the city of Toulouse, the value of its Gini index is 0.550 (ATLAS BRASIL, 2019). The Gini index in Toulouse is 0,327 (THE WORLD BANK, 2019). São José dos Campos has a higher income concentration than that of the city of Toulouse. Despite having a smaller income, Toulouse distributes its income better, which should explain the apparent unexpected difference observed.

For the indicator "number of patent applications" there were difficulties in finding values. For the city of São José dos Campos, the average number of patents deposited in the period from 2014 to 2017 was used due to the availability of data only in this period. The São José dos Campos data comes from INPI - National Institute of Industrial Property (INPI, 2018). For the city of Toulouse the average number of patents deposited in the period from 2008 to 2012 was used due to the availability of data only in this period. The Toulouse data comes from Eurostat (EUROSTAT, 2018). Caragliu and Bo (2018) verified in their study that Smart Cities policies really stimulate innovation, which increases the stock of knowledge of a city, one of the main recognized drivers of economic growth. According to the authors, the propensity to innovate is measured by the number of patents registered in: total patent applications, high-tech patent applications, applications for Information and Communication Technology (ICT) and Smart City patent applications. The average number of patents registered in the period for the city of Toulouse is much higher than that of São José dos Campos, which may indicate that the adoption of policies that stimulate innovation and Smart Cities contributes to this result. The city of Toulouse has a specific master plan

for Smart City, with clear goals until the year 2020. The city of São José dos Campos, despite having an innovation law, has not yet a plan dedicated to the Smart City theme. In the "unemployment rate" indicator, there were difficulties in finding values referring to the municipalities. For both cities, the national unemployment rate was considered. The São José dos Campos data comes from IBGE and the data from Toulouse come from Eurostat (IBCE, 2018, EUROSTAT, 2018).

The data of São José dos Campos are from the "Synopses Statistics of Basic Education" of the National Institute of Educational Studies and Research Anísio Teixeira (Inep) for the year 2018 (INEP, 2018). The data for Toulouse refer to the year 2017 and come from Eurostat (EUROSTAT, 2018).

The indicator "number of private cars registered" of São José dos Campos refers to the year 2018 and come from the National Department of Transit - Denatran (DENATRAN, 2018). For Toulouse data, the average for the years 2009 to 2015 was taken from Eurostat data (EUROSTAT, 2018).

The indicator "cycle paths" of the city of São José dos Campos refers to the year 2018 and comes from the Department of Urban Mobility of the municipality (PREFEITURA, 2018). For the data of Toulouse was considered the data of the metropolitan authority with current data (TOULOUSE MÉTROPOLE, 2018). It can be seen that the city of Toulouse has more than three times the number of bicycle lanes implanted than São José dos Campos. This result reflects the focus given in the past to other transport modes in the city of São José dos Campos, a common feature in Brazilian cities. Currently, the city has an Urban Mobility Plan and a program to encourage the use of the bicycle, which includes the extension and connection of the bicycle lane, shared bicycles, conscious use of the modal and legislation. The goal is that by 2020 the city will reach 157,000 meters of the cycle network.

The observations made allow us to conclude that the city of Toulouse has an advantage over São José dos Campos in terms of economically active population, number of patent applications, unemployment rate and bicycle lanes, which may be considered acceptable due to having a city longer established in an important regional industrial center, besides being in an arguably more developed country.

In the other items examined, that is, GDP per capita, number of day care registrations, number of private cars registered, there was no clear differentiation in favor of any of the municipalities. The example examined suggests that it is possible, to establish a competitive differential between cities, selecting exactly the same qualifying characteristics.

VI. CONCLUSION

The concept of "smart city" has become popular in scientific literature. The article provided information that corroborates this increased interest of the researchers on the subject. The population living in the cities has increased in the last decades and has a tendency of growth in the next years. As a result of this increase, new urban challenges have emerged, establishing a new paradigm for city management. To measure these new challenges and to assist municipal governance, various city rankings initiatives are emerging and assisting managers in this regard.

The comparative analysis of the European Smart Cities and Connected Smart Cities rankings made it possible to verify that both have convergences in most of their indicators. For the elaboration of the Brazilian ranking, international rankings already established were consulted, which may explain this convergence.

It can be seen that the European ranking has more academic characteristics and provides a more in-depth analysis of the cities data. In its web page is present a tool of comparison between the cities and a general ranking. The ranking encourages benchmarking between selected cities.

Another characteristic that differentiates the European ranking of the Brazilian one is the number of cities analyzed. While the Brazilian ranking analyzes more than 500 cities, the European ranking establishes more strict criteria of selection, establishing a number of only 70 cities wich were analyzed. In the Brazilian ranking, only the 100 best cities in each intelligence sector of the city are listed in the final ranking.

It is noticed that the choice of indicators for both rankings reflects the current situation of each analysed region with regard to its development. While the European ranking has indicators such as "book loans per resident", the Brazilian ranking still establishes as a criterion of intelligence of a city the indicator "teachers with higher education". This portrays the concerns of both rankings with respect to the analysis of education in an intelligent city, but at distinct levels of development. This disparity in the choice of ranking indicators portrays issues of economic and social development in both regions and reinforces the challenge of comparing cities around the world.

In the comparison between the cities of São José dos Campos and Toulouse, it can be concluded that both have similar regional characteristics due to the regional technological development. Both have a structured network of companies and educational institutions linked to the aerospace chain, motivated in the past by private and governmental initiatives.

Toulouse has a specific master plan for smart cities. This master plan sets goals and criteria within a five-year period for transforming Toulouse into a smart city. The existence of a master plan for Smart City in Toulouse justifies the results obtained by the city and awards in this area. Already, São José dos Campos has only isolated initiatives of Smart City, needing to evolve towards the adoption of public policies aiming at this condition and considering its predominant vocations.

Regarding the performance of each city in the rankings of smart cities, the analysis showed that São José dos Campos moved from the 12th place in 2015 to the 34th place in 2018 in the country ranking.

For the city of Toulouse it was not possible to verify the position of the city in relation to the others in the ranking. The European ranking has not a general structured classification for cities with more than 500 thousand inhabitants. It is noticed through the Toulouse scores that the city performs well in the smart city sectors.

The nature of the city rankings is comparative. As such, the city must go beyond analyzing its own performance and expanding its analysis to include similar cities. For example, São Jose dos Campos can compare with the best performers, but should also look at cities of comparable size, GDP, geography, maturity and aspirations for global status - a group that could include a wide range of cities. Therefore it is not trivial to perform a comparison.

The present study shows the extent to which it a comparison can be done between two cities considered at regional and global technological poles in the aerospace area. Of course in conducting a detailed analysis of cities within a peer group, city managers can have a sense of where they need to improve and the impact of progress. In addition, they can set strategic goals for attracting investments and talents in their characteristic economic area of the city.

With the present work, the authors expect to have shown it is concluded that the city rankings are necessary tools for managers to elaborate public policies to make a city smarter. However, the visualization of an index is not always enough to observe all the characteristic aspects of intelligent cities, and may not show some revealing points. When the main purpose is to create headlines or attract potential customers, rankings can distort a clear and constructive discourse on how cities can improve. Instead, by refining approaches, improving data collection and analysis, and promoting methodological transparency, organizations that produce city performance literature can create an indispensable tool for developing more effective urban strategies and promoting knowledge sharing and collaboration between global cities.

Cultural differences are present in the comparative of the rankings, which allows establishing paths of evolution for the Brazilian ranking. The authors suggest further studies in the two cities to understand some results found. In addition, it is suggested as future studies to verify if the existence of structured policies of intelligent cities contribute in specialized supply chains such as the analyzed aerospace chain. The authors conclude that, in view of the observed value considerations, the process of elaborating city rankings should be refined in order to reduce random variations and give more consistency to the results.

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Efficiency of the Engine of Great Porte and Detection of Anomalies in the Operation of the Piston-Cylinder System through the Monitoring in Real Time

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Abstract— From the goodness of internal combustion engines as primary drive They Have Been Increasingly more widespread in power generation, either isolated power plants in the working system-based systems. Engines of large size and Especially the Internal Combustion engine (IC), Increasingly are Becoming more widespread in the generation of electricity by the degree of perfection That is Increasing, however in the the powers of these Also higher, costs of parts que make it up, and done maintenance activities engines Become more expensive, for that reason the consideration During the exploitation is to monitor the operation of the same, in real time. In this article Describes some of the characteristics of the great internal combustion engine and indications.

Keywords— Combustion engines, thermal plants, energy efficiency, piston-cylinder system, real-time monitoring.

I. INTRODUCTION

Internal combustion engines, compared to other type of primary drive, offer the advantage of better performance. The use of diesel engines for power generation was widespread in stationary plants of medium size. Currently, the industrial sector has several challenges regarding their energy sources in particular energy costs, market competition increasingly intense, higher costs in the supply of primary energy including electricity, the need for greater efficiency among other they are realities facing the industry and therefore are the driving force to redesign their energy supply strategies. To meet these challenges, it is necessary to maximize process efficiency, reduce energy consumption, opt for cheaper sources of energy, machines reduce operating costs and, of course, at the same time contribute to a cleaner and greener world. from various manufacturers dual-fuel fuel and bi-fuel systems use a widely-known technology and engines developed diesel systems of conventional internal combustion adding a second fuel may be any type of gas, particularly natural gas, biogas, coal gas, LFG[1].

The significant drop of Domestic Energy Supply (DES). Consistent with the decrease of 3.6% in the economy was mainly inducing a reduction of almost 20% in transformation losses due to the lower thermal generation and the reduction of 5.3% in the energy sector consumption (7 loss % in ethanol). The total demand for petroleum products fell by 5.6% (-7.2% in 2015), there including end uses in the sectors of the economy and the uses in the generation of electricity. The consumption in light vehicles decreased by 1.6% (an increase of 6.2% in 2014 and stable in 2015). Some industrial sectors showed negative rates above 9.0%, like cement, steel and Pellet. The Internal Energy supply 2015 and 2016, in which it had a small increase in the share of renewable sources, as a result primarily of strong reduction of non-renewable (-7.3%). The aggregate "Other renewables" wind [2].

In 2016, the ratio of CO_2 emissions by use of energy and total energy demand remained at 1.48 TCO₂/toe, the bottom indicator 2015 (1.55 TCO₂/toe) because less energy generation electricity from fossil sources [3]. Although TCO₂/toe in 2016 was lower, the difference is only 0.07 TCO₂/toe, which is a small amount, mainly due to the use of renewable sources and not just due to a more efficient use of fossil fuels.

The above suggests that energy efficiency should be one of the strategies work in the energy sector, not only reducing emissions, but also by reducing the physical consumption of hydrocarbons and all costs associated with infrastructure. Among the many responsible for the use of hydrocarbons, thermal power plants with natural gas (HFO) engines, play a key role in meeting the needs of the use of electricity in the country, hence the importance of achieving higher levels of efficiency in these plants, not only in order to reduce emission levels, but also by the fact that lower levels of efficiency are the result of possible operating problems and operation of facilities[4].

II. LITERATURE REVIEW

Currently, most of the energy consumed in the world (for example, in transportation, power generation, heating) is supplied by the combustion process. Thus, the knowledge and use of this process are of great importance in many areas, especially for power plants (TPPs) holding the same for power generation. One of the key drawbacks is that an important part of the energy generated in the combustion process is sent to the atmosphere affects directly the efficiency of combustion and the environment, by issuing a volume of gas with a high content of toxic gases and for its high energy content[5][6]. In internal combustion engines, eg petrol, diesel, gas or combination of gas-HFO, the pair formed by piston-cylinder (shirt) is one of the most important systems because it is where is the energy transformation process fuel into mechanical work to the shaft, which is possible through the combustion of the fuel supplied [7]. Saving diesel fuel - by replacing up to 99% of diesel in original Dual-Fuel engines and 80% of diesel by gas Bi-Fuel engines converted:

- Possible reductions in emissions compared with 100% diesel operation of pollutants as CO₂, NO_x, SO_x and particulate matter.
- Potential economic benefits due to the difference in fuel prices.
- operational flexibility in the use of fuels.
- power and performance characteristics similar to those of diesel engines.

 Lower investment costs in equipment converted to dual fuel compared to generation of systems with internal combustion engines to 100% gas.

Internal Combustion (IC) diesel engines are among the most efficient simple-cycle power generationoptions available. Efficiency levels increase with engine size and range fromabout 35% for small high-speed diesels up to 55% (on an lower calorific value (LHV) basis) for the largebore, slow speed engines (33% - 52% on an higher heating value (HHV) basis)[8].

Diesel gensets in the 5 MW range will achieve operating efficiencies of between40% and 45% on an LHV basis depending on the type and technology. In terms of relative efficiency this is significantly better than open cycle gas turbines and slightly worse than the average combined cycle power station.Natural gas spark ignition engine efficiencies are typically lower than dieselengines because of their lower compression ratios. However, large, highperformance lean burn engine efficiencies approach those of diesel engines of thesame size. Natural gas engine efficiencies range from about 28% for smallengines (<50 kW) to 42% (on an LHV basis) for the largest high performance, leanburn engines (>3 MW) (25% - 38% on an HHV basis)[8].

The maximum efficiency of 50% for the best engines is one of the highest ratings in efficiency between the main existing engines. The improvement in efficiency is increasingly challenging as the emission requirements become more stringent. The manufacturer has several programs running simultaneously to ensure high efficiency of their engines and reduce engine emissions[9][7][10].

For example, the engines with power that can range between 4 and 19 MW of power have the following estimated energy balance, naturally, it depends on operating conditions and technical state of the installation, figure 1.

Opportunity: Waste Heat From Stationary Engines



Fig.1: Waste heat from stationary engines. Source: [11].

2.1 KEY FEATURES OF THE GENERATORS MOTORS

This type of engine is characterized by a low revolution, requiring generators with a large number of poles.

The frequency of the current is one aspect which must be met with great precision, in the case of Brazil is 60 Hz.

The number of pole pairs is directly proportional to the frequency of the supply current and inversely proportional to the sync speed, according to equation (2.1) [12].

$$\boldsymbol{P} = \frac{60f}{N} \tag{2.1}$$

where:

P: number of pole pairs;f: frequency in Hz;

N. Speed of time in m

N: Speed of time in rpm.

It is known in Brazil that the frequency is 60 Hz and assuming an engine 514 rpm/min, the generator in this case have 14 poles as indicated above.

For the above mentioned generator, motors should take into account that the combustion is only one of the five component processes, although crucial, four times the thermodynamic cycle according to which they work: intake, compression, combustion, expansion and exhaust.

The process of periodic combustion is characterized by irregularities displayed in the mixture formation and physical proximity between the reactive (determined by the laws of aerodynamics and the motor geometry and its systems), the limited time available for carrying out chemical reactions (relevant for kinetic and chemical equilibrium) and the diffusion of gaseous components from the reaction zone and (also important to the overall speed of the combustion process).

2.2 DESCRIPTION OF THE MAIN COMPONENTS OF THE PISTON SYSTEM - CYLINDER OF THE COMBUSTION OBJECT OF ANALYSIS ENGINES

2.2.1 FUEL SUPPLY SYSTEM

In general, in the cases mentioned, this comprises storage tank, filters, fuel transfer pump, compressor and fuel tank for daily use. The fuel is provided on site of the plant through a pipeline, both the gas and the HFO. For daily storage tanks, fuel is pumped through filters to remove impurities and then is injected into the engine through the fuel injection pump[12].

2.2.2 AIR SUPPLY SYSTEM FOR COMBUSTION

This system provides air required for the engine manifold for combustion. The system has an air filter that removes dust particles which can act as an abrasive within the engine cylinder. The diesel engine requires close tolerances to achieve its compression ratio and because they are also turbocharged[12].

2.2.3 COOLING WATER SYSTEM

The engine cooling system removes heat generated by normal engine operation. Cooling is mostly done in the engine block, the turbocharger and charge air heat exchangers.

The cooling system consists of a single cooling circuit. This means that all heat sources are sequentially cooled by a common cooling water circuit. The cooling circuit is cooled by the radiators.

The water cooling system was set to be a loaddependent system, ie, heat can be recycled during low load operation to maintain adequate combustion temperature in the cylinders.

The internal system of the engine cooling water is a closed system which uses chemically treated fresh water. driven centrifugal pumps directly mounted on the engine, circulate the engine cooling water.

To prevent corrosion and formation of scale deposits or other deposits that occur in closed water circulation system, the water must be treated with additives.

2.2.3.1 ROLE SYSTEM

All engine heat sources are cooled in sequence by the single circuit cooling system. The cooling system operates in the following cooling sequence: cooler of the second charge air stage, lubricating oil cooler, the first charge air cooler stage and shirts and cylinder heads.

There are two points of independent temperature control. A set point is set to the output temperature of the jacket and the other for the water temperature at the inlet of the charge air cooler.

The cooling water circuit is cooled by radiators single circuit controlled by a frequency inverter. Moreover, the fan speed is set primarily in accordance with the temperature of the water after the radiators.

The cooling water circuit module Auxiliary Equipment motor (MI) has external water pipe, the thermostatic valve, the preheating unit, the lubricating oil cooler and instrumentation. The preheating unit is also mounted on the module. In addition, an attachment set for mixed cooling is connected to the EAM.

The purpose of the preheating unit is to preheat the engine block, the heating at the jacket temperature of cooling water required before starting the engine. The circuit is connected to the high-temperature circuit (HT) in parallel with HT circulation pump driven by the engine.

The preheating unit is formed of the following elements: electric centrifugal pump, a steam heater, closing and blocking valves, check valves and safety valves, and structure.

The preheating circuit has a check valve to prevent the flow of water in reverse. A safety valve with limit set at 6 bar, protects the circuit from a very high pressure. The system maintains a temperature of approximately 70 $^{\circ}$ C in the jacket water of the engine while the engine is stopped. This allows fast loading and starting the generator set. The preheating is also used to warm the engine before a starting after a prolonged period of shutdown. The pump handle preheat the water in the engine cooling circuit HT output line and pumps this water through the preheated back to the motor circuit HT[13].

2.2.3.2 UNITS RADIATOR

The water cooling system is circulated in the radiator units through circulation pumps with direct drive, installed in the engine. cooling fans are actuated by motors CA. In addition, frequency inverters regulate the rotation of the fan and thereby the radiator capacity Figure 2. The fan rotation is controlled primarily in accordance with the water temperature at the outlet of the radiators [12].



2.2.4LUBE OIL SYSTEM

The primary purpose of lubrication oil to the engine system is to provide a sufficient amount of clean lubricating oil (OL) at the required pressure and temperature. It is important that proper flow is maintained throughout the system. The oil lubricates the motor and removes heat (cooling) and pollution generated by the combustion process (gas passing through the piston rings).

The proper functioning of the lubricating system of figure 3, the engine protects against breakage due to very low pressure, high temperature, very low pressure prelubrication or impurities in the oil[15].

This systemcan be divided into the following subsystems:

- lubricant oil circulation system;
- Storage systemand lubricant oil transfer.



Fig.3. Simplified diagram of the lubricating oil circulation system Source: [14].

The following components can be identified in the illustration above: pre-lubricating oil pump; lubricating oil pump; Thermostatic valve; Lubricating oil cooler; Automatic Filter; wash filter; Motor.

2.2.5 EXHAUST GAS SYSTEM

The main function of the external exhaust gas system is driving the exhaust gases out of the power plant. Emissions and nearby noise level must be below the values specified by local authorities figure 4[16].



Fig.4: Simplified diagram of the charge air system and exhaust gas Source: [14].

The following units and components are identified in the illustration above: charge air filter; Silencers charge air;

turbochargers; charge air coolers; Recovery boiler exhaust gas; Muffler exhaust gas; water supply unit for cleaning the turbine and compressor and natural water supply.

2.3 ENERGY CONSERVATION

The thermodynamic analysis of the combustion process seeks to clarify the forms and amounts of energy involved in it from the application of the law of first conservation of energy or the law of thermodynamics. A characteristic of the combustion in the comparatively small volume of the combustion chamber of an engine, although large as in the case considered is that the reactions do not occur at constant pressures near atmospheric, such as a boiler, but in a case the nearest higher pressures the isovolumetric (V≈const), as the piston movement in times of occurrence of chemical reactions resulting combustion is negligible[17].

The principal amounts of energy involved in this process are as follows:

- air internal energy state at the beginning of the combustion, corresponding to the end of compression, characterized by a reduced volume and moderately high values of pressure and temperature;
- internal energy of the (s) fuel (ies) in the state in which he (s) enter (m) in the combustion chamber. In a first approximation, the value of the workflow (p · V) can be ignored for the liquid fuel because its low specific volume. However, gaseous fuel injected into the cylinder, the work flow comes from power consumed by injection compressor and can reach considerable values;
- Existing chemical energy in the fuel component compounds that can enter during the reaction process. The external effect of the chemical energy is evaluated by the magnitude of specific heat of combustion, also known as calorific value or calorific value, determined by standard laboratory tests and expressed in units of energy per unit weight, volume or mole, according to the system units in use;
- internal energy of the products obtained as a result of the combustion process;
- Heat transfer through the walls of the chamber. Since the temperatures involved much higher than ambient, heat is typically rejected to the outside. In a first approximation, the adiabatic process can be considered (with negligible heat);
- The end of the energy balance during the combustion process aims usually get the final condition of the goods

from the knowledge or assumption of the composition and speed of reactions (total combustion time). This final state is characterized by high values of pressure and temperature, and total or almost total completion of combustion reactions. When for various reasons the process does not end completely and extends to a part of the following process (expansion) while the energy released can equal as much as possible, to convert them into work, which is the ultimate goal of the motor is achieved incompletely.

2.4 FUEL INJECTION AERODYNAMICS

Being a diesel internal formation of air-fuel mixture that forms inside the cylinder in a process that starts with only the entry of a liquid or gas jet (depending on the fuel used). Thus, the formation of the mixture will come determined by the penetration of the jet into the chamber volume and the actual aerodynamic air movement within it. The first will mainly depend on the fuel injection pressure, in addition to the geometric characteristics of the nozzle (nozzle). The second chamber is dependent on the geometry and intake valves.

In the dual operating system, it will be necessary to consider two different jets: the fuel gas jet, which must ensure the homogeneous mixture as possible and the liquid jet, whose main purpose and initiate combustion of the gaseous mixture. As it produces the penetration of the jet into the air volume or gas mixture, the evaporation is observed along with the diffusion of fuel within the mixture. The diffusion processes play an important role in the formation of the mixture in both the liquid fuel system, as in the dual.

Simultaneously occurs intensive heating of the fuel, which quickly reaches the ignition temperature and after a time delay, the ignition or beginning of combustion in some regions of the diffusion boundary where appears the favorable local conditions (temperature and composition of the mixture). The propagation of the combustion to the rest of the chamber is a complex phenomenon which results different to the case of only liquid fuel (air atmosphere) for the case of dual fuel, where the atmosphere is it a flammable mixture of air and fuel, and intermediate gaseous products of combustion.

In the first case, the liquid combustion occurs as they leave the nozzle, because once started, the temperature is raised to just inflammation heat the fuel exits, and the amount of air is excessive, ensuring oxygen requirements. In the second.Case, combustion is initiated shortly with inflammation of the liquid jet spreads throughout the chamber volume following a complicated phenomena sequence. As the combustion process in diesel engine limited by the time available, since it must complete before the start of the piston descent from the PMS, the kinetics of chemical reactions seeks the greatest interest. However, the high temperatures normally reached in the process ensure high reaction rates, are present but the diffusion phenomena which influence the overall kinetics. Hence the importance of making the mixing processes achieve the highest degree of perfection possible. It is clear that the kinetics and distribution play different roles in the liquid jet and the hot air atmosphere of the scene from a single fuel, a jet tens of times lower, which is thrown into a gaseous fuel mixes with hot air, and also in propagating a front of the flame combustion chamber between regions of the gaseous mixture warmed [18].

2.5 COMBUSTION REACTIONS

Combustion reactions are chemical reactions involving the complete oxidation of a fuel. Materials or Compounds are considered as industrial fuel oxidation can be done with sufficient energy to release industrial use. The main chemical elements that constitute a fuel are carbon, hydrogen and in some cases, Sulfur. These elements react with oxygen, and in its pure form have the following heat release[19]:

> C + O₂----- CO₂---- 393.5 kJ/kmol H₂ + ¹/₂ O₂ H₂O ------ 241.8 kJ/kmol

S + O₂ SO₂ -----29.3 kJ/kmol 2.6 CHARACTERISTICS PAIR OF WORKING-CYLINDER PISTON AND, INDICATIONS, EFFECTS, EFFECTS, CAUSES THE PRESSURE AND TEMPERATURE WITHIN THE CYLINDER

The combustion takes place in a closed space defined by the shell wall, piston head, the head surface and the intake and exhaust valves. Its effectiveness depends on multiple factors that affect the performance of the engine as a whole.Knowing how the combustion process is developed is of great importance to correct possible problems, which can be done through the use of an indicator diagram or pressure indicator that describes the combustion curve and its deviations.

2.7. GRAPHIC PRESSURE INDICATOR IN THE COMBUSTION

The graphical display of pressure in the combustion figure 5, shows how the combustion is taking place within the cylinder. Good working conditions indicate that the pressure inside the combustion chamber continuously increases due to piston compression work. During the compression process, the temperature rises continuously and finally the fuel injected burns which may be indicated by a peak at exactly the moment of ignition, then the rich mixture will rapidly increase its volume (expansion process) delivering work to axis.





Any deviation from the diagram shown to be given by the pressure deviations from previously obtained curve can cause irregularities in engine operation, such as:

- Higher fuel consumption;
- Higher temperatures of the exhaust gases;
- Increased wear of the components involved in the combustion process;
- Incomplete combustion with a higher carbon residue content that creates scale mainly in the piston crown, the exhaust valve and the turbocharger;
- The air supply may not be adequate and the combustion efficiency decreases.

2.7.1 DISTORTIONS IN GRAPHIC INDICATOR OF THE PRESSURE IN THE COMBUSTION

Possible causes of indicator chart distortions of combustion pressure:

- cylinder liner and / or worn piston rings
- Wear injection pump, which causes low injection pressures.
- Wear or the injection nozzle fouling.
- advanced injection or delayed due to poor regulation of the injection time.
- Decreased air supply to the cylinder.
- Ignition delay
- With the correct interpretation of the specific character of these deviations, possible failures or

faults can be located and eliminated in both the engine itself and in the auxiliary equipment.

• The data and the measurement of indicated diagram form must be continuously compared with the data of the "New Engine" or with the new motor parameters after a "general repair" and trends should be observed and analyzed.

During engine operation, always observe any pressure difference for the different engine cylinders, which can oscillate around 2.5% of the working pressure, all that must be observed and it is desirable to make measurements every three months before a repair, and with the engine running at 100% of its load (SECO GmbH. Quedlinburg. Germany).

2.8 DELAYED IGNITION

Indications:

- peak pressure down and after the injection start;
- High temperature of the exhaust gases;
- Combustion during expansion;
- black smoke in the exhaust gas;
- Sometimes a power loss.

Consequences:

- Increased fuel consumption;
- reduced service life of exhaust valves;
- reduced service life of the piston crowns;
- environmental contamination due to the high emission of particles.

Causes:

- Supply of fuel, very slow due to contaminated gun.
 - Check the gun

Fuel quality, poor.

• Check your fuel treatment, send a sample to a laboratory

Cylinder, very cold.

• Check and adjust the temperature in the piston jacket

fuel pump, incorrect timing adjustment

 Check and adjust accordingly as to advise engine manufacturers

combustion pressure, very low due to worn cylinder and / or piston rings

 Compare dimensions and clearances to wear limits indicated

combustion air supply, very low

 Measure the content of the remaining oxygen in the exhaust or inlet of the combustion air filter and compare this measure -against the condition "as new".

In figure 6, the pressure in the combustion graph of late ignition.



Fig.6: Graph Pressure in Combustion Ignition in late. Source: [20].

2.9 GUN LEAKING

Indications:

- The maximum pressure is too low
- Pressure after the start of injection, oscillating during expansion
- Disturbance after combustion
- Increased fuel consumption
- High vibration levels in the fuel lines
- frequent noise

Consequences:

- Damage by vibration at the injection tubes
- reduced service life of the piston rings
- Increased fuel consumption

Causes:

Fuel injector leakCheck the gun on the test bench, replace it if necessary.

Worn spray nozzle injection holes clogged or

• Check the nozzle on the test bench of the workshop and replace if necessary

In figure 7, the pressure in the combustion graph: Gun leaking.



Fig.7: Graph Pressure in Combustion: Injector leaking. Source: [20].

2.9.1 EARLY IGNITION

Indications:

- Peak very high pressure.
- Very low temperature of the exhaust gas.
- Reduces fuel consumption.
- Increasing NOx emissions.

Ignition in advance- Consequences:

- The parts inside the combustion chamber will be overheated.
- The life of the engine affected components will be reduced.
- The rate for heavy loads are transmitted to the bearings through the transmission.
- shock loads and vibration can result in engine damage.
- The exhaust temperature will be lower because the combustion starts earlier than expected.

Early ignition - Causes:

Incorrect adjustment or accidental change the fuel pump timing

Check and adjust

Improper adjustment or fuel injector valve or damaged

Check and adjust

Fuel with flammable components

• The quality of the fuel must be controlled by an independent laboratory (can be harmful components that are mixed with fuel for disposal of illegal waste)

In figure 8, the pressure in the combustion graph:. Early ignition.



Fig.8: Pressure in Combustion Chart Early ignition. Source: [20].

2.9.2 PARTIALLY CLOGGED FUEL VALVE

Indications:

- maximum pressure, very low.
- exhaust gas temperature, too low.
- engine power loss due to the low fuel consumption.

Consequences:

- engine power loss.
- broken gun, caused by very high pressure at the nozzle tip.

Causes:

Fuel oil contamination and / or inadequate purification

- Check and adjust the tabs
- Check and replace the filters
- Perform a fuel oil analysis by an independent laboratory

Carbon formation on the injector tip

- Check and clean.
- Check the cooling efficiency

Carbon deposits in the fuel valve due to overheating

Check the injector cooling

In figure 9, the pressure in the combustion graph:. Partially clogged fuel valve.



Fig.9: Graph of pressure in the combustion: fuel valve partially obstructed. Source: [20].

2.9.2 AFTER COMBUSTION

Indications:

- exhaust gas temperature, too high.
- maximum pressure, very low.
- Pressure at the end of combustion, very high.
- Growth of exhaust emissions.
- Increased temperature in the cylinder liner.

Consequences:

Increased emissions to the environment

Very high temperatures in the combustion chamber cause:

- Combustion additional lube oil
- Increased wear of the cylinder liner, the piston crown and piston rings.

Carbon deposits unburned cause:

- Failure of the exhaust system
- Damage to the exhaust valve seat valves

Causes:

Slow process of fuel combustion

Run a Fuel Combustion Analysis.

Poor quality of fuel oil

• Perform a fuel oil analysis by an independent laboratory.

The temperature of the fuel oil is very low

• Check the final pre-heater and the viscosity controller through fuel analysis and measure the temperature.

In figure 10, the pressure in the combustion graph: After combustion.



Fig.10: Graph Pressure in Combustion: after combustion. Source: [20].

2.9.3 LOW COMPRESSION

Indications:

- Compression pressure, very low.
- Peak pressure, very low.
- Engine power decreasing.

Consequences:

- Increased fuel oil consumption
- Engine power loss

Causes:

Inadequate combustion.

• Run a Fuel Combustion Analysis.

Very low combustion air supply

- Measure the content of the remaining oxygen in the exhaust gas or air velocity at the entrance of the combustion air filter and calculate the flow rate and compare with the "As-New" condition.
- Check the drop in air pressure of the cooler.
- Check the speed of the turbo compressor, if it is too high, clean the nozzles.

Air leaking between the liner and the piston rings

 Disassemble the cylinder head and piston. Check the dimensions of the piston rings and cylinder liner, checking that the wear limits exceeded the threshold value.

In figure 11, the pressure graph in combustion:. Low compression.



Fig.11: Pressure in Combustion Chart: Low compression. Source: [20].

The above information shows how important and significant indicators are diagrams of pressure inside the combustion chamber.

You can detect many faults that influence engine efficiency and life of their components and other systems.

By regularly performing this measurement or monitoring of cylinder pressure, the management of a thermal power plant has a powerful tool for reducing operational costs and plan maintenance work in advance.

2.10 PISTONS, TYPICAL CONSEQUENCES AND DAMAGE

The piston engine component is a sometido to greater stresses during operation of the engine, it has built to withstand the increased stresses resulting from high injection pressures and aggressive compounds of heavy fuel oil (HFO).

With the passage of time, the piston construction technology aims to:

To ensure sufficient fatigue resistance and withstand the static, dynamic and thermal loads which generate large stresses during operation.

The design must be considered to ensure its operation in up to 1800 0C environments. Drawing that is sufficiently precise to ensure airtightness of the combustion chamber exposed to high injection pressures also to ensure that the lubricating oil penetration in the chamber does not occur.

To guarantee this, together with the piston compression rings, lubrication and sealing gasket between the cylinder head and they are also involved.

On the other hand, the pistons must be designed and constructed to maintain stability under the action of aggressive compounds in the fuel.

With the correct interpretation of the specific character of each of the deviations from design parameters, it is possible to prevent failure or malfunction of the motor itself or ancillary facilities.

One of the most common causes of premature wear on the piston, piston ring grooves and other engine components is caused by an insufficient fuel treatment for some reason, not always known.

Unfortunately, in many power plants, does not seem to be true, the attention given directly to the engine is the same, which lends itself to the characteristics of the fuel supplied and their treatment.

2.10.1 TYPICAL DAMAGE DUE TO INSUFFICIENT TREATMENT OF FUEL:

- The crown of the piston due to burning fuel burn on the surface of the piston crown;
- Piston rings are breaking because the residues are blocking free movement of the ring groove;
- The heat transfer from the piston crown is disturbed due to oil residues added cracks on the internal surface of cooling the piston crown.

From the operating experience of the engines, it was possible to prove that one of the most common causes of premature wear on the piston and hence the grooves of the pistons (and other engine components, of course) are insufficient treatment of the fuel.

2.10.2 CONSEQUENCES OF INSUFFICIENT FUEL TREATMENT

As mentioned above, insufficient fuel treatment, of course, not only damages the piston crown, but also affects the fuel injectors. Some of the holes in the injector nozzle will be blocked and as the fuel flow is constant, the result is a faster rate of fuel through the holes of the nozzles that are not blocked. When this happens, the injected fuel is fast reaching the surface of the piston crown creating hot spots with continuous overheating of the piston crown surface.

In these conditions the piston crown warming is strongly disturbed the cooling oil in the piston crown of the cooling chamber, cannot fulfill its function of keeping the temperature recommended values and can reach values up to 1800 0C as previously mentioned.

All this means that these elements are subjected to harsh conditions because they are subject to high working temperatures and pressures, in addition to this friction tribological pair. The system also comprises lubricating rings and two compression rings, the sealing ring between the head and the upper part of the cylinder and the intake and exhaust valves. The sealing ring is responsible for ensuring tightness between the cylinder head and being subjected to high temperature and pressure occupying the position in the system.

The situation described above has been confirmed during operation of the engine in TPP.

One of the key objectives in research and search for solutions in large motors installed in power generation plants to keep the thermal efficiency levels at the highest possible levels, for which constantly monitor you need your order to detect in good time any deviation of their nominal operating parameters, as well as thermal efficiency, reduces maintenance costs while working on the basis of a predictive maintenance system.

One of the parameters that may be affected during operation of the engine and its rate compression. Any one of the directions, causes and consequences mentioned above has a negative influence on the compression ratio and therefore in thermal performance engine. O engine efficiency diesel can be calculated by equation (2.2).

$$\eta = \frac{Pot}{Q_a} \tag{2.2}$$

Heat absorbed, equation 2.3.

$$Q_a = M_c V C I \tag{2.3}$$

At where: **Pot** - machine power **Q**_a- Absorb Heat **Mc**- Fuel Mass **VCI** - Net calorific value of fuel

Derived from the general equation, yields a more detailed view equation for the influence on the compression ratio γ_k in the engine thermal efficiency. compression ratio is calculated as in equation (2.4):

$$\gamma_k = \frac{V_1}{V_2} \tag{2.4}$$

And the isobaric expansion rate (combustion process) γ_c , Admission closing rate.

After several mathematical and thermodynamic transformations, we obtain an equation of the thermal efficiency of the diesel engine as follows (equivalent air motor diesel), equation (2.5).

$$\eta_t = 1 - \frac{1}{\gamma_k^{k-1}} \left[\frac{\gamma_c^k - 1}{k(\gamma_c - 1)} \right]$$
(2.5)

For the same compression ratio, the gasoline engine would have a higher thermal efficiency than diesel, but such a situation will never occur in practice, since in the case of the diesel engine is compressed air only and autoignition never happen before reaching the point top dead center of the piston, but the gas is compressed a mixture of air-fuel and the possibility of autoignition always be present. In the above, it is shown that as the ratio of isobaric expansion increases the factor in brackets does this and the efficiency decreases. So lower rates of fuel inlet closure theoretically lead to higher efficiency but a higher value of the indexes results in higher power. [15]

III. CASE STUDY 3.1 MONITORING THE PRESSURE OF COMBUSTION PRESSURE AND TEMPERATURE OF THE COOLING WATER

For engine generators, planning of maintenance activities is done according to the established, as verified at the plant and not according to the actual characteristics presented by the engines. The once exposed is valid during the technical warranty period for an installation, however when the generators engine generators have a running time that exceeds the technical warranty period, then maintenance activities must be performed in accordance with the diagnosis that would have be done during the operation, and depending on the actual technical condition, adjust the length of time between maintenance activities become fundamentally in a period in which engine parts and systems are exchanged without further analysis than defined by provider.

The permanent monitoring of the combustion pressure and the pressure and temperature of the cooling water are diagnostic parameters to reverse the situation that sometimes it has been presented with the plants in the cylinder piston and cylinder head system.

The monitoring system based on conditions is able to identify potential problems and development failures while the engine is in service. This engine monitoring system is the cornerstone of predictive maintenance and complements the scheduled maintenance programs, allowing longer intervals between overhauls. The system helps reduce damage, unnecessary maintenance activity and therefore helps to minimize the cost of any repair.

The monitoring system is a continuous measuring instrument that monitors the status, health and efficiency of a combustion engine. The system should be designed to recognize the functional deviations in engine operation in order to measure their mechanical and thermal state.

The monitoring also reduces the amount of fuel consumption due to monitoring of engine efficiency, which also extends the life of the installation.

3.1.1 SOME BENEFITS OF THIS MONITORING SYSTEM:

- Early detection prevents damage and the consequences.
- The monitoring increases the reliability of the mechanism.
- Keeping engine efficiency within the set values, which contributes to lower fuel consumption for the same power
- Maintenance based on engine performance instead of hours of operation.
- Extends the life of a monitored engine.
- Reduce downtime

In order to corroborate the feasibility of using monitoring software in the field level, it has been tested in a real engine in the laboratory level.

Engine features:

- bike generator 150 kW;
- Engine: 6-cylinder in-line;
- Fuel: Diesel;
- Generator: Three-phase.

To make measurements in the actual engine in laboratory level from the use of the corresponding sensor and software that will monitor the combustion pressure, temperature and pressure of the cooling water, the aforementioned cylinder head was removed and a hole was made by the front of the inwardly head head located in the space between the intake and exhaust valves housed in the engine block. In the figures (12, 13 and 14), it is possible to appreciate the location where the hole was made as well as the communication pipe between the inside and the outside of the cylinder where the pressure sensor is connected.



Fig.12: Engine head. Source: Authors, (2018).



Fig.13: Engine head. Source: Authors, (2018).



Fig.14: engine head. Source: Authors, (2018).

3.1.2 RESULTS OF THE MEASUREMENTS

The software developed for the monitoring screen of the three quantities: the combustion pressure, pressure and cooling water temperature, is shown in figure 15, figure 16 and figure 17.



Fig.10 - Figure 15: Pressure in the combustion engine in the actual laboratory. Source: [21].



Fig.16: Cooling Water Pressure Source:[21].



Fig.17: cooling water temperature. Source:[21].

IV. CONCLUSIONS

The monitoring system in real time allowed to know the deviations of the measured parameters, with the possibility of taking the measures required by the operator, if necessary. Both a very high combustion pressure in addition to the nominal values and low values is an indication of malfunction of the cylinder and is a clear indication of possible causes that can cause major damage to the piston-cylinder system and its sealing accessories.

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Instruments for Diagnosing Stress in Nursing Professionals and Academics: A Systematic Review

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Abstract— Introduction: Stress is defined as feedback from the body in the face of psychophysiological stress. It can cause major health problems to the individual, directly affecting their quality of life in different ways, for there are some validated tools to detect symptoms and make their diagnosis. Objective: To point out instruments used to diagnose stress and to describe their differences. Methodology: Article conducted through systematic review, including studies that had greater relevance in their information and were related to health, and excluded those who escaped the proposed theme. In all, 32 sources were used, published between 1956 and 2019, thus covering initial stress research and more recent studies. Results: After searching the literature we found 8 validated instruments to diagnose stress, highlighting a translated version of 2017 of Stress Assessment in Nursing Students being the most current. Discussions: Stress is considered a disharmony situation of the organism, with adaptive responses that can be specific to the stressor and highly generalized. The importance of early diagnosis made by psychologists was highlighted, as well as the use of strategies to mitigate the effects of this disease. Conclusion: The means to diagnose stress are diverse, as stressors, so health professionals should be aware of all signs of stress experienced by both nursing students and trained nurses.

Keywords—Diagnosis, Stress, Nursing, Nursing Academics.

I. INTRODUCTION

Stress is characterized as an organism's response to a threatening situation, that is, a psychophysiological exhaustion, which can cause major health problems and drastically affect an individual's quality of life in many ways. Studies show that 90% of the population is affected by this disease, and is then seen as a global epidemic that may eventually cause a rise in blood pressure [1][2][3].

In this context, nursing is classified as the fourth most stressful profession, precisely because it has a higher susceptibility to stressors, since this occupation directly witnesses the health / disease process, which often happens in precarious conditions, in addition to being read daily, with suffering and death [4][5]. The stress caused by occupational stress contributes to the development of another harm, Burnout syndrome, occupational exhaustion that acts as a response caused by the chronic stress that makes professionals sick, at times when combat strategies are poorly resolved, causing a deficit in the quality of care provided, as well as physical and psychological damage [6][5][7].

For some authors, overload, communication problems with staff, responsibility to provide adequate care, interpersonal conflicts and job dissatisfaction are also stressors present in nursing work [8]. In short, these stressors are closely linked to the inherent factors of work [9].

In universities, nursing students are constantly facing stressful situations, precisely because they carry

responsibilities that concern the lives and health of others. Given this it is noticeable that stress is rooted in the profession, both trained professionals and academics, due to the demand for large collections lived [10].

During nursing undergraduate stress is triggered when the student feels overwhelmed with academic demands, the beginning of contact with human pain and suffering in the internship field, insecurity about the professional future, in addition to the financial factor, since part of the students work to fund their studies. Symptoms affect their interpersonal relationships that compromise their well-being, so reducing these factors is necessary, since the labor market has received professionals with stress symptoms, which can interfere with the quality of nursing care offered to patient in the early years of formation [11].

This way, further studies are needed to provide a better understanding of stress diagnoses in order to develop possible prophylaxis methods for stress mitigation. Therefore, the objectives of this study are to point out the instruments used to diagnose stress, besides describing their differences. This article is based on a systematic review on Google Scholar, PubMed and Scielo platforms. This type of research is characterized by conducting a synthesis on a particular health theme, aiming to provide data obtained on a problem [12].

For the execution of this work, a wide search in the literature was performed. In the end 32 sources were used, published from 1956 to 2019, thus covering initial research on stress, as well as more recent studies. We selected scientific articles that presented greater relevance in their data and were related to the health area, and excluded those who escaped from the theme addressed. The instruments were left in their original languages to retain their original quirks and characteristics.

III. RESULTS

Considering the focus and general objective of this study, we searched the world literature for instruments that can measure and diagnose stress. The data obtained were distributed in a table for better organization, and there is also a short synthesis about it, aiming to help researchers who wish to use any of these tools.

II. METHODOLOGY

Chart 1 - Instruments to diagnose stress

AUTHORS	INSTRUMENT	INSTRUMENT SUMMARY
[13].	Bianchi Stress	• Focused on Determining the Level of Stress in Hospital Nursing in the Basic
	Scale(annex1).	Exercise of Her Work;
		• It is self-applicable;
		• It takes an average of 15 minutes to answer;
		• Formed by 51 items, divided into 6 domains, which gets a score ranging from 1 to
		7;
		• DOMAINS:
		1 - relationship with other units and supervisors (nine items: 40, 41, 42, 43, 44, 45,
		46, 50, 51);
		2 - activities related to the proper functioning of the unit (six items: 1, 2, 3, 4, 5, 6);
		3 - personnel management activities (six items: 7, 8, 9, 12, 13, 14);
		4 - nursing care provided to the patient (fifteen items: 16, 17, 18, 19, 20, 21, 22, 23,
		24, 25, 26, 27, 28, 29, 30);
		5 - coordination of the unit's activities (eight items: 10, 11, 15, 31, 32, 38, 39, 47);
		6 - working conditions for the performance of nurses' activities (seven items: 33,
		34, 35, 36, 37, 48, 49).
		• SCORES:
		\leq 3.0: low stress level;
		Between 3.1 and 5.9: medium stress level;

		\geq 6.0: high stress level.
[14].	Stress Assessment	• Aimed at nursing academics, but there is guidance for use on different samples;
	in	• The instrument consists of 30 items, organized into six domains:
	Nursing	1- Realization of practical activities;
	Students (annex 2).	2- Professional communication;
		3- Time management;
		4- Environment;
		5- Professional qualification;
		6- Theoreticalactivity.
[14] apud [15].	Stress Assessment	• Aimed at university nursing students:
	in	• It can be applied anywhere in the undergraduate degree:
	Nursing Students –	• This version consists of 19 items:
	VersionReduced	• Consisting of 4 domains:
	(annex 3).	1. Realization of practical activities (Items 2, 3, 4 and 5):
		2. Theoretical activity (Items 1, 7, 9, 10, 15, 17 and 19):
		3. Environment (Items 8, 14, 16 and 18):
		4- Vocational Training (Items 6 11 12 and 13)
[16]	Porcoived Stress	• The scale has 14 questions the answers are: 0: never: 1: almost never: 2:
[10].	Scale (PSS) (figures	sometimes: 3: fairly often: 4: very often:
	1 and 2)	• The items declared positive are: 4, 5, 6, 7, 9, 10 and 13
[16] anud[17]	Perceived Stress	• The article size to translate the Deresived Strass Scale (DSS) into Dertuguese and
[10] <i>apua</i> [17].	Scale in Brazilian	• The article and to translate the reference Stress Scale (FSS) into Foltuguese and
	Portuguese (annex	• The scale has 14 questions with answer options that can have 0 never 1 almost
		• The scale has 14 questions with answer options that can be: 0: never, 1: annost
	4).	never, 2: sometimes; 3: almost always; 4: always;
F1 (1 1/10)	D 10	• Positive questions are: 4, 5, 6, 7, 9, 10 and 13.
[16] <i>apud</i> [18].	Perceived Stress	• PSS-10 includes items 1, 2, 3, 6, 7, 8, 9, 10, 11, and 14 of PSS-14;
	Scale in Portuguese	• Possible answers are: 0- never, 1- almost never, 2- sometimes, 3- often, and 4-
	from Portugal	very often).
[16] any d[10]	(annex 5).	$\sim DCC A$ is formed both a number $2 < 7$ and $14 = 5 DCC = 14$.
[10] <i>apua</i> [19].	Ferceived Siress	• PSS-4 is formed by the numbers 2, 6, 7 and 14 of PSS-14;
	Scale 4 (PSS-4)	• This scale can be used in telephone interviews and in other situations where a
[20] [[1]		smaller scale is required to provide data under stress.
[20] <i>apud</i> [1].	Lipp Adult Stress	• It consists of 53 symptoms, organized hierarchically by symptom intensity. It
	Symptom Inventory	takes about 10 minutes to perform, and can only be done in one interviewee or in
	(annex/).	groups of up to 20 people. To respond to each of the phases, the person indicates
		the physical or psychological signals felt in the last 24 hours, the past week or the
		last month [21] [22].
		• This instrument contains 37 somatic and 19 psychological symptoms, which are
		often repeated, modifying only their intensity and severity;
		• It consists of three frames relating to the four phases of stress.
		1st chart: has 15 items related to the alert phase, of which 12 relate to physical
		symptoms and 3 to psychological symptoms experienced by the person in the last
		24 hours;
		2nd chart: it consists of 15 items, related to the phases of resistance and near
		exhaustion, 10 physical and 5 psychological symptoms observed in the last week;
	1	3rd chart: includes 23 items, which are equivalent to the exhaustion phase, of

	these 12 are physical and 11 psychological signs, experienced in the last month.
Source: Prepared by the authors.	

After investigation of the literature, a total of 8 validated instruments were found, being the 2017 smallest version ofStress Assessment in Nursing Students the most current, already the oldest was PSS-14, 10 and 4, published in 1983 [16]. This scale was translated into Portuguese from Brazil [17] and Portugal, but in this study, we used one of the shortened versions, the PSS-10 [18].

Psychological assessments are systematic observational procedures that record the conduct and responses of individuals for the purpose of describing and / or measuring psychological peculiarities and processes, commonly understood in the areas of emotion / affect, cognition / intelligence, motivation, personality, psychomotor, attention, memory, perception, among others, in their various ways of expression, based on patterns defined by the construction of instruments [23].

Thus, it should be emphasized that the use of instruments for the assessment or measurement of psychological characteristics for the purpose of psychological diagnosis is a private matter of the psychologist [24].

IV. DISCUSSIONS

Originally from physics, the word stress was used in the early twentieth century by Hans Selye to name the joint actions of forces that can reach any part of the human body. He presented the thesis that a series of stereotyped psychological and physiological occurrences in critically ill patients reproduced serious and lasting consequences of adaptive responses. He referred to this as the 'General Adaptation Syndrome (GAS)' or 'Stress Syndrome (SS)' [25].

Stress can still be classified as a disharmony situation when the body's homeostasis is endangered, with adaptive responses that may or may not be stressor-specific [26].

If this problem is not taken care of, it affects the health of the individual, the efficiency and professional and personal performance and can cause a scenario of depression, but it is not simple to find the agent responsible for stress, so it is suggested that the best way to detect it is through diagnosis and consultation with able psychologists using appropriate instruments [27].

In a survey of 136 nursing students from a private institution, 30.9% showed low perception of stress, 46.3%

medium and 22.8% high. From these results we can evidence something positive related to the small number of students with high perception, because the available literature shows that in most cases the rates are higher [28].

As in a study that showed that among 209 academics, 163 had stress indicators and only 22% of the total did not show the indicative [29]. Authors say that the high perception of stress affects performance, lifestyle and causes damage to the health of the university, point out that the higher the perception of stress the greater the danger of illness [28].

From the relationship between stress in future nurses and sociodemographic factors, it was found that 75% of a sample of 32 people were classified with signs of this disease and the sociodemographic variable that showed the highest relationship with stress was marital status [30].

Because of the stressors caused by the course, academics use methods to relax and combat stress, but still use smoking and alcohol as a means to remedy their effects [31].

Coping is cited as a strategy to alleviate stress in nursing students. It is characterized by the ability to cope with and adapt to stressful events in a positive way, concerns the form of behavior or even thoughts in the face of such events, and can also be considered a union of physical and psychological techniques that can be learned, changed. and even discarded [10].

In nurses who perform the function, authors suggest that these are the most susceptible to stress at work, given that the deficit of professionals in the area causes an increase and overload of service, along with the separation relationship between nurses and technicians or nursing assistants, decreased professional authority and autonomy, and disagreements with other health officials [32].

V. CONCLUSION

As noted, the tools to diagnose stress are numerous, which makes a vast possibility for researchers. In addition, they can be applied to both active nursing professionals and academics, which increases the possibilities for future studies.

The stressors are varied, with different nature and several triggering factors. They are closely linked with the performance of nursing professionals, since the academic life, because students go through situations that can trigger imbalance due to both professional and social pressure, so
health professionals should pay attention to all symptoms of stress experienced by both academics and working nurses.

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Annex 1 - Bianchi Stress Scale [13].

Este questionário tem a finalidade de levantar dados para conhecer a suaopinião quanto ao desempenho de suas atividades. NÃO PRECISA IDENTIFICAÇÃO. Assinale a alternativa que revele a sua percepção, levando em consideração os números:

$\begin{array}{cccccccccccccccccccccccccccccccccccc$	7
Nãoseaplicapoucomédio muito	
"nãofaço" desgastante desgastante	
PARTE 1	
Sexo : feminino () masculino ()	
Faixa etária : () 20 a 30 anos	
() $41 a 50 a nos$	
() mais de 50 anos	
Cargo:	
Unidade a que pertence:	
() de2 a 5 anos	
() de 6 a 10 anos	
() 11 a 15 anos	
() maisde 16 anos	
() sim Qual (is)	
Tempo de trabalho nessa unidade:	
PARTE 2	
1. Previsão de material a ser usado	01234567
2. Reposição de material	01234567
3. Controle de material usado	01234567
4. Controle de equipamento	0 1 2 3 4 5 6 7
5. Solicitação de revisão e consertos de equipamentos	0 1 2 3 4 5 6 7
6.Levantamentodequantidadedematerialexistentenaunidade	0 1 2 3 4 5 6 7
7. Controlar a equipe de enfermagem	0 1 2 3 4 5 6 7
8. Realizar a distribuição de funcionários	0 1 2 3 4 5 6 7
9. Supervisionar as atividades da equipe	0 1 2 3 4 5 6 7
10. Controlar a qualidade do cuidado	0 1 2 3 4 5 6 7
11. Coordenar as atividades da unidade	0 1 2 3 4 5 6 7
12. Realizar o treinamento	0 1 2 3 4 5 6 7
13. Avaliar o desempenho do funcionário	0 1 2 3 4 5 6 7
14. Elaborar escala mensal de funcionários	0 1 2 3 4 5 6 7
15. Elaborar relatório mensal da unidade	0 1 2 3 4 5 6 7
16. Admitir o paciente na unidade	01234567
	01224567

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Annex2–Stress Assessment in Nursing Students [14].

Leia atentamente cada item abaixo e marque com um "X" o número correspondente comaintensidade de estresse que a situação lhe provoca, conforme a legenda a seguir:

0 = não vivencio a situação

- 1 = não me sinto estressado com a situação
- 2 = me sinto pouco estressadocom a situação
- 3 = me sinto muito estressado com a situação

Nova Numeracão	Itens	0	1	2	3
1.	Ter preocupação com o futuro profissional				

2.	A obrigatoriedade em realizar os trabalhos extraclasse					
3.	Estar fora do convívio social traz sentimentos de solidão					
4.	Realizar os procedimentos assistenciais de modo geralal					
5.	As novas situações que poderá vivenciar na prática clínica					
6.	Comunicação com os demais profissionais da unidade de estágio					
7.	O ambiente da unidade clínica de estágio					
8.	Comunicação com os profissionais de outros setores no local de estágio					
9.	Ter medo de cometer erros durante a assistência ao paciente					
10.	A forma adotada para avaliar o conteúdo teórico					
11.	Distância entreafaculdadeeo local de moradia					
12.	Executardeterminadosprocedimentosassistenciais					
13.	Sentir insegurança ou medo ao fazer as provas teóricas					
14.	O grau de dificuldade para a execução dos trabalhos extraclasse					
15.	A semelhança entre as situações que vivencia no estágio e aquelas que					
	poderá vivenciar na vida profissional					
16.	Perceber as dificuldades que envolvem o relacionamento com outros					
	profissionais da área					
17.	Pensar nas situações que poderá vivenciar quando for enfermeiro					
18.	Tempo reduzido para estar com os familiares					
19.	Perceber a responsabilidade profissional quando está atuando no campo de estágio					
20.	Observar atitudes conflitantes em outros profissionais					
21.	Sentir que adquiriu pouco conhecimento para fazer a prova prática					
22.	Transporte público utilizado para chegar à faculdade					
23.	Tempo exigido pelo professor para a entrega das atividades extraclasse					
24.	Distância entre a maioria dos campos de estágioeo local de moradia					
25.	Vivenciar as atividades, como enfermeiro em formação, no campo de estágio					
26.	Faltar tempo para o lazer					
27.	Perceber a relação entre o conhecimento teórico adquirido no curso e					
	o futurodesempenhoprofissional					
28.	Assimilar o conteúdo teórico-prático oferecido em sala de aula					
29.	Transporte público utilizado para chegar ao local do estágio					
30.	Faltar tempo para momentos de descanso					

Cálculo dos escores:

Para aferição do resultado, deve ser feita a soma do número correspondente da intensidade de estresse dos itens presentes em cada domínio. O domínio com maior pontuação seráconsiderado predominante e com maior intensidade de estresse para o respondente.

Domínio 1:(6 itens) 4, 5, 7, 9, 12, 21Domínio 2:(4 itens) 6, 8, 16, 20Domínio 3:(5 itens) 3, 18, 23, 26, 30Domínio 4:(4 itens) 11, 22, 24, 29Domínio 5:(6 itens) 1, 15, 17, 19, 25, 27Domínio 6:(5 itens) 2, 10, 13, 14, 28

Interpretação dos escores:

Domínio 1: 0-9 baixo nível de estresse; 10-12 médio nível de estresse; 13-14 altonível deestresse; 15-18 muito alto nível de estresse.

- Domínio 2: 0-5 baixo nível de estresse; 6 médio nível de estresse; 7-8alto nível de estresse; 912 muito alto nível de estresse.
- Domínio 3: 0-10 baixo nível de estresse; 11-12 médio nível de estresse; 13-14 alto nível de estresse; 15 muito alto nível de estresse.
- Domínio 4: 0-7 baixo nível de estresse; 8-10 médio nível de estresse; 11 alto nível de estresse; 12 muito alto nível de

estresse.

- Domínio 5: 0-9 baixo nível de estresse; 10 médio nível de estresse; 11-12 alto nível de estresse; 13-18 muito alto nível de estresse.
- Domínio 6: 0-9 baixo nível de estresse; 10-11 médio nível de estresse; 12-13 alto nível de estresse; 14-15 muito alto nível de estresse.

Annex 3 - Stress Assessment in Nursing Students – Version Reduced [14]apud[15].

Leia atentamente cada item abaixo e marque com um "X" o número correspondente com a intensidade de estresse que a situação lhe provoca, conforme a legenda a seguir:

0	1	2	3
Nãovivencio a situação	Não me sinto estressado	Me sinto pouco estressado	Me sinto muito estressado
	com a	com	com
	situação	a situação	a situação

1	A obrigatoriedade em realizar os trabalhos extraclasse	0	1	2	3
2	Realizar os procedimentos assistenciais de modo geral	0	1	2	3
3	Comunicação com os demais profissionais da unidade de estágio	0	1	2	3
4	O ambiente da unidade clínica de estágio	0	1	2	3
5	Comunicação com os profissionais de outros setores no local de estágio	0	1	2	3
6	Ter medo de cometer erros durante a assistência ao paciente	0	1	2	3
7	A forma adotada para avaliar o conteúdo teórico	0	1	2	3
8	Distância entre a faculdade e o local de moradia	0	1	2	3
9	Sentir insegurança ou medo ao fazer as provas teóricas	0	1	2	3
10	O grau de dificuldade para a execução dos trabalhos extraclasse	0	1	2	3
11	Perceber as dificuldades que envolvem o relacionamento com outros profissionais	0	1	2	3
	da área				
12	Perceber a responsabilidade profissional quando está atuando no campo de estágio	0	1	2	3
13	Observar atitudes conflitantes em outros profissionais	0	1	2	3
14	Transporte público utilizado para chegar à faculdade	0	1	2	3
15	Tempo exigido pelo professor para a entrega das atividades extraclasse	0	1	2	3
16	Distância entre a maioria dos campos de estágio e o local de moradia	0	1	2	3
17	Faltar tempo para o lazer	0	1	2	3
18	Transporte público utilizado para chegar ao local do estágio	0	1	2	3
19	Faltar tempo para momentos de descanso	0	1	2	3

Figures 1 e 2 - Perceived Stress Scale (PSS) [16].

Figure 1

APPENDIX A:

Items and Instructions for Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate *how often* you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:

- 0. never
- 1. almost never
- 2. sometimes
- 3. fairly often
- 4. very often
- 1. In the last month, how often have you been upset because of something that happened unexpectedly?
- 2. In the last month, how often have you felt that you were unable to control the important things in your life?
- 3. In the last month, how often have you felt nervous and "stressed"?
- 4.^a In the last month, how often have you dealt successfully with irritating life hassles?
- 5.^a In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?
- 6.^a In the last month, how often have you felt confident about your ability to handle your personal problems?
- 7.^a In the last month, how often have you felt that things were going your way?
- 8. In the last month, how often have you found that you could not cope with all the things that you had to do?
- 9.ª In the last month, how often have you been able to control irritations in your life?
- 10.^a In the last month, how often have you felt that you were on top of things?

Figure 2

APPENDIX A (Continued)

- 11. In the last month, how often have you been angered because of things that happened that were outside of your control?
- 12. In the last month, how often have you found yourself thinking about things that you have to accomplish?
- 13.^a In the last month, how often have you been able to control the way you spend your time?
- 14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

^a Scored in the reverse direction.

Annex4 -Perceived Stress Scale in Brazilian Portuguese [16]apud[17].

Itens e instruções para aplicação

As questões nesta escala perguntam sobre seus sentimentos e pensamentos durante o último mês. Em cada caso, será pedido para você indicar o quão frequentemente você tem se sentido de uma determinada maneira. Embora algumas das perguntas sejam similares, há diferenças entre elas e você deve analisar cada uma como uma pergunta separada. A melhor abordagem é responder a cada pergunta razoavelmente rápido. Isto é, não tente contar o número de vezes que você se sentiu de uma maneira particular, mas indique a alternativa que lhe pareça como uma estimativa razoável. Para cada pergunta, escolha as seguintes alternativas:

- 0= nunca
- 1= quase nunca
- 2= às vezes
- 3= quase sempre

4= sempre

Ne	ste último mês, com que frequência					
1	Você tem ficado triste por causa de algo que aconteceu inesperadamente?	0	1	2	3	4
2	Você tem se sentido incapaz de controlar as coisas importantes em sua vida?	0	1	2	3	4
3	Você tem se sentido nervoso e "estressado"?	0	1	2	3	4
4	Você tem tratado com sucesso dos problemas difíceis da vida?	0	1	2	3	4
5	$Voc {\hat{e}tems entidoque est} {\hat{a}lidando bemas mudanças importantes que est {\hat{a}oo correndo em suavida?}$	0	1	2	3	4
6	Você tem se sentido confiante na sua habilidade de resolver problemas pessoais?	0	1	2	3	4
7	Você tem sentido que as coisas estão acontecendo de acordo com a sua vontade?	0	1	2	3	4
8	Vocêtemachadoquenãoconseguirialidarcomtodasascoisasquevocêtemquefazer?	0	1	2	3	4
9	Você tem conseguido controlar as irritações em sua vida?	0	1	2	3	4
10	Você tem sentido que as coisas estão sob o seu controle?	0	1	2	3	4
11	Você tem ficado irritado porque as coisas que acontecem estão fora do seu controle?	0	1	2	3	4
12	Você tem se encontrado pensando sobre as coisas que deve fazer?	0	1	2	3	4
13	Você tem conseguido controlar a maneira como gasta seu tempo?	0	1	2	3	4
14	Vocêtemsentidoqueas dificulda dessea cumula maponto devocê a creditar que não pode superá-las?	0	1	2	3	4

Annex 5 -Perceived Stress Scale in Portuguese from Portugal [16]apud [18]

Anexo

Instruções e itens traduzidos da Perceived Stress Scale

Para cada questão, pedimos que indique com que frequência se sentiu ou pensou de determinada maneira, durante o último mês. Apesar de algumas perguntas serem parecidas, existem diferenças entre elas e deve responder a cada uma como perguntas separadas. Responda de forma rápida e espontânea. Para cada questão, escolha a alternativa que melhor se ajusta à sua situação.

0 - Nunca. 1 - Quase nunca. 2 - Algumas vezes. 3 - Frequentemente. 4 - Muito frequentemente.

1. No último mês, com que frequência esteve preocupado(a) por causa dealguma coisa que

aconteceu inesperadamente?

- 2. No último mês, com que frequência se sentiu incapaz de controlar ascoisas importantes da sua vida?
- 3. No último mês, com que frequência se sentiu nervoso(a) e em stresse?
- 4[†].No último mês, com que frequência sentiu confiança na sua capacidade para enfrentar os seus problemas pessoais?
- 5[†]. No último mês, com que frequência sentiu que as coisas estavam acorrer à sua maneira?
- 6. No último mês, com que frequência sentiu que não aguentava com ascoisas todas que tinha para fazer?
- 7[†]. No último mês, com que frequência foi capaz de controlar as suas irritações?
- 8[†]. No último mês, com que frequência sentiu ter tudo sob controlo?
- 9. No último mês, com que frequência se sentiu furioso(a) por coisas que ultrapassaram o seu controlo?
- 10. No último mês, com que frequência sentiu que as dificuldades se estavam a acumular tanto que não as conseguia ultrapassar?

† Itens cotados de forma inversa.

Annex 6 - Perceived Stress Scale 4 (PSS-4)[16] apud [19].

Perceived Stress Scale 4(PSS-4)

The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate your response by placing an "X" over the square representing HOW OFTEN you felt or thought a certain way.

		Never	Almost Never	Sometimes	Fairly Often	Very Often
		0	1	2	3	4
1.	In the last month, how often have you felt that you were unable to control the important things in your life?					
2.	In the last month, how often have you felt that you were unable to control the important things in your life?					
3.	In the last month, how often have you felt confident about your ability to handle your personal problems?					
4.	In the last month, how often have you felt that things were going yourway?					
5.	In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?					

Scoring for the Perceived Stress Scale 4:

Questions 1 and 4	Questions 2 and 3
0 = Never	4 = Never
1 = Almost Never	3 = Almost Never
2 = Sometimes	2=Sometimes
3 = Fairly Often	1 =Fairly Often
4 = Very Often	0 = Very Often

Lowest score: 0 Highest score: 16

Higher scores are correlated to more stress.

Annex7 -Lipp Adult Stress Symptom Inventory [20] apud [1].

QUADRO -1

QUADRO - 2

Você vai me dizer os sintomas que sentiu na últimasemana (de____ atéhoje) () 01 Problemas com amemória () 02 Mal-estar generalizado, sem motivo () 03 Formigamento demãos/pés () 04 Sensação de desgaste físicoconstante () 05 Mudança deapetite () 06 Aparecimento de problema de pele () 07 Pressão alta () 08 Cansaço constante () 09 Aparecimento de úlcera () 10 Tontura ou sensação de estarflutuando () 11 Muito sensível em nível deemoção () 12 Dúvida quanto a si próprio () 13 Pnesar direto em um só assunto () 14 Irritabilidadeexcessiva www.lagrs.lanpiminuição do desejo por sexo Page | 142

QUADRO 3

Você vai me dizer os sintomas que sentiu no último mês (deaté hoje).

- () 01 Diarreia frequente
- () 02 Dificuldade com sexo
- () 03 Dificuldade para pegar no sono/acordar durante a noite
- () 04 Náuseas/ânsia de vômito
- () 05 Tiques/manias, por exemplo: ficar mexendo no cabelo
- () 06 Pressão alta direto
- () 07 Problemas de pele por um tempo longo
- () 08 Mudança extrema de apetite
- () 09 Excesso de gases [estômago/intestino(barriga)]
- () 10 Tontura frequente
- () 11 Úlcera
- () 12 Enfarte
- () 13 Impossibilidade de trabalhar () 14 Pesadelos
- () 15 Sensação de não ser competente em todas as áreas

Avaliação

F1 ()	
F2()	
F3 ()	
Total (vertical)	

Total (horizontal)

- P1 ()
- P2 ()
- P3 ()
- P()

Aesthetic rehabilitation with ultra-thin ceramic veneers - Case report

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Abstract— The evolution of the ceramic systems increasingly seeks to meet the aesthetic and functional needs of the restorations, providing composites with greater tenacity, translucency and resistance to traction and flexion, increasing the longevity of the restorations. Concomitantly with the development of restorative materials and minimally invasive techniques, professionals combine digital tools to improve visualization of aesthetic problems, create possible solutions and accurately guide clinical and laboratory procedures to achieve predictable results. Thus, in this case report we aimed to describe the changes in facial expression, through ultrathin ceramic laminates in patients with the main complaint of dissatisfaction with the aesthetic appearance of their smile. The team of professionals followed all the clinical steps required, from digital planning, restorative testing, mock up, the choice of material and the cementation of the restorations. In this way, it was possible to obtain satisfactory aesthetic results, through the choice of a highly personalized treatment, with adequate materials and planning the patient's needs.

Keywords—Dental aesthetics, Ceramics, Dental prosthesis, Dental Veneer.

I. INTRODUCTION

In the last decades, the facial beauty has been shown with enormous importance in the most varied areas of life in society. Despite the subjectivity of the concept of beauty pattern, the aesthetics industry together with the media and the contemporary community establish body and facial patterns that are increasingly demanding and difficult to achieve through the overvaluation of the phenotype (FRESE; STAEHLE; WOLFF, 2012).

The increasing search for improvement in the appearance of teeth is one of the main reasons why the patient has sought treatment in dental offices (CÖTERT; DÜNDAR; OZTÜRK, 2009).

These treatments have provided satisfactory results due to the advance of conservative restorative techniques, combined with the development of new materials. Thus, modern dentistry has been improved in less invasive and more efficient clinical procedures capable of promoting a harmonization of the smile with an aesthetic and functional balance (HWANG et al., 2012; KORKUT; YANIKOĞLU; GÜNDAY, 2013).

Thus, the ideal model proposes to obtain a smile with white teeth, aligned in the arch, with a balance between the white architecture (teeth) and the pink architecture (gingival tissue) and free from any wear and tear, such as dental trauma, changes in color, shape, structural abnormalities, and position of anterior teeth. In all these changes, getting a beautiful smile is always the main goal ((BHUVANESWARAN, 2010).

In this context, ceramic laminates represent a restorative modality of minimally invasive approach with clinically satisfactory results as changes in color, shape or positions preserving the remaining tooth (WOLFF et al., 2010).

The manufacture of ceramic laminates includes the most varied types of reinforcing crystals that allow the production of thinner, highly esthetic and more wear resistant coatings (MORAES et al., 2018).

With the evolution of the reinforced ceramic pieces and the adhesion system, it has become possible to develop very thin venners with thickness ranging between 0.3 and 0.5 mm (SHETTY et al., 2011).

The most commonly accepted name in the scientific literature for these types of facets is dental contact lens, where through a small wear on the dental structure, a porcelain layer (PINI et al., 2012).

Thus, restorations with minimally invasive ceramic laminates in recent years has become a widely accepted, predictable procedure for longevity regarding periodontal response and patient satisfaction (SHETTY et al., 2011; KORKUT; YANIKOĞLU; GÜNDAY, 2013).

The aim of this study is to describe the alteration in facial expression, with the change in harmony and the relationship between the anterior teeth, through ultrafine ceramic laminates associated with two visualization techniques prior to the rehabilitation treatment: the mock up test, and digital planning.

II. CASE REPORT

General profile of the patient

A 45 year-old male patient, who reported dissatisfaction with her smile, with no relevant systemic medical history, was treated in the Dental Center of Itabuna, Brazil.

Clinical findings

Extra-oral examination of the patient revealed an asymmetrical commissural plane and smile alterations (Fig.1A). The intraoral examination showed stable occlusion, slight anterior-lower crowding and wear of the edges of the maxillary central incisors, change in color, shape and size (Fig.1B-C). In addition, mild attrition were observed in the central incisors, height 10.02 mm (Fig.1D



Fig.1: A - Extra-oral evaluation of altered smile line; B -Intraoral view during occlusion; C - Frontal close-up view before treatment; D - Height of the maxillary central incisors measured using a digital caliper.

After clinical, radiographic, photographic examination and the digital smile designer evaluation (DSD) was done through the preparation of study models waxing (Fig.2A-B). Based on our evaluation, a conservative treatment approach was proposed through the manufacture of indirect laminates of lithium disilicate in the central, lateral, and canine incisors.

Therapeutic intervention

The first step of the treatment was the alginate (Hydrogum 5, Zhermack, Badia Polesine, RO, Italy) molding to obtain diagnostic waxing, which served as the

basis for the creation of an addition silicone matrix (Express XT, 3M ESPE, St. Paul, Mn, USA) for performing the mock-up assay. The silicon matrix was customized with a scalpel blade for cervical contouring that provided a precise mock-up without excess. For the mock-up the silicon matrix was filled with bisacrylic resin (Protemp 4, 3M ESPE, St. Paul, MN, USA) and brought into position. It was observed that the customization of the cervical contour facilitated the removal of the excesses of the provisional material. Then the custom matrix and the resin layer were removed with cotton soaked in alcohol. The mock-up was finalized after total removal of the excess with scalpel blade. A conservative preparation for ceramic laminates was performed with a fine-grained diamond drill (# 1012 and # 2135F, KG Sorensen, SP, Brazil), followed by finishing the preparation with multilaminated drills (# 118L, Angelus Prima Dental, Londrina, PR, Brazil) and flexible abrasive discs (Sof-lex, 3M ESPE, St. Paul, MN, USA). Gingival Retraction Cord was obtained using wire retractor (Ultrapak # 000, UltradentSouth, South Jordan, UT, USA). The ceramic color was designated by the color scale co-mo Blitting 3 (Ivoclar A-D, Ivoclar Vivadent, Schann Liechtenstein) (Fig.2C). The spacing wires were removed and the molding was performed with addition silicone in the one-step molding technique. The heavy silicone was inserted into the tray and then the fluid was first applied onto the teeth and then into the tray. After 5 minutes, the tray was removed and checked. Interocclusal registration was performed with silicone for occlusal registration (Scan Light, Yller, Pelo-tas, RS, Brazil). In the laboratory, the scanning of the plaster model was carried out to make the digital model, and then the digital planning of the ceramics and subsequent milling of the pieces were done. Lithium disilicate ceramics were used (IPS e.max Press. Ivoclar Vivadent, Schann Liechtenstein). The low-grade Opaque White color was selected and confirmed using test paste to simulate the color of the cement (Allcem Veneer APS Try-In, FGM, Joinville, SC, Brazil). The internal surfaces of the laminates were conditioned with 10% hydrofluoric acid for 20 seconds (Condac Porcelana, FGM, Joinville, SC, Brazil). As superfícies foram lavadas com água e a seguir foi aplicado ácido fosfórico a 37% durante 60 segundos (Condac, FGM, Joinville, SC, Brasil) e novamente lavadas. The laminates were silanized with a silane coupling agent (Prosil, FGM, Joinville, SC, Brazil). The enamel was conditioned with 37% phosphoric acid for 30 seconds (Condac, FGM, Joinville, SC, Brazil), while the adjacent teeth were protected (Isotape, TDV Dental, Pomerode, SC, Brazil). The adhesive agent (Scotchbond,

3M ESPE, St. Paul, Mn, USA) was applied over the enamel. The photopolymerizable resin cements (Allcem Veneer APS, FGM, Joinville, SC, Brazil) were used in the ceramic veneers. The excess cement was removed with a brush (KG brush, KG Sorensen, SP, Brazil), and each surface was photopolymerized for 60 seconds by a light emitting light-curing radiator of 1200 mW /cm² (Radii-Cal, SDI, Bayswater, Australia). The excess cement was removed and the finishing and polishing was done on the edges of the ceramic. The occlusal contacts were marked, and the protrusion and laterality movements were checked. The final appearance is shown in Figure 2D.



Fig.2: A – Dental design, B – Ideal dental design; C -Color selection Log; D - Frontal view close-up after treatment.

III. DISCUSSION

Dental treatments for performing aesthetic procedures have as main objective to achieve a design that corresponds with the functional, aesthetic and emotional needs of the patient (COACHMAN et al., 2014).

In recent years, the increasing search for highly personalized treatments has provided the development and improvement of new techniques and materials that meet the expectations of the dental surgeon and the patient (VENEZIANI, 2017).

Therefore, the predictability in the dental treatment has become very important as it provides the planning of cases through studies, changes, plaster models, waxing and photographs. Some tools such as the use of digital smile design (DSD) together with the mock up technique, in the planning and execution of aesthetic rehabilitations, allows to develop a treatment plan and use it initially as a product sale, guaranteeing patient confidence and credibility (MEEREIS et al., 2016).

Thus, the methodology used in this study showed that ultra-thin ceramic laminates associated with previous visualization techniques were capable of altering the facial expression, harmony and relationship between the anterior teeth, providing an improvement in the patient's self-esteem.

A combination of the intraoral mock-up and the mathematical parameters allowed more predictable results because it took into consideration the initial and final color desired for the tooth by calculating the required thickness of the ceramic system selected to achieve this color and the height and width of central incisors (SCHMIDT et al., 2011).

It is also necessary to consider the type of material used in the making of the facets and their implications on the results obtained. In this case the ceramics reinforced by lithium disilicate were used due to their satisfactory mechanical properties, greater resistance to bending, without losing the aesthetic characteristics (FUZZI et al., 2017).

Another relevant point is the color and shape of the restorations with ceramic laminates, in this case report, which were obtained with the least wear in the tooth structure.

In summary, it is necessary to emphasize that in order to achieve aesthetic excellence, it is not enough to only use good materials and techniques, that is, a correct diagnosis and adequate planning, should be considered as a primordial and indispensable stage.

IV. CONCLUSION

Thus, it is possible to conclude that the design proposed by the team of professionals provided a highly personalized treatment, that is, all steps were chosen correctly which made the results satisfactory for the professionals and the patient.

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Dual-channel Supply Chain Pricing Decisions under Network Sales Efficiency and Equity

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Abstract— Considering the difference in the efficiency of direct selling and e-commerce online sales, this paper takes the manufacture-led dual-channel supply chain as the research object and takes no fair concern as the benchmark to analyze the influence of network marketing efficiency and fair concern mode on the pricing decision of dual-channel supply chain. The research results show that: with the improvement of the network sales efficiency of manufacturers, under the non-dual-member equity concerns (N, M and R modes), both the selling price of e-commerce and the direct selling price of manufacturers will be reduced, and the price reduction rate of manufacturers is faster than that of e-commerce. Under the dual-fair concern (MR) model, the selling price of e-commerce will be reduced, but whether the direct selling price of manufacturers will be reduced depends on the degree of fair concern of both sides. The leading party's equity concern will reduce the impact of network sales efficiency on price reduction, while the follower's equity concern will enhance the impact of network sales efficiency on price reduction. In addition, the influence of network marketing efficiency on price reduction and speed reduction of manufacturers in MR mode is simulated.

Keywords—dual-channel supply chain, equity concerns, Stackelberg games, network sales efficiency..

I. INTRODUCTION

With the in-depth integration of the Internet and consumer behavior, manufacturers' sales strategies have been expanded from physical sales to electronic channels such as HP, IBM, and others. They have opened direct selling websites and cooperated with e-commerce platforms to build their products' online sales channels. The involvement of manufacturers in online sales has brought a certain impact on e-commerce, thus intensifying the fierce competition between manufacturers and e-commerce enterprises and causing channel conflicts (Qiu and Xu 2019). Meanwhile, through a large number of experiments, behavioral researchers have learned that decision-making subjects have behavioral characteristics of equity concerns (Güth et al 1982, Kahneman et al 1986, Ho and Zhang 2008). Faced with many problems in the operation of dual-channel mode, many scholars have carried out corresponding researches. For example, Wang (2012) studied the coordination of dual-channel supply chain under different models of equity concern. Li (2017)

studied the influence of retailers' fair concerns on cooperative advertising decisions of dual-channel supply chain under the game dominated by manufacturers. Li (2015) studied the impact of the fair concern behavior of traditional retail enterprises on the ordering decision of dual-channel supply chain. The above research shows that the fair concern behavior of traditional retail enterprises affects the decision-making of members of dual-channel supply chain.

In addition, channel cost is becoming the main indicator of competition among supply chain members. In this regard, Li (2009) analyzed the impact of channel sales efficiency on dual-channel game pricing. Liu (2015) studied the influence of network channel entry on double-channel validity under different channel sales efficiency. Zhang (2017) studied the impact of distribution efficiency on pricing and coordination of dual-channel supply chain enterprises. Shu and Jian (2017) studied the impact of e-commerce efficiency on dual-channel game with different rights structure under the concern of traditional retail enterprises' equity. Du (2010) studied the influence of manufacturer's network sales efficiency on enterprise pricing and performance under three different rights models under the concern of e-commerce fairness.

To sum up, at present, to consider fair under the concern of dual channel supply chain coordination problem, most of the literature in the traditional retail and direct sales of double channels as the research object, few literature consider sales efficiency and fairness is concerned with the pricing problem of the supply chain. This paper takes the dual channel composed of direct selling and e-commerce as the research object, considers the difference of online sales efficiency between direct selling and e-commerce, and takes no fair concern as the benchmark to analyze the impact of manufacturers' on line sales efficiency on manufacturers' and e-commerce's price reduction decisions under different fair concern modes and degrees.

II. PROBLEM DESCRIPTION AND HYPOTHESIS

Assumed that the manufacturer produces a product and sells it through e-commerce wholesale and online direct sales. Because the two sides have a single market, they have competitive behavior, and face different fair concern mode, the bidding game behavior between the two will change. Based on this, this paper proposes the following hypothesis: (1)Single manufacturer and single e-commerce are rational decisions, complete information to each other;

(2)The manufacturer's production cost is c, the wholesale price of per unit product is w, the network selling cost of e-commerce and the direct selling cost of manufacturers are x and kx, k > 0 respectively. Where k is the efficiency coefficient of online sales of manufacturers relative to e-commerce. The larger k is, the lower the efficiency of online sales of manufacturers relative to e-commerce;

(3) The direct selling price and e-commerce selling price

under different fair concern models are p_m^i and p_e^i

respectively, i = N, M, R, MR;

(4) The market demand of e-commerce and manufacturers is $q_e^i = \mu a - p_e^i + \beta p_m^i, q_m^i = (1 - \mu)a - p_m^i + \beta p_e^i$. Since the product pricing of competitive enterprises has less impact on the network market demand than the product pricing of the enterprise has on the network market demand, $0 < \beta < 1$, The profit for both parties is $\pi_{e}^{i} = (p_{e}^{i} - w - x)q_{m}^{i}, \pi_{m}^{i} = (p_{m}^{i} - kx - c_{m})q_{m}^{i} + (w - c)q_{e}^{i};$ (5) If the fair concern coefficient $\lambda_m \ge 0, \lambda_e \ge 0$ of manufacturer and retailer is introduced, then the utility function of manufacturer and e-commerce under fair concern is $u_e^i = (1 + \lambda_e)\pi_e^i - \lambda_e\pi_m^i, u_m^i = (1 + \lambda_m)_m^i - \lambda_m\pi_e^i$.

III. GAME MODEL CONSTRUCTION AND SOLUTION UNDER DIFFERENT FAIR CONCERN MODELS

3.1 Unfair concerns (N mode)

In this mode $\lambda_m = \lambda_r = 0$, the profit function of the manufacturer and the e-commerce is:

$$\pi_{e} = (p_{e} - w - x)(\mu a - p_{e} + \beta p_{m})$$

$$\pi_{m} = (p_{m} - kx - c)[(1 - \mu)a - p_{m} + \beta p_{e}] + (w - c)(\mu a - p_{e} + \beta p_{m})$$
(1)

Under the guidance of manufacturers, the game solution results are shown in equations (2) and (3)

$$p_m^N = \frac{(\beta\mu + 2 - 2\mu)a}{2(2 - \beta^2)} + \frac{(1 - \beta)(2 + \beta)c}{2(2 - \beta^2)} + \frac{(\beta + 2k - \beta^2 k)x}{2(2 - \beta^2)} + \frac{\beta w}{(2 - \beta^2)}$$
(2)

$$p_{e}^{N} = \frac{\mu a + w + x}{2} + \frac{(\beta \mu + 2 - 2\mu)\beta a}{4(2 - \beta^{2})} + \frac{(1 - \beta)(2 + \beta)\beta c}{4(2 - \beta^{2})} + \frac{(\beta + 2k - \beta^{2}k)\beta x}{4(2 - \beta^{2})} + \frac{\beta^{2}w}{2(2 - \beta^{2})}$$
(3)

3.2 E-commerce equity concerns (mode E)

In this mode, $\lambda_m = 0, \lambda_e > 0$, the profit function of the manufacturer and the e-commerce is: $u_e^E = (1 + \lambda_e)[(p_e^E - w - x)(\mu a - p_e^E + \beta p_m^E)] - \lambda_e[(p_m^E - kx - c)[(1 - \mu)a - p_m^E + \beta p_e^E] + (w - c)(\mu a - p_e^E + \beta p_m^E)]$ (4) $\pi_m^E = (p_m^E - kx - c)[(1 - \mu)a - p_m^E + \beta p_e^E] + (w - c)(\mu a - p_e^E + \beta p_m^E)$

Under the guidance of manufacturers, the game solution results are shown in equations (5) and (6)

$$p_{m}^{E} = (1+\lambda_{e})\frac{(2-2\mu+\beta\mu)}{2(2+2\lambda_{e}-\beta^{2})}a + \frac{(1-\beta)(2+\beta+(2-\beta)\lambda_{e})}{2(2+2\lambda_{e}-\beta^{2})}c + \frac{2k+\beta-k\beta^{2}+\lambda_{e}(\beta+2k+k\beta^{2})}{2(2+2\lambda_{e}-\beta^{2})}x + \frac{(2\lambda_{e}+1)w\beta}{2+2\lambda_{e}-\beta^{2}}$$
(5)

$$p_{e}^{E} = \frac{a\mu + x + w}{2} + \frac{(2 - 2\mu + \beta\mu)}{4(2 + 2\lambda_{e} - \beta^{2})}a + \frac{(1 - \beta)(\beta(2 + \beta) - 4\lambda_{e})}{4(2 + 2\lambda_{e} - \beta^{2})}c + \frac{2k + \beta - k\beta^{2} + 4k\lambda_{e}}{4(2 + 2\lambda_{e} - \beta^{2})}\beta x + \frac{w(\beta^{2} + 2\lambda_{e})}{2(2 + 2\lambda_{e} - \beta^{2})}$$
(6)

3.3 Manufacturer's equity concerns(mode M)

In this mode, $\lambda_m > 0$, $\lambda_e = 0$, the profit function of the manufacturer and the e-commerce is:

$$\pi_{e}^{M} = (p_{e}^{M} - w - x)(\mu a - p_{e}^{M} + \beta p_{m}^{M})$$

$$u_{m}^{M} = (1 + \lambda_{m})[(p_{m}^{M} - kx - c)[(1 - \mu)a - p_{m}^{M} + \beta p_{e}^{M}] + (w - c)(\mu a - p_{e}^{M} + \beta p_{m}^{M})] - (p_{e}^{M} - w - x)(\mu a - p_{e}^{M} + \beta p_{m}^{M})]$$
(7)

Under the guidance of manufacturers, the game solution results are shown in equations (8) and (9)

$$p_{m}^{M} = \frac{(1+\lambda_{m})(2-2\mu+\mu\beta)-\mu\lambda_{m}\beta}{2(1+\lambda_{m})(2-\beta^{2})+\beta^{2}\lambda_{m}}a + \frac{(1+\lambda_{m})(2-\beta^{2}-\beta)}{2(1+\lambda_{m})(2-\beta^{2})+\beta^{2}\lambda_{m}}c + \frac{(1+\lambda_{m})(2k+\beta-\beta^{2}k)+\lambda_{m}\beta}{2(1+\lambda_{m})(2-\beta^{2})+\beta^{2}\lambda_{m}}x + \frac{2+3\lambda_{m}}{2(1+\lambda_{m})(2-\beta^{2})+\beta^{2}\lambda_{m}}\beta w$$
(8)

$$p_{e}^{M} = \frac{\mu a + w + x}{2} + \frac{(1 + \lambda_{m})(2 - 2\mu + \mu\beta) + \mu\lambda_{m}\beta}{4(1 + \lambda_{m})(2 - \beta^{2}) + \beta^{2}\lambda_{m}}\beta a + \frac{(1 + \lambda_{m})(2 - \beta^{2} - \beta)}{4(1 + \lambda_{m})(2 - \beta^{2}) + \beta^{2}\lambda_{m}}\beta c + \frac{(1 + \lambda_{m})(2k + \beta - \beta^{2}k + \lambda_{m}\beta)}{4(1 + \lambda_{m})(2 - \beta^{2}) + \beta^{2}\lambda_{m}}\beta x + \frac{2 + 3\lambda_{m}}{4(1 + \lambda_{m})(2 - \beta^{2}) + \beta^{2}\lambda_{m}}\beta^{2}w$$
(9)

3.4 Fair concerns on both sides (MR model)

In this mode, $\lambda_m > 0$, $\lambda_e > 0$, the profit function of the manufacturer and the e-commerce is:

$$u_{e}^{MR} = (1+\lambda_{e})[(p_{e}^{MR} - w - x)(\mu a - p_{e}^{MR} + \beta p_{m}^{MR})] - \lambda_{e}[(p_{m}^{MR} - kx - c)[(1-\mu)a - p_{m}^{MR} + \beta p_{e}^{MR}] + (w - c)(\mu a - p_{e}^{MR} + \beta p_{m}^{MR})]$$
(10)
$$u_{m}^{MR} = (1+\lambda_{m})[(p_{m}^{MR} - kx - c)[(1-\mu)a - p_{m}^{MR} + \beta p_{e}^{MR}] + (w - c)(\mu a - p_{e}^{MR} + \beta p_{m}^{MR})] - \lambda_{m}(p_{e}^{MR} - w - x)(\mu a - p_{e}^{MR} + \beta p_{m}^{MR})]$$
(10)

Under the guidance of manufacturers, the game solution results are shown in equations (11) and (12)

$$p_{m}^{MR} = \frac{1}{4(1+\lambda_{m})(1+\lambda_{e}) - \beta^{2}(2+(1-2\lambda_{e})\lambda_{m})} \{ [(2-2\mu+\mu\beta)(1+\lambda_{e}) + 2(1-\mu)\lambda_{m}(1+\lambda_{e})]a + (2k+\beta-k\beta^{2}+(2\beta+2k-k\beta^{2})\lambda_{m} - 2k\beta^{2}\lambda_{e}^{2}\lambda_{m} + \lambda_{e}(\beta+2k+k\beta^{2}+(2\beta+2k+k\beta^{2})\lambda_{m}))x + (1-\beta)(2\beta\lambda_{e}^{2}\lambda_{m} + (2+\beta)(1+\lambda_{m}) + (2-\beta)\lambda_{e}(1+\lambda_{m}))c + (1+2\lambda_{e})[2+(3-\lambda_{e})\lambda_{m}]w\beta \}$$
(11)

$$p_{m}^{MR} = \frac{a\mu + x + w}{2} + \frac{\left[(2 - 2\mu + \mu\beta) + 2(1 - \mu)\lambda_{m}\right]a\beta}{8(1 + \lambda_{m})(1 + \lambda_{e}) - 2\beta^{2}(2 + (1 - 2\lambda_{e})\lambda_{m})} + \frac{(1 - \beta)(\beta(2 + \beta)(1 + \lambda_{m}) - 4\lambda_{e}^{2}(1 + \lambda_{m}) - \lambda_{e}(4 - 2\beta - \beta^{2} + 2(2 - \beta)\lambda_{m})}{2(1 + \lambda_{e})[4 - 2\beta^{2} + (4 - \beta^{2})\lambda_{m} + 2\lambda_{e}[2 + (2 + \beta^{2})\lambda_{m}]]}c$$

$$+ \frac{2k + \beta - k\beta^{2} + (2\beta + 2k - k\beta^{2})\lambda_{m} + 4k\lambda_{e}^{2}(1 + \lambda_{m}) + \lambda_{e}(\beta + 6k - k\beta^{2} + 2(\beta + 3k)\lambda_{m})}{2(1 + \lambda_{e})[4 - 2\beta^{2} + (4 - \beta^{2})\lambda_{m} + 2\lambda_{e}[2 + (2 + \beta^{2})\lambda_{m}]]}x\beta + \frac{4\lambda_{e}^{2}(1 + \lambda_{m}) + \beta^{2}(2 + 3\lambda_{m}) + 2\lambda_{e}(2 + \beta^{2} + (1 + \beta^{2})\lambda_{m})w}{2(1 + \lambda_{e})[2M_{4} + (2 + M_{4})\lambda_{m} + 2\lambda_{e}[2 + (2 + \beta^{2})\lambda_{m}]]}$$

$$(12)$$

IV. COMPARISON AND ANALYSIS

This section takes no fair concerns as the benchmark to explore the influence of network sales efficiency k on the game of dual-channel supply chain under different fair concerns. Through comparative analysis, propositions 1,2 and 3 can be obtained.

Proposition 1: p_m^N , p_m^E , p_m^M , p_e^N , p_e^E , p_e^M , p_e^{MR} is positively correlated with k; If p_m^{MR} is positively correlated with k, then λ_m, λ_e must satisfy certain conditions.

Proof:

$$\frac{\partial p_m^N}{\partial k} = \frac{x}{2}, \quad \frac{\partial p_e^N}{\partial k} = \frac{\beta x}{4}$$
(13)
$$\frac{\partial p_m^E}{\partial k} = \frac{2 - \beta^2 + \lambda_e (2 + \beta^2)}{2(2 - \beta^2 + 2\lambda_e)} x \quad , \quad \frac{\partial p_e^E}{\partial k} = \frac{2 - \beta^2 + 4\lambda_e}{4(2 - \beta^2) + 8\lambda_e} \beta x$$
(14)
$$\frac{\partial p_m^M}{\partial k} = \frac{(2 - \beta^2)(\lambda_m + 1)}{2(2 - \beta^2) + (4 - \beta^2)\lambda_m}, \quad \frac{\partial p_e^M}{\partial k} = \frac{(2 - \beta^2)(1 + \lambda_m)}{2(2 - \beta^2) + (4 - \beta^2)\lambda_m} \beta x$$
(15)

$$\frac{\partial p_m^{MR}}{\partial k} = \frac{(1+\lambda_m)(2-\beta^2+\lambda_e(2+\beta^2))-2\beta^2\lambda_e^2\lambda_m}{4(1+\lambda_m)(1+\lambda_e)+2\lambda_e(2+(2+\beta^2)\lambda_m)}x$$

$$\frac{\partial p_e^{MR}}{\partial k} = \frac{4\lambda_e(1+\lambda_m+\lambda_e\lambda_m)+(2-\beta^2)(1+\lambda_m+\lambda_e)+6\lambda_e\lambda_m}{2(1+\lambda_e)[2(2-\beta^2)(1+\lambda_m)+\lambda_e[4+\beta^2+2(2+\beta^2)\lambda_m]]}x\beta$$
(16)

Because of x > 0, $\frac{\partial p_m^N}{\partial k} > 0$ is true; Because of $0 < \beta < 1$, so $2 - \beta^2, 4 - \beta^2$ are both greater than zero, and

 $\frac{\partial p_{_{e}}^{^{\scriptscriptstyle E}}}{\partial k}, \frac{\partial p_{_{e}}^{^{\scriptscriptstyle E}}}{\partial k}, \frac{\partial p_{_{m}}^{^{\scriptscriptstyle M}}}{\partial k}, \frac{\partial p_{_{e}}^{^{\scriptscriptstyle M}}}{\partial k} > 0 \text{ is true. Because of } 0 < \beta < 1, \lambda_{_{m}} \ge 0, \lambda_{_{e}} \ge 0 \text{, formula 1 has a positive denominator.}$

$$(1+\lambda_m)(2-\beta^2+\lambda_e(2+\beta^2))-2\beta^2\lambda_e^2\lambda_m>0 \text{ gives us } \lambda_m>\frac{2-\beta^2+2\lambda_e+\beta^2\lambda_e}{\lambda_e(2\beta^2\lambda_e-2-\beta^2)+\beta^2-2}, \text{It is that Plus or minus } \frac{\partial p_m^{MR}}{\partial k} \text{ is determined}$$

by λ_m and λ_e together. Due to the complexity of calculation, the relationship between $\frac{\partial p_m^{MR}}{\partial k}$ and λ_m, λ_e is illustrated by

simulation below.

From proposition 1, it can be seen that with the decrease of k (That is, the improvement of the network sales efficiency of manufacturers relative to e-commerce), the selling price of e-commerce and the direct selling price of manufacturers will decrease under the three non-dual-member equity concerns (N, M and R modes). With the decrease of k, under the dual-member fair concern (MR model), the selling price of e-commerce will be reduced, but whether the manufacturer's direct selling price is reduced or not is related to the degree of fair concern of both parties. Due to the complexity of formula $\frac{\partial p_m^{MR}}{\partial k} > 0$,

the relationship between $\frac{\partial p_m^{MR}}{\partial t_e} > 0$ and λ_m, λ_e will be illustrated by simulation method below.

Proposition 2: $\frac{\partial p_m^N}{\partial k} > \frac{\partial p_e^N}{\partial k} > 0$, $\frac{\partial p_m^M}{\partial k} > \frac{\partial p_e^M}{\partial k} > 0$, $\frac{\partial p_e^E}{\partial k} > 0$, $\frac{\partial p_m^E}{\partial k} > \frac{\partial p_e^E}{\partial k} > 0$

Proof:

From equation (13), it can be known that: $\frac{\partial p_m^N}{\partial k} - \frac{\partial p_e^N}{\partial k} = \frac{(2-\beta)x}{4}$, Because of x > 0, so $\frac{\partial p_m^N}{\partial k} > \frac{\partial p_e^N}{\partial k} > 0$ is true. From equation (14), it can be known that: $\frac{\partial p_m^E}{\partial k} - \frac{\partial p_e^E}{\partial k} = \frac{4-2\beta-2\beta^2+\beta^3+2(2-2\beta+\beta^2)\lambda_e}{4(2-\beta^2+2\lambda_e)}x$, Because of

$$4 - 2\beta - 2\beta^2 > 0, 2 - 2\beta > 0, 2 - \beta^2 > 0, \text{ so } \frac{\partial p_m^E}{\partial k} > \frac{\partial p_e^E}{\partial k} \text{ is true.}$$

From equation (15), it can be known that: $\frac{\partial p_m^M}{\partial k} - \frac{\partial p_e^M}{\partial k} = \frac{(2-\beta^2)(\lambda_m+1)(1-\beta)}{2(2-\beta^2)+(4-\beta^2)\lambda_m} x$, Because of $2-\beta^2 > 0, 4-\beta^2 > 0, 1-\beta > 0$,

so
$$\frac{\partial p_m^M}{\partial k} > \frac{\partial p_e^M}{\partial k}$$
 is true

According to proposition 2, it can be seen that: With fewer k(that is, the improvement of the network sales efficiency of manufacturers relative to e-commerce), three members of double fairness concerns (N, M, R mode), rate of price reduction in direct sales is higher than the rate at which e-commerce prices are falling, But in dual member fair concern mode (MR mode), two members of the speed reduction compared with a fair degree of concern about each other, Due to the complexity of formula calculation, this relationship between $\frac{\partial p_m^{MR}}{\partial k} - \frac{\partial p_e^{MR}}{\partial k}$ and λ_m, λ_e will be illustrated by simulation method below.

Proposition 3:
$$\frac{\partial p_m^E}{\partial k} > \frac{\partial p_m^N}{\partial k} > \frac{\partial p_m^M}{\partial k} \blacksquare \frac{\partial p_m^{MR}}{\partial k} < \frac{\partial p_m^{RR}}{\partial k}$$
; $\frac{\partial p_e^E}{\partial k} > \frac{\partial p_e^N}{\partial k} > \frac{\partial p_e^M}{\partial k} > \frac{\partial p_e^{ME}}{\partial k} > \frac{\partial p_e^{$

Proof:

This simplifies to (13) (14) (15), so we know that :

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$$\frac{\partial p_{m}^{E}}{\partial k} = \frac{x}{2} + \frac{\lambda_{e}\beta^{2}x}{2(2+2\lambda_{e}-\beta^{2})}, \frac{\partial p_{m}^{M}}{\partial k} = \frac{x}{2} - \frac{0.5\beta^{2}\lambda_{m}}{2(2-\beta^{2})+(4-\beta^{2})\lambda_{m}} \\
\frac{\partial p_{m}^{MR}}{\partial k} = \frac{x}{2} - \frac{\lambda_{e}\left(2-\beta^{2}+2\lambda_{m}\right)+2\beta^{2}\lambda_{e}^{2}\lambda_{m}+\beta^{2}\left(1+\lambda_{m}\right)}{4(1+\lambda_{m})(1+\lambda_{e})+2\lambda_{e}(2+(2+\beta^{2})\lambda_{m})}x \\
\frac{\partial p_{e}^{E}}{\partial k} = \frac{\beta x}{4} + \frac{\lambda_{e}}{2(2(1+\lambda_{e})-4\beta^{2}}\beta x, \frac{\partial p_{e}^{M}}{\partial k} = \frac{\beta x}{4} + \frac{(4-2\beta^{2})+(4-3\beta^{2})\lambda_{m}}{4[(4-2\beta^{2})+(4-\beta^{2})\lambda_{m}]} \\
\frac{\partial p_{e}^{MR}}{\partial k} = \frac{\beta x}{4} + \frac{(4-\beta^{2}+4\lambda_{m}+\lambda_{e}(4-\beta^{2}+(4-2\beta^{2})\lambda_{m})\lambda_{e}x\beta}{4(1+\lambda_{e})[(4-2\beta^{2})(1+\lambda_{m})+\lambda_{e}[4+\beta^{2}+(4+2\beta^{2})\lambda_{m}]]}x\beta$$

Therefore $0 < \beta < 1$, the second term of all expressions in formula (17) is greater than zero. By contrast with equation (13), we can see that this proposition is true.

Proposition 3 is comparing different fairness concerns modes of pricing decision, the conclusion is that: from the perspective of the direct selling price drop speed, with no fair concern as a benchmark, as k reduce (that is, with manufacturer network sales efficiency improvement), the fair concern model of e-commerce has the fastest price reduction and is better than the no fair concern model, the two models of fair concern (E and ME) in which manufacturers participate are slower and lower than those without fair concern. From proposition 3, it can be seen that the leading party's equity concern will weaken the impact of network sales efficiency on price reduction, while the follower's equity concern will enhance the impact of network sales efficiency on price reduction.

V. SIMULATED ANALYSIS

In this section, the influence of network sales efficiency on members' pricing decisions under the dual-fair concern model is simulated and analyzed, taking $a = 200, w = 5, \beta = 0.4, x = 20, c = 2, \mu = 0.2$.

5.1 Network sales efficiency and direct selling price reduction under MR model



Fig.1: Network sales efficiency and direct selling price reduction under MR model



Fig.2: Network sales efficiency and e-commerce price reduction decision under MR mode

As can be seen from Figure 1, in MR mode, with the improvement of network sales efficiency, whether the two sides reduce prices depends on each other's fair concern coefficient.

The specific rules are as follows:

(1) When $\lambda_m \operatorname{or} \lambda_e$ is small, the manufacturer's direct selling price remains low;

(2) When λ_m is large, with the increase of λ_e , the manufacturer's direct selling price changes from reducing price to increasing price;

(3) when λ_e is large, with the increase of λ_m the

manufacturer's direct selling price changes from reducing price to increasing price.

As can be seen from figure 2, under MR fair concern mode, with the improvement of network sales efficiency, the selling price of e-commerce has been in a state of reduction. This verifies proposition 1.

5.2 MR model network sales efficiency and relative speed of price reduction



Fig.3: Network sales efficiency and price reduction under MR model

As can be seen from figure 3, under MR fair concern mode, with the improvement of network sales efficiency, the law of price reduction of both parties is as follows:

(1) Manufacturers are cutting prices faster than e-commerce prices;

(2) When λ_e is small, the difference between the two speed drops is small, and the correlation between the difference and λ_m is minimal. When λ_e is large, the difference between them increases sharply, and the difference is

positively correlated with λ_e ;

(3) When λ_m is small, the difference between the two

speed drops is small, and the correlation between the difference and λ_e is minimal. When λ_m is large, the difference between them increases sharply and is positively

correlated with λ_e ;

VI. CONCLUSION

In this paper, considering the direct and the efficiency of the online sales of business fairness concerns behavior differences and members, constructing a dynamic game model of manufacturers dominated the double channel, contrast network sales productivity for equity concerns without fairness concerns, manufacturers, electricity fairness concerns, double fairness concerns four different fairness concern mode member pricing decision-making behavior, the influence of the main conclusions include:

(1) With manufacturers to promote the efficiency of network marketing, the members of the double fairness concerns (N, M, R mode), the electricity price and the manufacturer direct selling price will be lower and the double fairness concerns (MR mode), the electricity price will be lower, but the manufacturer direct selling price is the price depends on the two sides a fair degree of concern;

(2) From the perspective of direct selling price reduction speed, with the improvement of manufacturers' online sales efficiency, e-commerce fair concern reduction speed is the fastest and better than no fair concern mode. The two fair concern modes (E mode and ME mode) that manufacturers participate in are slower and slower than no fair concern mode.

(3) From the perspective of price reduction of e-commerce, with the improvement of network sales efficiency of manufacturers, two fair concerns (E mode and ME mode) involving e-commerce are better than no fair concerns, while the fair concerns of manufacturers are lower than no fair concerns.

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Waste Management at the Federal Institute of *Sertão* Pernambucano/Brazil: Environmental Education as a tool for environmental conservation

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Abstract — Among the products that can generate consequences to the environment is the residues of vegetable oils, generated daily in the preparation (fried) of food. The lack of information and knowledge on the part of establishments, industries and people, causes many to dispose improperly. Starting from the initial assumptions, this research originated from the discussions in the discipline of waste management of the higher course of food Technology of the Federal Institute of Sertão Pernambucano – Petrolina campus, and had as objective to make a brief Analysis, on how is the knowledge of the employees of the institution about the themes "waste management", "recycling" and "environmental conservation" and the real importance of formal and non -formal environmental education, aiming to bring sensitization Environment for the internal sectors of the Higher Education Institution (HEI), enabling a prior knowledge of the risks caused to nature and humanity, with actions inadequate to the environmental. This is an applied, quantitative-qualitative, exploratory and field nature, where data collection was obtained from the on-site visit, questionnaire application and systematic observation. Therefore, the results of the research showed that in the sectors surveyed people are aware of the consequences caused by oil residues, where they affirm that they give the correct destination in the form of waste recycling. Keywords — Vegetable oil residue, environmental education, recycling, sensitization.

I. INTRODUCTION

Throughout history man has always used resources through the environment to meet his needs, with this situation the environment remained balanced, because it was only removed what really needed for survival. With the passing of time, the habits were changing, as well as the environment too, the technology and needs were rapidly modifying, reflecting directly in people's way of life and in the form of exploitation of natural resources (WILDNER; HILLIG, 2012).

One of the major problems for planetary society is knowing what to do with the large amount of waste that is produced in the social environment, such as the oil of vegetable or animal origin that has always been used (SEGATTO, 2013).

In this sense, the present study aimed to quantify the waste oil generated in IF *Sertão*-PE Campus Petrolina, verifying the knowledge of those involved on the subject

in theory, seeking to strengthen social awareness regarding environmental responsibility.

This is an applied research of quantitative and qualitative nature, exploratory and field, where data collection was obtained from the on-site visit, questionnaire application and systematic observation.

Therefore, the research findings indicated that in the sectors surveyed, people are aware of the problems caused by waste oils, having the means to dispose of them properly and giving the correct destination in the form of waste recycling. Thus, environmental education plays an important role in raising awareness among IF *Sertão* Pernambucano - Petrolina campus, as expected by the researchers.

II. THEORETICAL REVIEW

The waste of cooking oil generated daily in homes, industrial and establishments of the country, due to the

lack of information of the population, ends up being dumped directly into the waters, such as rivers and streams or simply to sinks and toilets, ending up in the water systems.sewage, causing damage to the clogging of the pipes and the increase of the processes of the treatment plants, in addition to causing pollution of the aquatic environment, or even in the domestic waste, contributing to the increase of the landfill areas (CASTELLANELLI et al., 2007).

There are four usual destinations for used oils and fats: sewage, soil, water bodies and landfills. Even the most controlled form of landfill, they are improper in different degrees and factors, causing damage to human settlements, the people who live in them, the forms of governments that control them and the environment that supports them (BRAZIL, 2011). Cooking oil, when disposed of incorrectly, has great damage as a consequence, but there are still people who experience these habits and have little knowledge of such a relevant subject.

Waste, currently better called waste, is the major cause of environmental degradation and research indicates that each human being produces on average little more than one (1) kilogram of waste per day. This leads to serious environmental problems that are clearly visible in society, whether through changes in the landscape or climate around us, or through the media that daily bombards us with reports of local and global disasters and disasters (WILDNER; HILLIG, 2012).

Humberto (2007) reports in his research and points out that Brazilians consume approximately 03 (three) billion liters of cooking oil per year. In Espírito Santo, this consumption is approximately 150 (one hundred and fifty) million. Once used, some of this oil is discharged into the rainwater drainage and sewage system. This increases the cost of treating these networks by up to 45% and also causes clogging of the pipes.

The environment is already quite degraded by social development, which calls for acts that seek its preservation. Aiming to alleviate the ecological impact created by the expansion of consumption, as well as develop as economic activities arise the reverse channels. Such activities as training, conversations for awareness, recycling of waste obtained, among others, is one of the alternatives where it is possible to sensitize the population and modify the attitude of people before a highly polluting society.

For Costa Neto et. al. (1999), waste recycling is gaining increasing space, not simply because waste represents low-cost raw materials, but mainly because the effects of environmental degradation due to industrial and urban activities are reaching ever higher levels. alarming. Materials that pose a risk of environmental pollution and therefore deserve special attention include vegetable oils used in dipping frying processes.

Environmental issues are currently the subject of debate and concern in communities, as there is awareness that the fragility of nature endangers human survival. Therefore, it is necessary nowadays, the elaboration of sustainable alternatives, in order to sensitize the population about the incorrect disposal of waste oil, through environmental education.

According to Dias (2006), this is a set of activities that seek to inform and sensitize people about this complex theme, encouraging involvement in actions that promote sustainable habits of natural resource use, as well as providing reflections on the relationships of the human being. human-environment.

In this sense, it was important the development of research on environmental education and recycling of frying oil to verify and be able to sensitize the people who work daily with this product generating waste, so that they acquire knowledge regarding the proper/ inappropriate disposal, as well as the benefits/harms that can bring to the environment.

III. MATERIAL AND METHODS

3.1 LOCATION OF THE RESEARCH

The research was conducted at the Petrolina campus of the Federal Institute of Education, Science and Technology of *Sertão* Pernambucano (IF Sertão-PE), from August to December 2018, targeting servers located in the sectors surveyed. IF *Sertão*-PE is located in the city of Petrolina, State of Pernambuco/Brazil.



 $Map \ 1-Geographic \ Location \ of the \ community \ Wall$

Source: Institutional Site (2019)

The Federal Institute of Education, Science and Technology of Sertão Pernambucano (IF SERTÃO-PE), created under the terms of Law No. 11.892 of December 29, 2008, is a specialized, pluricurricular and multicampi higher education institution. providing vocational and technological education in different teaching modalities, based on the combination of technical and technological knowledge with their pedagogical practices, which aims to improve the systemic action of education, internalize and socialize knowledge, popularize science and technology, developing local social and cultural productive arrangements, focusing on reducing inter and intra-regional social inequalities (LETTER OF SERVICE/IF SERTÃO-PE, 2015).

3.2 METHODS AND MATERIALS

This article deals with the environmental consequences of improper disposal of vegetable oil residues generated daily in the preparation (frying) of foods. This is a quantitative and qualitative research, exploratory and field, where the instrument used in data collection was the form with closed questions, as well as the method of observation and recording from photographs. Furthermore, such research is essentially based on method of Discourse Analysis and of Content of Bardin (2009).

In order to verify the environmental sensitivity and responsibility at the Federal Institute of Sertão Pernambucano - Petrolina campus, as well as to check the knowledge of those involved in the disposal, recycling and final destination of cooking oil waste, an on-site survey was conducted. investigated directly with those responsible for the respective sectors that produce the waste.

The work was divided into stages, from which a survey was first made of the sectors that produce the waste at the Institute. Soon after this verification, the interviewees were presented with an Informed Consent Form - ICF, this term is necessary for the interview participants and/or legal guardian to be sufficiently informed of all benefits, risks and procedures relevant to the research, protecting both the participant as well as the researcher.

After signing the consent form, the interview was held containing 10 (ten) questions pertinent to the theme. The questionnaires were applied as a data collection instrument in the following sectors: Internal canteen, external canteen, Institute cafeteria, LEA (Experimental Food Laboratory) and Chemistry Laboratory, the latter is responsible for collecting, treating and recycling waste. produced on campus, and also collects this waste at establishments outside the Institute.

After collecting the data, they were analyzed and discussed based on the literature relevant to the theme, besides having been presented in the classroom, in the

IV. RESULTS AND DISCUSSIONS

The present work was structured in two moments. Initially a survey was conducted in relation to the sectors that would be applied to the interview. In a second moment, the intention of the research along with the Informed Consent Form (ICF) was presented and afterwards, the questionnaire was applied.

The sectors have an average of 05 (five) employees, with an average age between 30 and 55 years, where all divided the daily activities. It was noted that the level of education varies depending on the position and requirement for admission. Employees in only one sector have elementary and secondary education. Employees in other sectors have higher education, specialization and masters, which shows that most of the group has a higher degree of education.

The forms in question had 10 (ten) questions, with the purpose of obtaining information on the level of awareness of the local employees regarding the destination of the waste generated from the sectors, as well as the process of separation and disposal.

Graph 1 shows the sectors that participated in the field interview and which of these generate the most waste monthly.



Graph 1 - Sectors that participated in the survey

The second question was related to waste management, segregation and packaging, where it was verified that all sectors carry out this activity and store the waste in polyethylene and ethylene terephthalate, thus leaving it reserved in their own places and in visible spaces.

According to Felizardo (2003) this practice of disposing the oils used in a plastic bottle is a very simple alternative to be performed, regardless of whether it is

Source: Authors (2018)

recycled waste or for disposal, the organic waste is betrayed, and the bottles will be opened and leaked to a suitable location rather than being discharged into the sewers, thus avoiding unnecessary wastewater treatment at sewage plants.

The third question of the questionnaire was about the identification of packaging with waste, and unfortunately it was realized that there is no knowledge on the part of employees about this importance. In none of the sectors were the packages packed in the places identified.

Accordingly, in August 2005, the Federal Senate Gazette published Bill n°. 296, authored by Senator Valmir Amaral, which "provides for the obligation to include on the label of edible oil packaging a warning about the correct destination of product after use" (BRAZIL, 2005). Said Law decrees that the label of edible oil packaging shall contain a legible and visible explanatory note about the convenience of packaging the product, after use, in closed plastic bottles, as well as for organic waste such as avoid contamination of water resources.

In addition, the aforementioned Bill serves as a warning for companies and establishments to prepare themselves with correct habits, where there is a high probability that they will have to take responsibility for their products during all phases of their life cycle, including disposal.

Regarding the fourth question, you asked yourself whether or not there is any treatment for the oil, either for recycling or for disposal. Two sectors interviewed showed that the treatment that the waste receives is the removal that materials generated from frying by food, that is, are removed by filtration, but neither a standardized procedure, the other sectors simply segregate and store without any treatment.

However, the standardized process does not happen for a variety of internal reasons, but not for lack of current legislation addressing the issue. An example is the socalled "Waste Law" Law n°. 12.305/2010, which establishes the National Solid Waste Policy (PNRS). In practice the law states that all waste, domestic or industrial, must be properly processed before final disposal, ie needs treatment. Also, that cannot be used after the treatment or recycling process are called tailings, and should go to landfills, co-processing, incineration, etc. (BRAZIL/PNRS, 2010).

Since waste is not treated properly through composting and recycling, the waste accumulated loses characteristics that could be harnessed for energy production or reapplication. For example, waste can become proven organic fertilizers for use in agriculture. Energy can also be produced through waste treatment, gas to supply homes, among other potentials lost by not reusing the waste.

The next question, fifth, was related to the person responsible for the collection of the waste, where it was verified that there is no collection by the public sector in the institution, and how the waste is recycled, a collaborator responsible for the "Chemical Laboratory" sector collects this waste from sectors: IF Kitchen, LEA (Experimental Food Laboratory) and Internal Canteen. This gathering is held weekly, as the students in the area of Chemistry Degree develop projects aimed at recycling vegetable oil residues, producing bar soap and also in liquid, with various pleasant odors, thus drawing the attention of other students regarding awareness about recycling and proper disposal of waste.

According to Alberici and Pontes (2004) and Almeida (2002), if the waste is not disposed of properly and done in the sewage collection system, the oil accumulates in the pipes forming a crust, contributing to its obstruction, and consequently, damage to society and especially to the environment.

For the removal of oil or unclogging of the pipes, which must be performed periodically, toxic chemicals such as caustic soda are used. Such measures increase the cost of sewage treatment, as well as contribute to the occurrence of floods and disease proliferation, if the clearing of the pipe does not occur in a timely manner. The presence of oil in treatment plants impairs the biological secondary treatment of sewage, as it impairs the biological processes.

Having all this information, it was clear, in some sectors, that there is a need for clarification on the environmental pollution questions caused by improperly discarded oil, since the consequences of this action may not yet be known.

Thus, the idea was passed that recycling alone cannot be considered the solution, but that changing habits and attitudes can lead society to take more comprehensive and responsible measures, with actions that minimize the amount of waste. in the generating source itself, recycling and reusing the surplus oil, hoping to contribute to the improvement in the handling and less polluting destination of this waste.

V. CONSIDERAÇÕES FINAIS

According to Boff (2004) Environmental Education has become essential for the population as it claims and prepares citizens to demand social justice, national and planetary citizenship, self-management and ethics in social relations and with nature.

Embasada nessa premissa, constatou-se que nos

setores pesquisados as pessoas estão conscientes dos problemas causados pelos resíduos de óleos, possuindo meios para descartá-los adequadamente e dando a destinação correta na forma de reciclagem dos resíduos. Sendo assim, a educação ambiental tem um papel importante na sensibilização por parte do IF Sertão Pernambucano – campus Petrolina, como era esperado pelos pesquisadores.

Entretanto a comunidade acadêmica pode ampliar esse conhecimento sobre a educação ambiental sensibilizando, não só a comunidade interna, mas também as comunidades circunvizinhas, que além de aprender a conservar o meio em que vivem, podem adquirir uma forma de obter uma renda extra através da produção do sabão/detergente, além destes, o óleo usado pode ser transformado em biodiesel após um longo tratamento, ser aproveitado para fazer tinta e ração para animais.

Other incentives and awareness-raising should be developed in this regard, as cooking oil waste from various sectors of society is an extremely polluting product when improperly disposed of. Therefore, solutions are needed to enable their recycling, ensure environmental conservation and, as a consequence, promote economic and social development.

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Teacher Training and Pedagogical Assistance in Distance Education

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Abstract— The present study aims to understand the teacher training and pedagogical assistance processes in distance education (EaD). The study is a bibliographic research based on some authors, the current legislation on the distance education, among others. We identified that the distance teacher training has legal protection, which legitimizes, organizes and operationalizes its action in Brazil. Through didactic -methodological mediation and the use of TIC, it is possible to overcome the distance in the time and space in which the distance formative processes take place. Furthermore, the knowledge acquisition is possible in the Virtual Learning Environment, when the tutor, as mediator of the learning process stimulates and challenges students to reflect and build their knowledge individually or collectively with their colleagues in this cyberspace training. Through the proposed reflections, the present study contributes to understanding the distance education for teacher training, besides the criticisms that this education model receives in the educational scenario.

Keywords—Distance Education (EaD), Pedagogical assistance, Teacher training.

I. INTRODUCTION

The teacher training process is one of the topics that covers big discussions in the educational scenario, especially regarding the environment where it takes place. It is stated that the teacher formative processes are constituted in practice, in the daily actions. Therefore, "... the exercise of training teachers can lead to unveiling and reflecting on the possibilities and limitations of each perspective or trend, in the most different aspects of this formation" [1].

The different aspects that permeate the teacher training process cover the diversity in the teaching modalities, as presence, semi-presence and distance. Currently, we are experiencing a situation of big changes in the legislation that regulates teacher education in Brazil, mainly after the promulgation of the Law on the Guidelines and Bases of National Education [2]. Diverse "[...] Decrees, Opinions and Resolutions aim to regularize and finalize a stage of proposals for educational reform in the field of teacher training" [3].

As an example, [4] states in its Article 1, the definition of this teaching modality, "[...] in which the didactic-pedagogical mediation in the teaching and learning processes occurs with the use of means of communication and information technologies. The

students and teachers develop educational activities in different places or times." [4].

In the process of distance teaching, teachers and students are physically separated in space and/or time. This type of education requires the intense use of information and communication technologies, with or not present face-to-face moments [5]. In other words, although this does not require physical contact between teacher and student, it does not mean that they do not interact with each other, since the digital technologies overcome this contact.

Thus, considering the process of teacher education, especially, the distance education, warm discussions have happened, on the one hand in defense of this training model, but on the other, it is target of various criticisms. [6] point out that since the 1990s, the advancement of digital technologies and the spread of the Internet allowed the distance education process to gain a greater accessibility to information in solving problems related to the democratization of education, both in initial and continuing education of professionals from different areas.

The growing demand for distance undergraduate courses highlights the importance to turn our attention to this theme. Distance teacher training happens through the interaction between teachers and students in the Virtual Learning Environment (VLE), a space for learning and exchanging of experiences. This interaction allows "the development of learning by interacting with others, aiming at searching for new possibilities of acting in the reality of the school" [6].

In this context, it is a fact that education has an important role in human formation and especially in the constitution of critical and autonomous individual. According to Paulo Freire's conceptions, education should always be a possibility of humanization, and it is a role played by teachers. Therefore, it should be the way to train the future professionals in the process of distance education.

The present study is a bibliographic research. According to [7], "[...] bibliographic research is usually developed as part of a wider research, aiming at identifying the available knowledge on the subject, the best formulation of the problem or the construction of hypotheses". In order to achieve the objectives, the research is carried out in stages including the choice of theme, bibliographical survey, search of sources, reading of the material, and the preparation of the paper.

Bibliographic researches are necessary to increase the knowledge of researchers on the investigated subject, mainly, for the elaboration of the Doctoral Thesis in Education, as it happens in the Postgraduate Program in Education (PPGEd) at Federal University of Piauí (UFPI). This study was carried out based on books, legislation on teacher education and distance education, and scientific articles in the area. The theoretical part of the research is structured based on the conceptions of [3], [5], [6], [8]-[12], and the current legislations such as [2], [4], among others.

Therefore, the study is extremely relevant for teacher training, regarding the distance modality, due the fact that it instigates us to reflect on this new configuration of teacher formation that is present in the educational scenario. This modality of teaching has its peculiarities and that differs from the face-to-face modality in concepts, form of execution and organization. Finally, distance teacher training has been consolidating over the years with the advent of Information and Communication Technologies (ICT).

Thus, this study aims to understand the process of distance teacher training and the pedagogical assistance process, by addressing the laws that regulate this modality of teaching and its training context.

Next, we present some reflections on the distance teaching and the teachers training in this modality of teaching.

II. DISTANCE EDUCATION (EAD): CONCEPTS AND REFLECTIONS

In order to formulate a conceptual consensus on distance education, in the recent years, several discussions have permeated this field of education. The debates address the issue of quality (the problem of lack of quality) in this modality. This theme, on the other hand, is correlated with teaching activity, and frequently ignore the effort that undergraduate courses have made in to improve their performance, undertaking a constant struggle against the adversities faced by this modality of teaching.

In Brazil, the legal bases for the EaD were established by the Law on Education Guidelines [4], which allowed offering Distance Education for all levels and modalities of education. On December 10th, 2004, the MEC Ordinance n. 4.059 established the offer of Distance Education in the scope of higher education [13]. Subsequently, the Decree n^o. 5,622 regulated it, on December 19th, 2005.

Thus, LDB/1996 presents in its Art. 80, the general provisions that determine the Distance Education. In paragraph 4, it states that the EaD will have a differentiated treatment, which includes:

I - reduced transmission costs in commercial sound broadcasting and imaging channels;

II - channels exclusively for educational purposes;

III - minimum time reserve, free of charge to the Public Authorities, by commercial channel concessionaires [2]

Thus, it is noticed a preoccupation with the educational policies related to this modality of education. The concept of Distance Education is officially defined in the Decree n° . 5.622, dated on December 19th, 2005:

Art. 1°. For the purposes of this Decree, Distance Education is characterized as an educational modality in which didactic-pedagogical mediation in teaching and learning processes occurs information by using and communication media and technologies, with students and teachers developing educational activities in different places or times [4].

In its Article 2, the Decree establishes that EaD can be offered in the following levels and educational modalities: basic education; youth and adult education; special education and professional education [4].

Thus, in 2005, the Ministry of Education created the Open University System (UAB) in Brazil, as a partnership with the National Association of Directors of Federal Institutions of Higher Education (ANDIFES) and State Companies, within the framework of the State Forum Education, focusing on Policies and Management of Higher Education. It is a public policy of articulation between the Special Secretariat of Distance Education (SEED/MEC) and the Directorate of Distance Education (DED/CAPES), aiming the expansion of higher education, as proposed in the Education Development Plan (PDE).

The UAB was established by the Decree 5.800, from June 8th, 2006, and it states "[...] the development of the distance education modality, in order to expand and internalize the offer of courses and programs of higher education in the country." According to the single paragraph of the decree, the UAB's objective is to foment the modality of distance education in public higher education institutions, supporting the researches in innovative methodologies of higher education supported in information and communication technologies [14].

According to the Article 1°, the UAB aims to use the distance education to broaden and internalize the offer of courses and programs of higher education. In addition, the UAB offers initial training to teachers in effective exercise in public basic education, who do not have a degree and continuing education for those graduates. In its proposal, it intends to offer courses to managers and other professionals from public networks that offer basic education. Moreover, the program intend to reduce inequalities in the supply of higher education, and to develop a broad national system of distance higher education [14]. It was noted that at Federal University of Piauí, the Center for Open and Distance Education (CEAD / UFPI) has its courses available in accordance with the Decree n. 5,800/2006, with 30 (thirty) courses offered, 15 (fifteen) are undergraduate courses and 15 (fifteen) graduate courses [12]. Currently, the courses are distributed in 42 poles of face-to-face support, 40 in the State of Piauí and 02 poles in the State of Bahia. There are also, 02 master's degrees in Public Administration and Philosophy.

In order to get in the courses, the students should apply to a Selective Process (Vestibular), organized by the Permanent Selection Committee (COPESE) from UFPI. [12] reports the number of students enrolled in the CEAD/UFPI, the total number of students in the undergraduate courses corresponds to 62.85% of the total number of students enrolled in this type of education. Therefore, it is highlighted the necessity of discussing the teacher training in the CEAD/UFPI.

In this training model, teachers and students are separated in space and/or time. This type of education is carried out through the intense use of Information and Communications Technology (ICT), and may or may not present face-to-face moments [5]. Thus, it does not require physical contact between teacher/student, but does not mean that they do not interact with each other, through the digital technologies that overcome this contact.

In this way, we understand that EAD was designed to overcome problems of time and space in the educational context, but without minimizing the importance of developing appropriate teaching tools and methods. Therefore, [15] states that "Distance Education does not only refer to the physical distance between student and teacher, but the infrastructure and interactive processes that allow them get pedagogically close." Therefore, didactic-pedagogical mediation provides effective learning, through the interaction between teacher and student in the virtual environment by using ICT.

Regarding physical separation and the use of ICTs, [11] stats that when the teaching process occurs between teacher and student separated (in time or space), this distance can be overcome by the use of technologies, which bring them closer to the virtual environment.

[16] defines the EaD as "[...] an evolutionary process that began with the approach to the physical separation of people and reaches the process of communication, including, at the end of the XX century, technologies of information." This definition reaffirms the conceptions of [11], on this question.

Thus, [10] proposes a new pedagogic model in the Distance Education system, which provides both personalized learning and collective learning. Therefore, regarding the teaching and learning process in the EaD, we can highlight that the overcoming of time and space is established by the use of educational technologies, which brings teacher and student in the Virtual Learning Environment (VLE).

In addition, the EaD provides an opportunity for those who are excluded from the regular system of education, such as students and workers residing far from a higher education institution. They would have many physical, mental and financial issues to attend a daily and face-to-face course.

Therefore, it should be highlighted that EaD normally requires less financial investment from the

students, or as [5] states, "[...] the cost is undoubtedly a huge attraction of the EaD." In addition, the geographical aspect (reaching marginalized populations, outside the educational centers), the great impact, the convenience of access (at home, at work, cybers, educational poles), the possibility of respecting the learning times of the students, the different methodologies to reach the learning objectives, and it is a form of technological inclusion.

III. TEACHER TRAINING IN EAD: MEDIATING KNOWLEDGE

Due to the increasing demand for distance learning Undergraduate courses, it is increasingly necessary to discuss teacher training and how these professionals are being trained. In this discussion, [17] defines teacher education as being:

[...] area of knowledge, research, and theoretical and practical proposals that, regarding the Didactics and School Organization, studies the processes through which teachers - in training or in practice - are involved individually or in teams, in learning experiences. through which acquire or improve their knowledge, skills and dispositions, These experiences enable them to intervene professionally in the development of their education, curriculum and school, with the aim of improving the quality of education that students receive. This systematic and organized formation carried out in the different modalities of teaching, as the author affirms, has the same concept. It only changes the content, the focus, and the methodology. Regarding the EaD, didactic-methodological mediation is possible by using technologies, which will overcome the distance in time and space, as we will see below.

According to [18], we start from the perspective of pedagogical mediation, which is concretized by the constant re-creation of strategies during a course, based on the interrelationship of materials, activities and interactions, articulating the teaching and learning process. In other words, the process of pedagogical mediation can be understood as the art of teaching, through a systematic planning, integrating the teaching methodologies, so that the learner will be the center of the teaching and learning process.

In this context, [19] considers pedagogical mediation to be:

[...] the attitude, the behavior of the teacher who acts as a facilitator or motivator of learning, building a bridge between the learner and his learning - not a static bridge, but a "rolling

bridge", which actively collaborates to the learner reaches his or her goals.

According to the author, teachers act as a bridge between the learner and the learning, having as essential elements of this process the dialogue, the exchange of experiences, the debate and the proposition of situations. Therefore, it is necessary to understand the relationships that permeate the learning process, in order to obtain a new configuration for distance learning, which should surpasses the virtualization of the traditional classroom [18].

Thus, it is necessary to rethink the formative processes carried out at a distance and, mainly, the training of teachers in this modality, starting from the perspective of being together virtual [20]. The pedagogical mediation is the result of two processes: human and technological. The first one comes from the tutoring system and the second from the existing communication system, which is provided from the first one to enable pedagogical mediation [21]. The authors states that teachers developed a role of mediator that permeated the interactions between them and the students. In addition, it is important the teachers have attention to the actions of the students and, at the same time, putting them in movement, mobilizing them in function of knowledge and studying themes.

The mobilization of knowledge is based on the understanding the necessity of a knowledge base for the exercise of the profession. The teacher training process should provide conditions for personal and professional development through the acquisition of knowledge that favors the search for answers to the real needs posed by the educational action. Whether in face-to-face or distance learning, this mobilization takes place through a pedagogical mediation of the content and the use of technologies by the tutor.

knowledge, Regarding the teaching [8] understands as habits, attitudes, knowledge, skills, and abilities; in other words, what is commonly called knowledge, know-being and know-how. Considering the knowledge of teaching required for the development of skills, the author proposes teacher knowledge as a plural, heterogeneous knowledge, which is established specific way from varied sources and influenced by several factors. Due to the diversity of use with which they manifest themselves in the know-how and knowhow of teachers approaches, these processes were classified as disciplinary, professional, curricular and experience knowledge.

The EaD teacher should use the AVA to create a space for the mobilization of knowledge, which

"stimulates thinking, challenges the student to learn and build knowledge individually or in partnership with colleagues, and allows the development of self-esteem, the sense-critic and responsible freedom" [22]. Here, the tutor is seen as mediator of the learning process, playing its role with the ICT, encourages, stimulates and challenges the student to reflect and build their knowledge collectively.

Therefore, this constructed knowledge is not reduced to mental processes; it is also a social knowledge that it obtained from the complex relationships between teachers and students. It is necessary to "situate the teacher's knowledge at the interface between the individual and the social, between the actor and the system, in order to capture its social and individual nature as a whole" [8]. Therefore, it is necessary to understand the teacher's knowledge as a toll that works with human beings and comes from several instances: from the family, school that formed it, personal culture, university, peers, and from training courses. This knowledge is plural, heterogeneous, and temporal since it is built during life and throughout the career.

The classroom is one of the main decisionmaking spaces taken by the teacher in all the teaching modality: distance learning or in face-to-face teaching. Therefore, it is in this space that all teaching action takes place. Therefore, it must be perceived by the teacher, through behaviors that often reveal the limitations of a precarious formation resulted from the devaluation of the teaching profession and the students, imposed by the educational policy.

[12] presents a discussion about the supervised internship at UFPI, noting that the main difficulties for the accomplishment of Internships in Distance Education are the distance between teacher and student, the shortage of schools in the rural cities of the State, besides issues related to the internet systems.

It is highlighted the need to think about the formation of teachers in EaD process, due to the numerous problems that arise in this training process. Therefore, in order to guarantee quality in the EAD, it is necessary that the institutions respect the legislation and regulations, for the respective levels and modalities of the national education. It is worth noting that in Art. 3°, Paragraph 1°, "... distance courses and programs should be designed with the same duration defined for the respective courses in the face-to-face modality" [4]. In other words, there is a concern with the organization of these courses, and how is carried out the teachers training.

Therefore, the process of pedagogical mediation in EaD (Figure 1) should involve the interaction between students, teachers and tutors in the VLE; systematic planning of the process of teaching and learning, using ICT, since the teacher/tutor is a mediator of this process, and responsible for providing the learner with knowledge.



Fig.1 - Pedagogical mediation in EaD. Source: Research data, 2019.

Figure 1 shows that the process of teacher education must offer conditions for personal and professional development through the acquisition of knowledge that favors the searching for answers to the real needs resulted from the educational action. The discussion about the teacher's technical competence is imperative since the dignity of being a teacher can be maintained in the construction of the professional identity that necessarily goes through this issue.

According to [9], the formation must provide a critical-reflective perspective, with autonomy both in thinking and in acting. Therefore, it requires personal and creative investment in the construction of your professional identity. Thus, it can be inferred that everyone is capable of creating and re-creating praxis through the relationships maintained with the physical and social world. It is in this interactive and dynamic movement that happen the exchange of experiences and the sharing of knowledge in a mutual formation.

[23] corroborate their opinion that "[...] the fundamental goal of education is to create conditions for students to strengthen and constitute themselves as political individuals". Thus, it is necessary to review teacher education and instigate them by seeking for a more critical and humane pedagogy, aiming at obtaining a democratic reform guided by critical citizenship.

Therefore, we think the formation of distance teachers as a process that develops in the training teachers a language of criticism, self-reflexive and union of theory and practice, starting from pedagogical mediation, in this process of interaction between teachers and students that defies distance learning.

IV. CONCLUSIONS

The new educational scenarios of teacher training are a reality in Brazilian life, which has been consolidating in recent decades, with the advent of ICT. Based on the assumption that people's demand for distance learning courses has expanded, the way the formative process happens also need to be discussed. In this study, our analysis focused on the teachers training process, considering how it is legitimated in our country.

In addition, mobilization of knowledge is possible in the Virtual Learning Environment (VLE), when the tutor, as mediator of this learning process, stimulates and challenges the students to reflect and build their knowledge individually or collectively with their colleagues, in this cyberspace of formation. Through the proposed reflections, the present study emerges as a contribution to the understanding of teacher education in the EaD, amid the criticisms that this training model receives in the educational scenario.

The study aimed to reflect on the formation of teachers about the perspective of EaD, portraying the initial academic formative process, since this process constitutes an epistemological field responsible for the construction of knowledge and the professional identity of the future teacher. Thus, the pedagogical mediation process must take place in order to provide the student with the necessary knowledge to teach.

Therefore, we seek to understand teacher training in the context of the distance modality and its consolidation in the educational scenario, regarding the pedagogical mediation process. The legislation LDBEN n. 9,394 / 96 and the Decree n°. 5,622/2005 have already been established on the EAD, which has been consolidating in the country in recent years, through the emergence of educational policies focused on this type of education. The purpose of expanding and internalizing the offer of courses and programs of higher education in the country, although recent, has several courses adhering to this teaching proposal in both public and private institutions.

Therefore, in order to develop teachers as transforming intellectuals, they must have a discourse in the language of criticism, so that they can recognize that they can promote change, manifesting themselves against economic, political and social injustices inside and outside schools. This training model is what we expect from EaD, which overcomes the difficulties encountered in its course and can act in the quality of teaching, through the interactions provided by pedagogical mediation, from the perspective of being virtually together.

Finally, we emphasize that this study about teacher training in the distance modality requires the understanding of many other factors, given the complexity of this field and this modality of teaching. Our lens focused in general on the legal and formative parameters of EAD. In this sense, other studies may be carried out on the various elements of this training process, such as the curriculum or the process of teaching and learning in this and/or other contexts.

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Production of Coriander (Coriandrum sativum L.) in Organic Substrates and Fertigation with **Biodigester Effluents**

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Abstract— The objective of this work was to analyze the effects of different organic substrates, fertigated with effluents from biodigesters in the production of coriander. The experiment was carried out in a greenhouse, greenhouse type. It was used a completely randomized design, with three replications, in a 2x2x2 factorial arrangement, being: cultivars (king and tabocas); substrates (natural, fermented) and source of irrigation (water, biofertilizer). The size of the plants were evaluated; number of stems and yield of green mass. No significant effect was observed between the organic substrates and the coriander cultivars for any of the analyzed variables, however, regarding the irrigation source, statistical significance was observed for the variables plant size and green mass yield, and the best means were obtained when the plants were irrigated with water. It is concluded that organic substrates and coriander cultivars studied are recommended for cultivation. However, the use of concentrated biofertilizers did not increase coriander production, and more research is needed to recommend the best doses of this biofertilizer.

Keywords—Biodigestion, Biofertilizer, Horticulture, Solid waste.

I. INTRODUCTION

Currently, there is a growing demand for research aimed at rationalizing the use of natural resources in a sustainable way, so that demands for food, energy and water supply the needs of current generations and do not compromise production capacity for future generations. In this context, several technological innovations have been encouraged, among them, the use of residues from the anaerobic fermentation of animal waste in biodigesters, generating biogas and at the end of the fermentation process result in the by-product called biofertilizers.

SANCHEZ et al., (2005) [1] describe that the biofertilizer can be used as an organic fertilizer as a nutrient supplement for plants, in which its yield is comparable to those of chemical use, thus adding to the production process a cost reduction. The biofertilizer has the advantages of improving the quality of the soil

facilitating the penetration of the roots, as well as, it assists in the process of retention of water leaving the subsoil for more wet weather BARICHELLO et al., (2015) [2].

According to WU et al., (2005) [3] biofertilizer has been identified as an alternative to chemical fertilizers to increase soil fertility and crop production in sustainable agriculture, as well as to reduce the indiscriminate use of synthetic mineral and synthetic fertilizers in agriculture, thereby reducing the cost of production and contamination of the environment (DIAS et al., 2003) [4].

It should be emphasized that, as an organic fertilizer alternative, the biofertilizer is widely used by family farmers, especially in the cultivation of horticultural plants, for example, the coriander (*Coriandrum sativum L*.) characterized by being a predominantly cultivated crop in climatic regions, have a short cycle of production with an average of 45 to 60 days, which favors a rapid return of applied capital, being useful enough to complement the income of the families involved in their production (LINHARES et al., 2012) [5]. In this way the production takes place predominantly of organic form having bovine manure the main organic residue used (LINHARES et al., 2015) [6].

In this context, we tried to analyze the effects of different organic substrates, fertigated with effluents from biodigesters in the production of coriander.

II. MATERIALS AND METHODS

2.1 Location and duration

The experiment was conducted at the Agricultural and Environmental Sciences Center of the Federal University of Maranhão, in the municipality of Chapadinha-MA, in the period from May to July 2018.

2.2 Systems and experimental treatments

In a greenhouse, greenhouse type was planted the coriander seeds, in pots with na area of 0.073 m^2 . The pots were filled with dystrophic yellow Latosol soil and with natural and fermented organic substrates, which were then prepared three grooves and seeded 30 seeds per pot.

To obtain the biofertilizer, after anaerobic fermentation of the biomass in biodigesters, the solid and liquid residue was separated. The process of obtaining the biofertilizers was carried through a sieve with a mesh of 0.35 mm. With the separation of the solid and liquid fraction of the biofertilizers, the solid fraction constituted the fermented organic substrate, while the liquid fraction (without dilution, 100% concentrate) constituted one of the sources of irrigation. While the natural organic substrate used was cattle manure, mixed in a proportion of 40% of manure with 60% of soil, the same proportion was established with the biofertilizer from the biodigester.

Irrigation in the vessels that constituted the experimental units was performed daily in a quantity of 500 mL (water or biofertilizer liquid) according to the treatments. The coriander cultivars used were: King and Tabocas, and the harvest was performed at 30 days of sowing and data from the experiment variables were collected.

A completely randomized design with three replications was used in a 2x2x2 factorial arrangement, constituting a total of 24 experimental units. The three factors were: cultivar (King and Tabocas), organic substrates (natural and fermented / biofertilizer solid) and irrigation source (water and biofertilizer liquid).

2.3 Variables and data collections

The variables analyzed were: plant size (determined in a sample of ten plants randomly chosen from the useful

plot, from the soil level to the end of the highest leaves, expressed in cm), number of stems per plant (determined in the same sample of ten plants, counting the number of stems per plant expressed in terms of average) and estimated green mass yield (obtained by using the fresh mass of the plants of the plot area expressed in grams - g).

2.4 Statistical analysis

The data obtained were submitted a variance analysis and the means compared by Tukey test (P<0.05), utilizing the statistical program SISVAR in the version 5.6 (Ferreira, 2014) [7].

III. RESULTS AND DISCUSSION

In table 1 shows the data of the analysis of variance of the treatments under the variables: plant size (PS), number of stems per plant (NSP) and green mass yield (GMV).

Table 1. Synthesis of Analysis of variance under the variables, plant height (PS), number of stems (NSP) and green mass yield (GMV), as a function of experimental treatments

"	cuments			
Source of variation	Medium Squares			
	PS (cm)	NSP	GMV (g)	
		(und)		
Grow Crops - GC	7.99 ^{NS}	0.63 ^{NS}	0.13 ^{NS}	
Organic Substrate - OS	0.72 ^{NS}	2.600 ^{NS}	366.60 ^{NS}	
Irrigation Source - IS	607.25*	8.050 ^{NS}	13891.28*	
GC*OS*IS	35.02 ^{NS}	3.15 ^{NS}	180.40 ^{NS}	
Erro	11.620	1.517	173.853	
P>F	0.000	0.032	0.000	
CV (%)	32.84	40.34	48.79	
Average	10.37	3.054	27.02	

NS – not significant; * significant at 5% probability, test F.

There was a significant effect of irrigation sources (water and biofertilizer liquid) under all variables analyzed. The cultivars of coriander King and Tabocas received that irrigation water, obtained better performance both in plant height, stem number and yield of green matter, independent of the organic substrate used. What probably contributes to these results is that the plots that received as irrigation source the liquid biofertilizer presented a superficial layer of compaction in the soil, altering the physical structure, with accumulation of excess organic matter from the irrigation source (biofertilizer liquid) and that must have prevented the root growth of the plants, besides making water drainage difficult and limiting the nitrogen availability in the roots. As the liquid biofertilizer was used without dilution, it probably occurred at the time of separation of the solid fractions and liquidates a large amount of organic material, as a result of the sieve mesh having a diameter of 0.35 mm, increasing its concentration.

Although organic matter plays an important role in the physical, chemical and biological properties of the soil, when used in excess, accumulation may be associated with changes in susceptibility to compaction and that the magnitude and type of effect, however, are texture dependent of soil and associated effects on water retention, soil cohesion and soil density (BRAIDA et al., 2010) [8].

The mean values of the variables, plant height, number of stems and green mass yield as a function of the interactions of the cultivars of coriander (King and Tabocas), organic substrate (natural and fermented biofertilizer) and irrigation sources (water and biofertilizer liquid) are shown in table 2.

Table 2 - Averages of interactions between irrigation sources for the variables: plant height, number of stems and yield of green mass.

	Sources of irrigation		
Interactions between	water	biofertilizer liquid	
Treatments	Heigh	t of plants (cm)	
King x natural	15.16 ^a	7.66 ^b	
King x fermented	17.28 ^a	3.73 ^b	
Taboca x natural	14.70 ^a	3.30 ^b	
Taboca x fermented	14.50 ^a	6.71 ^b	
	Number of stems per plant		
	(unity)		
	water	biofertilizer liquid	
King x natural	3.37 ^a	2.90 ^a	
King x fermented	4.17 ^a	2.43 ^a	
Taboca x natural	3.33 ^a	1.30 ^a	
Taboca x fermented	3.67 ^a	3.27 ^a	
	Green	mass yield (g)	
	water	biofertilizer liquid	
King x natural	36.67 ^a	5.10 ^b	
King x fermented	64.67 ^a	1.40 ^b	
Taboca x natural	47.33 ^a	3.40 ^b	
Taboca x fermented	55.67 ^a	2.00 ^b	

Means followed by the same lowercase letter in the column do not differ statistically by the Tukey test at 5% probability.

There was no differentiation between the cultivars and organic substrate used in the research, however, statistical significance was observed for the irrigation source, where low productive performance occurred when the irrigation source was the wet biofertilizer. Low productive performance of vegetable plants using biodigesters effluents were also reported by Factor et al., (2008) [9] that when working with chilies irrigated with effluents from biodigesters, low values were also observed when irrigation with total concentration was used. The authors attributed to the imbalance and nutritional deficit the possible cause of the low yield.

NAZARIO et al., (2007) [10] reported that the high content of salts in the soil influences the development of the plant, because it entails an osmotic gradient that retains water in addition to promoting ion action. This stress inhibits the growth functions of plants affecting their physiology, atrophied branches, leaf yellowing and part area totally dry out. FRANÇA et al., (2006) [11] recommend that the doses of biofertilizers for application with nutrition in mind, fertigation in general should be analyzed carefully because it may be underestimating or overestimated the amount used which ultimately influences the results.

IV. CONCLUSION

The organic substrates and the coriander cultivars studied are recommended for cultivation, without influencing the productive performance of the plants, however, the use of concentrated biofertilizers, without dilution, did not increase the production of coriander, and more research is needed to recommend the best doses of this biofertilizer.

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Hardware-in-the-loop Emulation of a Control and Longitudinal Compensation System of a Submarine

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Abstract— Naval machinery is designed to ensure proper operation of a ship and includes pumps, compressors, tanks, piping and other equipment. In modern vessels, the operation of this equipment is automated through Programmable Logic Controllers (PLC). In general, the development of PLC control software takes place in parallel with the mechanical construction of the vessels, so that integration tests are performed only at the time of commissioning. In order to reduce the risks associated with integration, the tests are performed by comparing the control software against a real-time simulator of the plant to be controlled. The contribution of this work is the development of a commissioning solution for the longitudinal compensation system of a submarine-based in a virtual simulation environment called Hardware-in-the-Loop (HIL). A HIL simulation refers to a system in which parts of a pure simulation have been replaced with actual physical components. The results were considered satisfactory since the test platform allowed the early identification of errors in the PLC software, tests of different control strategies and finally the possibility of the use for the purpose of operator training. Keywords— Virtual commissioning, programmable logic controllers, control system, submarine, Hardware-in-the-loop, simulation.

I. INTRODUCTION

The use of modeling and simulation software has become increasingly popular in offshore machinery design. This reduces the effort of project engineers by allowing them to test and remake various solutions in a virtual simulation environment. In addition, virtual prototyping indirectly helps reduce the number of accidents because critical or defective equipment components can be identified early in the project. This is a strong argument that supports the effort to create more realistic and reliable simulators for naval systems [1], [2], [3], [4].

In recent years, one of the most used techniques for prototyping and testing is called Hardware-in-the-Loop (HIL). According to the manufacturer of National Instruments, HIL is a method that offers powerful features and greater efficiency to the test of embedded systems, since it allows to simulate the subsystems that cannot be physically included in the tests, which allows validating the control completely in a virtual environment before moving on to the whole system tests in the real world. A significant role of the HIL real-time simulation platform is to test the software of controllers under normal or abnormal conditions, so as to verify the corresponding response expected [5], [6], [7], [8]. Figure 1 exemplifies the concept of implementing a system for HIL tests.

Many authors have considered the HIL in a naval system. For instance, Sanchez et al [9] presented the ability of HIL models to emulate a diesel engine generator in a US Navy ship. Modifications to a previously documented experiment have been made to replace a gasoline-powered generator with a HIL diesel generator and it has been shown that when the generator is used alone to power a transient load, the power quality is severely impacted.



Fig. 1. Hardware-in-the-Loop concept [6].

Nounou et al [10] present a Hardware-in-the-Loop Emulation of an Electric Naval Propulsion System based on a Multiphase Permanent Magnet Synchronous Machine. The emulator of the Electric Naval Propulsion System was used to emulate the effect of propeller resistive torque on the propulsion motor. Dufour et al [11] describe a HIL test made on a simplified zonal power system of a naval ship. This approach is compatible with model-based design; a design philosophy that is based entirely on simulation models, from the specifications to release and field commissioning. Palla et al [12] present a design procedure of HIL test for power system modeling and simulation using Simulink and National Instruments (NI) equipment. The validated relay model can be used in the modeling of Shipboard Power Systems (SPS).

Ji-qing et al [13] present a fuzzy control method based on the varied universe to determine the overall control system structure and the corresponding parameters. This approach not only improves the accuracy of the control system but also makes the control object enjoy a certain anti-interference ability.

In this paper, the development of a commissioning solution for the longitudinal compensation system of a submarine has been presented. A virtual simulation environment called Hardware-in-the-Loop (HIL) was built up with the LabVIEW Control Design, Programmable Logic Controller (PLC) and Control System (SCADA).

This paper is organized as follows: Section 1 gives the general introduction of the topic. Section 2 gives a brief description of the virtual commissioning platform. Section 3 presents the experiments and analysis while section 4 provides the results and conclusion.

II. THEORETICAL BACKGROUND

A. Longitudinal Compensation System – TRIM System

Submarines are very sensitive to weight displacement, and during their operation, the center of gravity may be affected due to the withdrawal of loads such as fuel consumption and unloading of weapons. To ensure stability and good navigability, the submarine must maintain the balance between the front and rear [13]. This project studied a system of adjustment and compensation of the longitudinal weight of a submarine, better known as the TRIM system[14], [15]. TRIM is particularly sensitive on a submarine once submerged due to the lack of a waterline. The TRIM movement of the underwater vehicle is controlled by adjusting the volume of ballast water in the bow and stern ballast tanks [13]. The system consists basically of two water tanks, connected in a closed circuit, located aft and ahead of the submarine, being the longitudinal adjustment obtained from the movement of water between the two tanks, as can be seen in Figure 2.



Fig. 2. TRIM adjustment system.

According to the variation of the level in the tanks (figure 2), the submarine revolves around its horizontal axis. It is also possible to simulate external factors that may affect the angle of the submarine. These factors are represented by two controls. The first is the weight of the longitudinal displacement moment (W) and the second is the arm of the longitudinal displacement moment (l). In this way, the operator can simulate where external situations affect the TRIM angle of the submarine and verify the behaviour of the control system in the occurrence of these external disturbances. Equation (1) determines the TRIM angle of the submarine [16].

$$\tan \theta = \frac{wl}{\Delta_s \overline{BG_0}} \tag{1}$$

Where:

W = weight of the longitudinal displacement moment;

l =longitudinal moment arm;

 $\Delta_s =$ submarine weight;

 $\overline{BG_0}$ = distance between the center of gravity and the center of fluctuation;

- θ = angle of TRIM of the submarine.
- B. Hardware Components HIL System

HIL testing is a technique where real signals from a controller are connected to a test system that simulates reality, tricking the controller into thinking it is in the assembled product. Test and design iteration takes place as though the real-world system is being used. HIL systems can vary considerably from application to application. Even so, it is possible to identify numerous components that are always present in a similar form[8]. Hardware components of HIL system are: (i) Host PC; (ii) Realtime processor system; (iii) I/O boards and signal conditioning system (PLC); (iv) Bus system; (v) Electrical loads and local simulation; (vi) Electrical fault simulation and; (vii) Real components. Figure 3 presents the components of HIL а system.



Fig. 3. Components of a HIL system [8].

III. VIRTUAL COMMISSIONING PLATFORM

The virtual commissioning and test platform HIL developed in this work (Fig. 4) used two computers connected through an Ethernet switch and RJ-45 cables, creating a local network. In the first computer was used the SCADA software TIA Portal manufactured by Siemens . The choice of this tool was because it is a fully integrated engineering platform for the development of industrial automation solutions. In the same environment, the programming of the PLC was developed according to the

languages and specifications defined in the standard IEC 61311-3.

In the second computer, were simulated the equipment of a longitudinal compensation system of the submarine. This simulator was developed using LabVIEW software developed by National Instruments. This software allows the implementation of systems and tests in real-time, with user-friendly interface and features such as graphing and reporting. From the point of view of the control system, the simulation environment had the same behaviour as a real system, and no differences in interacting with simulated equipment or physically existing equipment. The response dynamics of the simulated equipment, as well as the generated signals, were the same as those of a real system. The virtual commissioning and test platform HIL developed in this work are presented in Figure 4.



Fig. 4. The virtual commissioning and test platform HIL.

C. Longitudinal Compensation System

Figure 5 shows the front panel of the longitudinal compensation system simulator. It consists of two tanks with a capacity of 100 liters capable of moving the TRIM angle of the submarine by 30°. In order to carry out the transfer between the tanks, a motor / pump assembly was used that could be operated by different methods (direct

start, soft starter and frequency inverter), plus a 4-way valve with two positions for reversing the flow sense of water flow between the tanks. The system also- had level sensors in the tanks, water pressure flow line pressure sensor. There was also an interface with the operator that allows insertion of faults in the equipment for the installation.



Fig. 5. The front panel of the longitudinal compensation system simulator

This feature is a great advantage of the use of a virtual commissioning platform because through the simulator programming defects were added in the equipment, which was used to verify the behaviour of the control system in such situations. In the case of the developed simulator, it was enough that the operator clicked on one of the selection buttons on the defect menu to add a fault during the simulation.

D. Control System (SCADA)

Figure 6 presents a front panel of the Control System (SCADA).



Fig. 6. The front panel of the control system (SCADA).

The front panel of the control system allows three control modes:

• Manual / Configuration: In this mode, all the equipment is manually controlled by the operator through the Human Machine Interface (HMI)

screen, as well as the configuration of the parameters of the equipment such as starting methods, speed and ramp time.

• Semi-Automatic: In this control mode the operator must choose the amount of water to be transferred between the tanks taking into account the parameterization of the equipment performance in the manual / configuration mode, such as the water transfer direction adjustment of the valve (XV -1).

• Automatic: This control mode takes the submarine to the TRIM angle automatically. The program developed in the PLC reads the current TRIM angle and does all the necessary sequencing, also using a proportional control for the pump speed set-point, as seen in Fig. 7.



Fig. 7. The control diagram of the pump speed set-point.

IV. EXPERIMENTS AND ANALYSIS

To implement the system performance tests, the SCADA software graph tool was used, generating realtime values of the system. The purpose of these tests was to observe whether the control system effectively takes the submarine to TRIM zero position automatically and independently of external disturbance conditions. For this, three variables were measured: TQ-02 level, TRIM angle, and Pump speed. The initial TRIM angle for the test was -10°. It was observed that as soon as the operator passed the control system to the manual mode, the speed of the motor was maximized, saturating at 3600 rpm. This happened because the error between the angle set-point is was the actual angle which was too great, causing the controller to send a very high-speed value to the pump. As the angle approached zero, the speed of the pump decreased proportionally. As a result, it was observed that the zero TRIM angle was perfectly achieved, as can be seen in Figure 8. It was further noted that since the submarine had no disturbance external to the compensation system the volume value of the TQ-02 and TQ-01 is was exactly 50 litres.



Fig. 8. Performance automatic mode – balanced submarine.

A second test was performed in automatic mode, but this time with the submarine unbalanced. From this weight change, a longitudinal unbalance occurred, resulting in a non-zero TRIM angle. The simulation of this external disturbance was performed by adjusting the weight and position of the controls of the longitudinal compensation system. The control system made the transfer of water between the tanks, taking the submarine from an angle of approximately -20° to the ideal setting of zero degrees, as can be seen in Figure 9. It is was also verified that due to the longitudinal unbalance initial value of the submarine, the value at TQ-02 at the end of the transfer cycle was different from 50 liters, proving that the control system was capable of bringing the submarine to the TRIM angle equal to zero under different conditions.



Fig. 9. Performance automatic mode – unbalanced submarine

V. RESULTS AND CONCLUSIONS

The main goal of this paper was to explain various testing requirements needed for the development of a commissioning solution for the longitudinal compensation system of a submarine. In this paper, an emulation of control and longitudinal compensation system of a submarine using the technique of Hardware-in-the-Loop (HIL) was carried out. From simulation and experimental results, it could be concluded that the emulator could reproduce the dynamic of the longitudinal compensation system, and the control was well done. The presented emulator could be useful for repetitive tests that were required for commissioning of a submarine. The results were considered satisfactory since the test platform allowed the early identification of errors in the PLC software, tests of different control strategies and finally the possibility of the use for the purpose of operator training.

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The Analysis of Road Condition on the Performance of Muara Teweh – Puruk Cahu Road Section

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Abstract— The existing condition of Muara Teweh-Puruk Cahu road section with ± 100 km long is mostly uphill and bend that currently is experiencing significant damage. This study aims to determine the type of damage in Muara Teweh-Puruk Cahu road section and to analyze the correlation between damage and vehicle speed on flat roads and hilly terrain.

The study was conducted by collecting primary data in the form of data of road damage, vehicle speed, and road geometric. Data analysis of road damage is done by the BinaMarga method to obtain the type of damage. The correlation between road damage and vehicle speed is shown in a regression model.

The results of the analysis show the vehicle speed will tend to decrease as the increasing number of road damage. The speed of light vehicles on roads with flat terrain shows a very strong correlation with the type of damage, such as cracks, grooves, and depression. The speed of light vehicle going uphill shows a very strong correlation with the type of damage, such as cracks, grooves, potholes, and depression. Meanwhile, when the vehicle goes downhill, it is seen a strong correlation with the types of damage such as cracks, grooves, and depression. The speed of heavy vehicles on roads with flat terrain shows a very strong correlation with the type of damage like cracks, grooves, and depression. The speed of heavy vehicles on roads with flat terrain shows a very strong correlation with the type of damage like cracks, grooves, potholes, and depression. Meanwhile, when the vehicle goes downhill, it is shown a very strong correlation with the types of damage like cracks, grooves, and depression. Meanwhile, when the vehicle goes downhill, it is shown a very strong correlation with the types of damage like cracks, grooves, and depression. Meanwhile, when the vehicle goes downhill, it is shown a very strong correlation with the types of damage like cracks, grooves, and depression.

Keywords—Road Damage, Vehicle Speed, Regression Analysis.

I. INTRODUCTION

The condition that road infrastructure is burdened by traffic volume with heavy burden repeatedly will cause a decrease in the quality of the road. As an indicator, it can be seen from the condition of the damaged road surface, both in terms of structural and functional conditions.

The existing condition of Muara Teweh-Puruk Cahu road section with \pm 100 km long is mostly uphill and bends. The road section is currently experiencing significant damage, both minor and severe damage, on several roads and almost along the road section. This road damage disrupts the traffic, both heading to PurukCahu and vice versa.

This study aims to determine the type of road damage on MuaraTeweh-PurukCahu road section and to

analyze the correlation between damage and vehicle speed on roads with flat and hilly terrain. The benefit of this research is to provide findings obtained from the results of evaluation and analysis that will later be used as input to the relevant technical agencies, so that the damage repair can be conducted optimally and efficiently.

II. LITERATURE REVIEW

2.1 Inter-City Road Geometry

Classification of road terrain for geometric planning can be seen in the following table:

Table 2.1 Classification	based on	Road Terrain	
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No.	Types of	Notatio	Medan Slope
	Terrain	n	(%)
1.	Flat	D	< 3
2.	Hilly	В	3 - 25
3.	Mountain	G	>25

Source: Geometric Planning Procedures for Inter-City Roads, Ministry of Public Works, Director General of BinaMarga (1997)

2.2 Criteria of Road Flexibility Pavement

In order to provide a sense of security and comfort to road users, road pavement construction must meet the traffic and strength/structural requirements.

2.3 Analysis of Road Performance

Pavement performance of a road section must be able to provide safe and comfortable services according to the plan for the road durability. The pavement evaluation will record the characteristics that can describe the performance of the pavement through several indexes. Based on the characteristics that have been surveyed, pavement evaluation can be classified into functional evaluation and structural evaluation (Christopher Bennett, 2007).

Based on MKJI 1997, the parameters of road performance include the volume and the speed of vehicle.

2.4 Road Damage

Road damage is one of the parameters to determine the performance of a road section. Damage on the pavement can be seen from the condition of functional and structural damage. Functional damage occurs when the pavement cannot function as what has planned. Meanwhile, structural damage can be seen by damage of one or more parts of the road pavement structure. Functional failure occurs when the pavement no longer functions as what has been planned and causes discomfort for road users. Meanwhile, structural failure is characterized by damage of one or more parts of the road pavement structure due to unstable subsoil, traffic loads, surface fatigue, and environmental conditions (Yoder, 1975).

One of the ways to find out the type of road damage is by looking at the classification of road damage (BinaMarga) according to the Road Maintenance Manual Number 03/MN/B/1983 issued by the Directorate General of BinaMarga.

2.5 Statistics Testing

2.5.1 Regression

Analysis with regression method has two variables, namely dependent variable (Y) and independent

variable (X) which have the basic form Y = f (X). Modeling may be influenced by more than one independent variable and the possibility of a large number of independent variables that can affect the program together or separately.

2.5.2 Correlation

Correlation test is used to determine whether a variable has a correlation or affects a problem or other variables.

2.5.3 T – Test

This test is intended to test the independent variable (regression coefficient) whether it has an influence on the dependent variable.

2.5.4 F – Test

Testing on the distribution of F or F-test is intended to determine whether the variables that predict the formation of regression meet the requirements seen from a significant value at a certain level of confidence. This significant value is gained by comparing the calculated F value with F value of the table with a certain level of confidence. Said to be significant if the calculated F value is greater than the table F value.

III. RESEARCH METHOD

3.1 Steps of Data Collection

There are 2 (two) types of data that will be used for analyzing this study, namely:

a. Secondary Data

Secondary data is data that already exists. In this study, the sources of data can be obtained from relevant agencies. The types of data needed to support this study are administrative boundary maps, road network maps, and road status.

b. Primary Data

Primary data is a source of research data obtained by conducting direct observations in the field (surveys) including traffic volume data, road damage data, vehicle speed data, and road geometric data.

c. Instruments

The instruments used in this study are in the form of a daily survey form, speed gun, stopwatch, stationery, and other supporting tools related to this study.

d. Procedure of Data Collection

The data needed in this study can be grouped into three data groups, namely traffic volume data, average speed data, and road damage data.

3.2 Data Analysis Technique

Based on the data collected, the techniques of data analysis applied in this study are:

a. Analysis of the type of road damage using the BinaMarga method, namely by calculating the

speed of LV, HV vehicles passing through the road in good condition, and damage on flat and hilly terrain;

b. Analysis of the correlation between vehicle speed and road damage through statistical tests with SPSS 20 (Statitistical Program for Social Science) software.

IV. RESULT AND DISCUSSION

4.1 Analysis of Traffic Volume

The traffic data used is LHR data obtained based on a survey conducted for 2 (two) days, Saturday and Sunday, with the duration for survey of 12 hours. The distribution of survey observations on vehicles is grouped into three groups, namely:

a. Light Vehicles, which are all four-wheeled motorized vehicles, include sedans (private cars), public transportation, mini bus, pick-up/boxes, and mini trucks. b. Heavy Vehicle, i.e. all four-wheeled motorized vehicles, including large buses, 2-axle trucks, 3-axle trucks, trailers, and trailer trucks

c. Motorcycle

Survey data can be seen in the following table 4.1

Table 4.1 The Average Number of Vehicle								
Day	Т	Types of Tot						
		Vehicle						
HV LV MC Vehicle PC								
Saturday	22	65	53	140	173			
Sunday	30	73	67	170	215			
				Average	194			

4.2 Analysis of Road Damage

Data is grouped based on topography or type of road terrain, namely flat and hilly, as seen in table 2.1 in Chapter II. Based on the survey results, the extent and percentage of comparison of the types of damage can be seen in table 4.2 below:

$(\mathbf{r}_1, \mathbf{r}_2, \mathbf{r}_3, r$	Table 4.2 Extent and	Percentage of	of Comparison	of the Types	of Damage
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				Width		Types of Road Damage							
		Types	Length	of	Seg.				Patches	and		Road	
No.	STA.	of	of Seg	Seg	Area	Cra	cks	Groove	potho	les	Surface	Depress	ion
		Terrain		565		Area	%	Inner	Area	%	Roughness	Area	%
_			(m)	(m)	(m ²)	(m²)	70	(mm)	(m²)	70		(m²)	70
1	90+800	F	100	5	500	1.02	0.21	-	-	-	R	-	-
2	90+400	F	100	5	500	0.63	0.13	30	104.67	20.93	D	10.00	2.00
3	90+200	F	75	5	375	1.21	0.32	20	22.12	5.90	D	-	-
4	89+500	F	50	4.5	225	0.07	0.03	-	1.25	0.56	D	56.00	24.89
5	87+600	F	100	5	500	5.60	1.12	-	-	-	-	10.50	2.1
6	85+500	Н	75	5	375	18.39	4.90	-	-	-	-	54.53	14.54
7	85+165	Н	50	5	250	0.24	0.10	22	-	-	-	10.25	4.10
		н										120.0	
8	76+700		100	6	450	-	-	-	-	-	R	0	26.67
9	74+600	Н	75	6	450	20.53	4.56	-	-	-	R	14.40	3.20
10	71+600	Н	50	6	300	-	-	-	0.35	0.12	-	71.20	23.73
11	70+650	Н	50	6	300	2.30	0.77	-	-	-	R	-	-
12	67+700	Н	50	6	300	-	-	-	-	-	-	81.80	27.27
13	62+300	Н	100	6	600	8.76	1.46	20	241.89	40.32	-	10.08	1.68
14	40 + 200	Н	100	4.5	450	18.30	4.07	25	35.74	7.94	R	24.07	5.35

Based on the table 4.2, it can be seen that in Sta. 89 + 500, damage occurs with the largest percentage of roads with flat terrain, namely road depression with a percentage of 24.89% of the road segment area. As for the road on the hilly terrain, at Sta. 67 + 700, damage occurs with the largest percentage in the form of depression of 27.27% of the road segment area.

Cracks, with the largest percentage on roads with flat terrain, occur at Sta. 87 + 600, that is equal to 1.12%, and on roads with hilly terrain occurs at Sta. 40 + 200, that is 4.07%.

Types of damage in the form of patches and potholes with the largest percentage on roads with flat terrain occurs at Sta. 90 + 400, that is equal to 20.93%,

and on roads with hilly terrain occurs at Sta. 62 + 300, that is equal to 40.32%.

4.3 Vehicle Speed

Based on the local speed survey (spot speed) on roads with flat terrain, it is known that the minimum speed of light vehicle (LV) occurs at Sta. 90 + 400 of 12.59 km/hour with the types of damage that occur are cracks, grooves, potholes, and depression. Based on the calculation of the local speed (spot speed) of heavy vehicles on roads with flat terrain is the minimum speed of heavy vehicles (HV) occurs at Sta. 90 + 400 of 13.14 km/hour with the types of damage that occur are cracks, grooves, potholes, and depression.

Based on the local speed survey (spot speed) when the light vehicle goes uphill, it is seen that the minimum speed of light vehicles (LV) occurs at Sta. 85 + 500 of 18.11 km/hour with the types of damage are cracks and depression. Meanwhile, when light vehicle goes downhill, the minimum speed of light vehicles (LV) occurs at Sta. 74 + 600 at 11.73 km/hour with the types of damage are cracks and depression. Based on the local speed survey (spot speed), the minimum speed at which a heavy vehicle (HV) goes uphill occurs at Sta. 40 + 200 of 14.52km/hour with the types of damage are cracks, grooves, potholes, and depression. Meanwhile, when heavy vehicle goes downhill, the minimum speed heavy vehicles (HV) occurs at Sta. 85 + 500 of 15.46 km/hour with the types of damage are cracks and depression.

Based on the explanation above, the road performance, in this case is the speed of the vehicle, is affected by road damage, where the dominant ones occur are cracks, grooves, potholes, and depression. Therefore, a statistical test is needed to determine the correlation between the dominant road damage and vehicle speed.

4.4 Analyzing Data using Statistic Testing

Software used in this statistics test is SPSS (Statistical Program for Social Science) 20 for Windows.

The dependent variable is the speed of vehicle, while the independent variables selected based on the types of road damage according to the BinaMarga method are cracks, grooves, potholes, and depressions. The test aims to determine the correlation between independent variables and dependent variable. Based on the statistical test with SPSS 20, a model with the following criteria is chosen:

- 1. It is selected based on the value of the correlation coefficient (R) because this value can reveal how much the variation of the dependent variable that can be represented by the regression equation. F value is calculated, where F value at a certain level of confidence can show how much variation in the regression line equation that can be represented by the independent variables.
- 2. The value of t-count, where with the value of t can show how strong the influence of coefficient of the independent variable equation toward the regression line equation.
- 3. The results of the regression analysis are tested using classic assumption test, namely the normality regression test, the multicollinearity test, and the heteroscedasticity test.

The results of statistical tests of data for light vehicles (LV) and heavy vehicles (HV) with the types of damage on roads with flat and hilly terrain are as follows:

1. Type of damage and speed of light vehicles (LV) on a flat road

Based on the statistics tests of Linear Regression using Stepwise method, the results are presented in the following table.

No.	Dependent Variables (y)	Independent Variables (x)	R	Coefficients, t(Sig.)	ANOVA, F(Sig.)
1	Speed	Groove area (x2)	0.55 8	-4.847(0,000)	23.498(0,000)
2	Speed	Groove area (x2) Depression area (x4)	0.72 0	-5.910(0,000) -4.675(0,000)	27.392(0,000)
3	Speed	Groove area (x2) Depression area (x4) Cracked area (x1)	0.81 6	-7.516(0,000) -5.367(0,000) -4.708(0,000)	33.227(0,000)

Table 4.3 The results of regression testing for the dependent variable (y) and the independent variable (x) LV in the flat terrain

Based on the table above, it can be seen that the correlation value in Model 3 shows a very strong correlation, so it can be interpreted that the speed of LV

on a flat road is affected by road damage with the type of damage in the form of cracks, groove, and depression.

The ANOVA table from SPSS 20 test shows the calculated F value = 33.227 and Sig. 0.000 <0.05. Based

on the table, the value of F table = 2.790 because F count > F table, meaning that there is a linear correlation in the linear regression model between the independent variable and the dependent variable. Coefficients table from SPSS 20 test shows t-count > t table = 2.009 and Sig. <0.05, meaning that, partially, there is a significant influence between the independent variable (x1, x2, x4) and the dependent variables (y).

Regression normality test shows the histogram graph that the curve line is normal (mean~0) and the graph of normal probability plots shows that the points tend to approach diagonal lines, so it can be said as normally distributed. Statistic normality regression test One Sample Kolmogorov Smirnov D count <D table or 0.062 < 0.185, Z count <Z table or 0.454 < 1.96 (95%) and the significance value (Asymp. Sig. 2-tailed) of 0.986>0.05, then the residual value has been normal. In the multicollinearity test, the correlation table shows the entire correlation coefficient (R) <R value of the model, Table 4.4 The results of means in testing of the dependent so it can be concluded that there is no multicollinearity problem in the regression model.

Heteroscedasticity test can be done graphically and using Spearman's rho correlation coefficient test. Graphically, based on the results of the linear regression analysis plot, it can be seen that the points do not have pattern and spread above and below axis y (number 0). Thus, it can be concluded that there is no heteroscedasticity problem in the regression model. According to Spearman's rho Correlations table on the SPSS 20 results, it can be seen that the Sig. (2-tailed) Unstandardized Residual > 0.05. Thus, it can be concluded that there is no heteroscedasticity problem in the regression model.

1. Types of damage and speed of heavy vehicles (HV) on a flat road

Based on Linear Regression statistical test taken using the Stepwise method, the results are presented in the following table:

No.	Dependent Variables (y)	Independent Variables (x)	R	Coefficients, t(Sig.)	ANOVA, F(Sig.)	
1	Speed	Depression area (x4)	0.447	-3.603(0.001)	12.982(0.001)	
2	Correct.	Depression area (x4)	0.077	-4.245(0.000)	16 480(0,000)	
2	Speed	Groove area (x2)	0.627	-4.025(0.000)	16.489(0.000)	
		Depression area (x4)		-5.009(0.000)		
3	Speed	Groove area (x2)	0.779	-5.509(0.000)	25.721(0.000)	
		Crack area (x1)		-5.218(0.000)		
		Depression area (x4)		-5.615(0.000)		
4	Speed	Groove area (x2)	0.801	-5.125(0.000)	21.967(0.000)	
		Crack area (x1)		-5.156(0.000)		
		Hole area (x3)		2.194(0.000)		

Table 4.4 The results of regression testing of the dependent variable (y) and the independent variable (x) HV on the flat field

Based on the table above, it can be seen that the correlation value in Model 4 shows a very strong correlation, so it can be interpreted that the speed of HV on a flat road is affected by road damage with the type of damage in the form of cracks, grooves, depression, and potholes.

The ANOVA table from the SPSS 20 test shows the calculated F value = 21,967 and Sig. 0.000 <0.05. Based on the table, the value of F table = 2.561 because F count > F table, meaning that there is a linear correlation in the linear regression model between the independent variable and the independent variable. The Coefficients table of SPSS 20 test shows t count > t table = 2.010 and Sig. <0.05, meaning that, partially, there is a significant influence between the independent variable (x1, x2, x4) and the dependent variable (y). Regression normality test shows the histogram graph that the curve line is normal (mean \approx 0) and the graph of normal probability plots shows that the points tend to approach diagonal lines, so it can be said as normally distributed. Statistic regression normality test of One Sample Kolmogorov Smirnov D count < D table or 0.131 < 0.185, Z count < Z table or 0.961 < 1.96 (95%) and the significance value (Asymp. Sig. 2-tailed) of 0.314> 0.05, then the residual value has been normal. In the multicollinearity test, the correlations table shows the entire correlation coefficient (R) <Rvalue of the model. Thus, it can be concluded that there is no multicollinearity problem in the regression model.

Heteroscedasticity test can be done graphically and Spearman's rho correlation coefficient test. Graphically, from the results of the linear regression analysis plot it can be seen that the points do not have pattern and spread above and below the axis y (number 0). Thus, it can be concluded that there is no heteroscedasticity problem in the regression model. Based on Spearman's Correlations rho table on the SPSS 20 results, it can be seen that the Sig. (2-tailed) Unstandardized Residual > 0.05, meaning that there is no heteroscedasticity problem in the regression model.

2. Type of damage and speed of light vehicles (LV) uphill on the road in the hilly terrain

Based on the Linear Regression statistical test taken using the Stepwise method, the results are presented in the following table.

Table 4.5 Regression test results on the de	pendent variable (v) and the inder	pendent variable (x) of LV when	going unhill
			80 mg mp mm

No. Variables (y) Variables (x) R Coefficients, (dig.) R HOVA, T(dig.) 1 Speed Crack area (x1) 0.440 -3.978(0.000) 15.827(0.000) 2 Speed Crack area (x1) 0.705 -6.466(0.000) 32.196(0.000) 2 Speed Depression are (x4) 0.705 -6.466(0.000) 32.196(0.000) 3 Speed Depression are (x4) 0.771 -7.636(0.000) 31.272(0.000) 3 Speed Depression are (x4) 0.771 -7.786(0.000) 31.272(0.000) 4 Speed Depression are (x4) 0.788 -8.077(0,000) 25.789(0.000) 4 Speed Depression are (x3) 2.093(0,040) 25.789(0.000) 25.789(0.000)	No	Dependent	Independent	R	Coefficients t(Sig.)	$\Delta NOV\Delta = E(Sig.)$	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	110.	Variables (y)	Variables (x)	K	coefficients, ((Sig.)	AITOVA, I (Sig.)	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1	Speed	Crack area (x1)	0.440	-3.978(0.000)	15.827(0.000)	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2	Speed	Crack area (x1)	0.705	-6.466(0.000)	22 106(0,000)	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	2	speed	Depression are (x4)	0.703	-6.274(0.000)	52.190(0.000)	
3 Speed Depression are (x4) 0.771 -7.786(0.000) 31.272(0.000) Groove area (x2) -3.909(0.000) -3.909(0.000) -7.941(0.000) 4 Speed Depression are (x4) -7.941(0.000) -8.077(0,000) Groove area (x2) 0.788 -8.077(0,000) -25.789(0.000) Pothole area (x3) 2.093(0,040) -4.019(0,000) -4.019(0,000)			Crack area (x1)		-7.636(0.000)		
	3	Speed	Depression are (x4)	0.771	-7.786(0.000)	31.272(0.000)	
$\begin{array}{c} \mbox{4} & \mbox{Speed} \end{array} \begin{array}{c} \mbox{Crack area (x1)} & -7.941(0.000) \\ \\ \mbox{Depression are (x4)} & & -8.077(0,000) \\ \\ \mbox{Groove area (x2)} & & 0.788 \end{array} \begin{array}{c} -8.077(0,000) \\ -4.019(0,000) \\ \\ \mbox{-4.019(0,000)} \end{array} \begin{array}{c} 25.789(0.000) \\ \\ \mbox{25.789(0.000)} \end{array} \end{array}$			Groove area (x2)		-3.909(0.000)		
4 Speed Depression are (x4) Groove area (x2) 0.788 -8.077(0,000) -4.019(0,000) 25.789(0.000) Pothole area (x3) 2.093(0,040)			Crack area (x1)		-7.941(0.000)		
4 Speed Groove area (x2) 0.788 -4.019(0,000) 25.789(0.000) Pothole area (x3) 2.093(0,040)	4	C J	Depression are (x4)	0.700	-8.077(0,000)	25 780/0 000)	
Pothole area (x3) 2.093(0,040)		speed	Groove area (x2)	0.788	-4.019(0,000)	23.169(0.000)	
			Pothole area (x3)		2.093(0,040)		

Based on the table above, it can be seen that the correlation value in Model 4 shows a very strong relationship. Thus, it can be interpreted that the speed of LV when going uphill the hilly roads is affected by road damage with the type of damage in the form of cracks, grooves, depressions, and potholes.

The ANOVA table from the SPSS 20 test shows the calculated F value = 25.789 and Sig. 0.000 < 0.05. Based on the table, the value of F table = 2.518 because F count > F table, meaning that there is a linear correlation in the linear regression model between the independent variable and the dependent variable. Coefficient table from the SPSS 20 test shows t-count > t table = 1.998 and Sig. <0.05, meaning that, partially, there is a significant influence between the independent variables (x1, x2, x3 and x4) and the dependent variable (y).

Regression normality test shows the histogram graph that the curve line is normal (mean \approx 0) and the graph of normal probability plots shows that the points tend to approach diagonal lines, so it can be said as normally distributed. Statistical normality regression test of One Sample Kolmogorov Smirnov D count < D table or 0.072 < 0.165, Z count < Z table or 0.594 < 1.96 (95%) and the significance value (Asymp. Sig. 2-tailed) of 0.873> 0.05, then the residual value has been normal. In the multicollinearity test, the Correlations table shows the entire correlation coefficient (R) <Rvalue of the model. Thus, it can be concluded that there is no multicollinearity problem in the regression model.

Heteroscedasticity test can be done graphically using Spearman's rho correlation coefficient test. Graphically, based on the results of the linear regression analysis plot, it can be seen that the points do not have pattern and spread above and below the axis y (number 0). Thus, it can be concluded that there is no heteroscedasticity problem in the regression model. Based on Spearman's Correlations rho table on the SPSS 20 results, it can be seen that the Sig. (2-tailed) Unstandardized Residual > 0.05, meaning that there is no heteroscedasticity problem in the regression model.

3. Types of damage and speed of light vehicles (LV) when going downhill the hilly terrain

Based on Linear Regression statistical test taken using the Stepwise method, the results are presented in the following table:

No.	Dependent Variables (y)	Independent Variables (x)	R	Coefficients, t(Sig.)	ANOVA, F(Sig.)	
1	Speed	Depression area (x4)	0.487	-4.465(0.000)	19.935(0.000)	
2	Speed	Depression area (x4)	0.716	-6.851(0.000)	22 142(0,000)	
2	speed	Crack area (x1)	0.710	-5.965(0.000)	55.142(0.000)	
		Depression area (x4)		-7.418(0.000)		
3	Speed	Crack area (x1)	0.741	-6,382(0,000)	25.207(0.000)	
		Groove area (x2)		-2,250(0,000)		

Table 4.6 Results of regression testing of the dependent variable (y) and the independent variable (x) of LV going downhill

Based on the table above, it can be seen that the correlation value in Model 3 shows a strong correlation, so it can be interpreted that the speed of LV when going downhill the hilly road is influenced by road damage with the types of damage in the form of cracks, grooves, and depressions.

The ANOVA table from the SPSS 20 test shows the calculated F value = 33.227 and Sig. 0.000 < 0.05. Based on the table, the value of F table = 2.753 because F count > F table, meaning that there is a linear correlation in the linear regression model between the independent variable and the dependent variable. Coefficients table from the SPSS 20 test shows t count > t table = 1.999 and Sig. <0.05, meaning that, partially, there is a significant influence between the independent variable (x1, x2, x4) and the dependent variable (y).

Regression normality test shows the histogram graph that the curve line is normal (mean≈0) and the graph of normal probability plots shows that the points tend to approach diagonal lines, so it can be said as normally distributed. Statistic regression normality test One Sample Kolmogorov Smirnov shows D count < D table or 0.108 < 0.167, Z count < Z table or 0.880 < 1.96 (95%) and the significance value (Asymp. Sig. 2-tailed) is 0.421 > 0.05, then the residual value has been normal. In the multicollinearity test, the Correlation table shows the entire correlation coefficient (R) <Rvalue of the model, meaning that there is no multicollinearity problem in the regression model.

Heteroscedasticity test can be done graphically using Spearman's rho correlation coefficient test. Graphically, based on the results of the linear regression analysis plot, it can be seen that the points do not have pattern and spread above and below the axis y (number 0). Thus, it can be concluded that there is no heteroscedasticity problem in the regression model. Based on Spearman's Correlations rho table on the SPSS 20 results, it can be seen that the Sig. (2-tailed) Unstandardized Residual > 0.05, meaning that there is no heteroscedasticity problem in the regression model.

Type of damage and speed of heavy vehicles (HV) 4 going uphill on the road with hilly terrain

Based on Linear Regression statistical test taken using the Stepwise method, the results are presented in the following table:

No	Dependent	Independent	D	Coofficients t(Sig.)	ANOVA E(Sig.)
INO.	Variables (y)	Variables (x)	Variables (x)		ANOVA, r(sig.)
1	Speed	Crack area (x1)	0.485	-4.466(0.000)	19.949(0.000)
2	Speed	Crack area (x1)	0.750	-7.366(0.000)	<i>41</i> 182(0,000)
Z	speed	Depression area (x4)	0.750	-6.928(0.000)	41.182(0.000)
3		Crack area (x1)		-8.472(0.000)	
	Speed	Depression area (x4)	0.800	-8.348(0.000)	37.429(0.000)
		Groove area (x2)		-3.694(0.000)	
		Crack area (x1)		-6.693(0.000)	
4	Smood	Depression area (x4)	0.916	-8.509(0.000)	20.706(0.000)
	speed	Groove area (x2)	0.810	-3.815(0.000)	50.790(0.000)
		Pothole area (x3)		-2.135(0.037)	

Table 4.7 Regression test results on the dependent variable (y) and the independent variable (x) HV when going uphill

Based on the table above, it can be seen that the correlation value in Model 4 shows a very strong corelation, so that it can be interpreted that the speed of HV when going uphill on a hilly road is affected by road

damage with the type of damage in the form of cracks, grooves, potholes, and depression.

The ANOVA table from the SPSS 20 test shows the calculated F value = 30.796 and Sig. 0.000 < 0.05. Based on the table, the value of F table = 2.520 because F

count > F table, meaning that there is a linear correlation in the linear regression model between the independent variable and the dependent variable. Coefficient table from the SPSS 20 test shows t count > t table = 1.998 and Sig. <0.05, meaning that, partially, there is a significant influence between the independent variables (x1, x2, x3 and x4) and the dependent variable (y).

Regression normality test shows the histogram graph that the curve line is normal (mean \approx 0) and the graph of normal probability plots shows that the points tend to approach diagonal lines, so it can be said as normally distributed. Statistical normality regression test One Sample Kolmogorov Smirnov shows D count <D table or 0.105 < 0.166, Z count <Z table or 0.861 < 1.96 (95%) and the significance value (Asymp. Sig. 2-tailed) is 0.449 > 0.05, then the residual value has been normal. In the multicollinearity test, the Correlation table shows the entire correlation coefficient (R) <Rvalue of the model, meaning that there is no multicollinearity problem in the regression model.

Heteroscedasticity test can be done graphically using Spearman's rho correlation coefficient test. Graphically, based on the results of the linear regression analysis plot, it can be seen that the points are patternless and spread above and below the axis y (number 0). Thus, it can be concluded that there is no heteroscedasticity problem in the regression model. Based on Spearman's Correlations rho table on the SPSS 20 results, it can be seen that the Sig. (2-tailed) Unstandardized Residual > 0.05, meaning that there is no heteroscedasticity problem in the regression model.

5. Type of damage and the speed of heavy vehicles (HV) going uphill on the road with hilly terrain

Based on the Linear Regression statistical test taken using the Stepwise method, the results are presented in the following table:

Table 4.8 Results of regression tests for the dependent variable (y) and the independent variable (x) HV when going downhill
the slope.

No.	Dependent variables (y)	Independent Variables (x)	R	Coefficients, t(Sig.)	ANOVA, F(Sig.)
1	Speed	Depression area (x4)	0.550	-5.274(0.000)	27.816(0.000)
2	Speed	Depression area (x4)	0.600	-7.110(0.000)	20 122(0 000)
2	speed	Crack area (x1)	0.099	-4.788(0.000)	30.133(0.000)
		Depression area (x4)		-7.589(0.000)	
3	Speed	Crack area (x1)	0.723	-5.133(0.000)	22.627(0.000)
		Groove area (x2)		-2.093(0.000)	

Based on the table above, it can be seen that the correlation value in Model 3 shows a strong correlation, so it can be interpreted that the speed of HV when going downhill the hilly roads is affected by road damage with the types of damage in the form of cracks, grooves, and depression.

The ANOVA table from the SPSS 20 test shows the calculated F value = 22,627 and Sig. 0.000 < 0.05. Based on the table, the value of F table = 2.753 because F count > F table, meaning that there is a linear correlation in the linear regression model between the independent variable and the dependent variable. Coefficients table from the SPSS 20 test shows tcount > t table = 1.999 and Sig. < 0.05, meaning that, partially, there is a significant influence between the independent variable (x1, x2, x4) and the dependent variable (y).

Regression normality test shows the histogram graph that the curve line is normal (mean \approx 0) and the graph of normal probability plots shows that the points tend to approach diagonal lines, so it can be said as normally distributed. Statistical normality regression test One Sample Kolmogorov Smirnov shows D count < D table or 0.064 < 0.167, Z count < Z table or 0.523 < 1.96 (95%) and the significance value (Asymp. Sig. 2-tailed) is 0.947 > 0.05, then the residual value has been normal.

In the multicollinearity test, the Correlations table shows the entire correlation coefficient (R) <Rvalue of the model, meaning that there is no multicollinearity problem in the regression model.

Heteroscedasticity test can be done graphically using Spearman's rho correlation coefficient test. Graphically, based on the results of the linear regression analysis plot, it can be seen that the points do not have pattern and spread above and below the axis y (number 0). Thus, it can be concluded that there is no heteroscedasticity problem in the regression model. Based on Spearman's Correlations rho table on the SPSS 20 results, it can be seen that the Sig. (2-tailed) Unstandardized Residual > 0.05, meaning that there is no heteroscedasticity problem in the regression model.

V. CONCLUSION

Based on the analysis and discussion of the data presented in the previous chapter, it can be concluded that:

- 1. The types of damage that occur at MuaraTeweh -PurukCahu road section based on the classification of BinaMarga method are cracks, grooves, patches, potholes, surface roughness and depression.
- 2. The speed of light vehicles and heavy vehicles that tends to decrease when passing through MuaraTeweh - PurukCahu road section is more dominantly affected by the types of damage, namely cracks, grooves, potholes, and depression.
- 3. The speed of light vehicles on roads with flat terrain shows a very strong correlation with the type of damage, namely cracks, grooves, and depression. The speed of light vehicle when going uphill shows a very strong correlation with the type of damage, namely cracks, grooves, patches, and depression. Meanwhile, the speed of vehicle when going downhill shows a strong correlation with the types of damage, namely cracks, grooves, and depression.
- 4. The speed of heavy vehicles on roads with flat terrain shows a very strong correlation with the types of damage, namely cracks, grooves, potholes, and depression. The speed of heavy vehicle when going uphill shows a very strong correlation with the types of damage, namely cracks, grooves, potholes, and depression. Meanwhile, the speed of vehicle when going downhill shows a strong correlation with the types of damage, namely cracks, grooves, and depression.

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Bryophytes in Maranhão/Brazil: A New Area, a New Species List

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Abstract—Bryophytes were collected from a Cerrado fragment, located in the municipality of Caxias, Maranhão/Brazil. In the study area, 175 bryophytes were distributed in 12 families (10 mosses and two liverworts), 17 genera (15 mosses and two liverworts) and 23 species (21 mosses and two liverworts). Sematophyllaceae was the most representative family with four species (Trichosteleum subdemissum, Microcalpe subsimplex, Brittonodoxa subpinnata, and Taxithelium planum), followed by Dicranaceae, Fissidentaceae, and Pottiaceae with three species each. The species of bryophytes in the researched area colonized substrates, such as corticolous, terrestrial, rupicolous, epixylics and casmofites. The table shows the families, species, phytogeographic domains in Brazil and colonized substrates. Keywords—Mosses, Liverworts, Biodiversity.

I. INTRODUCTION

The bryophytes are cryptogamic plants with heteromorphic alternation of generations (GRADSTEIN et al., 2001), represented by Anthocerotophyta, Marchantiophyta and Bryophyta (GLIME, 2013), being the second largest group of terrestrial plants after the angiosperms (BUCK; GOFFINET, 2000). They are predominantly terrestrial, with close dependence on water for sexual reproduction, since male gametes are flagellated (COSTA et al., 2010).

Brazil harbors tone of the last regions of forests, wetlands, and savannas, which are important for global climate stability and biodiversity conservation (KEHOE et al., 2019). The number of phytogeographical domains and environments makes Brazil, one of the countries that have an expressive diversity of mosses, liverworts, and hornworts, probably subsample because of the continental dimensions, with more species registered for the states of Rio de Janeiro (900 sp.), São Paulo (900 sp.), Minas Gerais (76 spp.), And for other states the number of species is lower.

The Brazil has a significant richness of bryophytes, most of which are of neotropical origin (GRADSTEIN et al., 2001), with a record of 1574 species for the country and 89 for the state of Maranhão (COSTA, PERALTA, 2015, BFG, 2018), corresponding to 5.6% of the total number of species known for Brazil.

The preservation of environments in tropical rainforestregions, whether in the Amazon Rainforest or in the Atlantic Rainforest region, as well as in vegetation

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of the Caatinga and Cerrado, which favors the development of bryophyte species, there are still unexplored areas that require intensified collections in the three groups of bryophytes to be known the real number of species for Brazil.

For Maranhão, collection efforts have been carried out by Santos (2010); Varão et al. (2011); Costa; Conceição (2014); Vieira et al. (2017); Silva et al. (2018); Costa et al. (2018); Oliveira et al. (2018a) and Oliveira et al. (2018b), to fill gaps in the knowledge of bryophytes.

The purpose of the study was to know the bryophytes, colonized substrates and Brazilian phytogeographical domains in the Buriti do Meio Municipal Environmental Protection Area, located in the municipality of Caxias, Maranhão, Brazil.

II. MATERIAL AND METHODS

The collections were carried out in the Buriti do Meio Municipal Environmental Protection Area, which covers an area of 58,347.30 ha, located 35 km from the urban perimeter of the municipality of Caxias/Maranhão (4°54'48,1"S- 43°06 ' 49.2" W).

Monthly collections were carried out by means of free walks and in all types of substrates available that the bryophytes could colonize. The methodology for the collection, herborization and preservation of the material followed Gradstein et al. (2001).



Fig.1: Location map of the Environmental Protection Area of Buriti do Meio, where the collections of Bryophytes were carried out. Source: IBGE/2013.

For the identification of the species the references of Schuster (1980), Gradstein; Buskes (1985), Frahm (1991); Gradstein (1989, 1994), Sharp et al. (1994), Buck (1998), Ilkiu-Borges (2000), Reiner-Drehwald (2000), Gradstein et al. (2001), and Gradstein; Costa (2003) Chamber; Costa (2006), Camera (2008), Ballejos; Bastos (2009), Yano; Peralta (2009).

The classification system adopted was Crandall-Stotler et al. (2009) for liverworts and Goffinet et al. (2009) for mosses. Robbins (1952) was used for the substrates of the species, where they were classified in corticolous, epixylics, epiphyllous, rupicolous, and terrestrial. The distribution in the Brazilian phytogeographical domains for the species was based on the Flora do Brasil 2020.

III. RESULTS AND DISCUSSION

In the study area, 175 bryophytes were collected, distributed in 13 families (11 mosses and two liverworts), 17 genera (15 for mosses and two for liverworts) and 23 species (21 for mosses and two for liverworts/table 1). As for the number of species per family presented in the study, Sematophyllaceae was the most representative subdemissum. with four species (Trichosteleum Microcalpe subsimplex, Brittonodoxa subpinnata, Taxithelium planum), followed by Dicranaceae

(Campylopus heterostachys, Campylopus savannarum, Campylopus surinamensis); Fissidentaceae (Fissidens submarginatus, Fissidens flaccidus, Fissidens angustifolius) and Pottiaceae (Hyophilla involuta, Hyophiladelphus agrarius, Splachnobryum obtusum) three species each. The Sematophyllace family is one of the largest families of mosses, comprising about 40 genera and approximately 800 species (MORAES, 2006; GRADSTEIN et al., 2008).

Table 1. List of families and species of bryophytes occurring in the Buriti do Meio Environmental Protection Area, Caxias/Maranhão, Brazil; Geographical distribution in Brazil; substrates colonized by the species (Co: Corticolous; Ep: Enjyylic: Bu: Bunjcolous; Ca: Casmofites and Te: Terrestrial)

Family	Species	Phytogeographic Domain	Substrates
Bryaceae	Bryum apiculatum Schwägr.	Caatinga, Cerrado, Atlantic Rainforest	Te, Co, R
Bartramiaceae	Philonotis uncinata (Schwägr.) Brid.	Amazon Rainforest, Caatinga, Cerrado,	R, Te
		Atlantic Rainforest, Pampa, Pantanal	
Calymperaceae	Octoblepharum albidum Hedw.	Amazon Rainforest, Caatinga, Cerrado,	Ep, Co, R
		Atlantic Rainforest, Pampa, Pantanal	
	Calymperes palisotii Schwägr.	Amazon Rainforest, Caatinga, Cerrado,	Co, Te
		Atlantic Rainforest	
Dicranaceae	Campylopus heterostachys (Hampe) A.	Amazon Rainforest, Caatinga, Cerrado,	R, Te.
	Jaeger	Atlantic Rainforest	
	Campylopus savannarum (Müll.Hal.) Mitt.	Amazon Rainforest, Caatinga, Cerrado,	Te, R
		Atlantic Rainforest, Pantanal	
	Campylopus surinamensis Müll. Hal.	Amazon Rainforest, Cerrado, Atlantic	Te, Ep
		Rainforest, Pantanal	
Fissidentaceae	Fissidens submarginatus Bruch	Amazon Rainforest, Caatinga, Cerrado,	Te
		Atlantic Rainforest, Pampa, Pantanal	
	Fissidens flaccidus Mitt.	Amazon Rainforest, Caatinga, Cerrado,	Te, Cas
		Atlantic Rainforest, Pampa, Pantanal	
	Fissidens angustifolius Sull.	Amazon Rainforest, Caatinga, Cerrado,	Со
		Atlantic Rainforest, Pampa, Pantanal	
Hypnaceae	Isopterygium tenerum (Sw.) Mitt.	Amazon Rainforest, Caatinga, Cerrado,	Ер
		Atlantic Rainforest, Pampa, Pantanal	
	Isopterygium tenerifolium Mitt.	Amazon Rainforest, Cerrado, Atlantic	Ep
		Rainforest	
Pottiaceae	Hyophilla involuta (Hook.) A. Jaeger	Amazon Rainforest, Caatinga, Cerrado,	Ep
		Atlantic Rainforest, Pampa, Pantanal	
	Hyophiladelphus agrarius (Hedw.) R.H.	Amazon Rainforest, Caatinga, Cerrado,	Ep e Co
	Zander	Atlantic Rainforest	
Pterobryaceae	Orthostichopsis praetermissa W.R. Buck	Amazon Rainforest, Cerrado, Atlantic	Со
		Rainforest	
Rhachitheciaceae	Zanderia octoblepharis (A. Jaeger)	Amazon Rainforest, Caatinga, Cerrado,	Te, Co, e
	Goffinet	Atlantic Rainforest	R
Sematophyllaceae	Trichosteleum subdemissum (Besch.) A.	Amazon Rainforest, Cerrado, Atlantic	Co e Ep
	Jaeger	Rainforest	
	Microcalpe subsimplex(Hedw.) W.R. Buck	Cerrado	Co, Ep, R

	Brittonodoxa subpinnata (Brid.) W.R.	Cerrado	Co, Ep
	Buck, P.E.A.S. Câmara & CarvSilva		
	Taxitheliumplanum (Brid.) Mitt.	Amazon Rainforest, Cerrado, Atlantic	Co
		Rainforest, Pantanal	
Splachnobryace ae	Splachnobryumobtusum (Brid.) Müll. Hal.	Amazon Rainforest, Cerrado, Atlantic	Te
		Rainforest, Pantanal	
Lepidoziaceae	Zoopsidella macella (Steph.) R.M. Schust.	Amazon Rainforest, Caatinga, Cerrado	Со
Lejeuneaceae	Lejeunea trinitensis Lindenb.	Amazon Rainforest, Caatinga, Cerrado,	Co
		Atlantic Rainforest, Pantanal	

In relation to the genera, *Campylopus* Brid. was the most representative, with three species (*C. heterostachys, C. savannarum* and *C. surinamensis*), and the genus *Campylopus* has approximately 165 species in the world (FRAHM, 1999, STECH, 2004) and 30 species for Brazil and only four species to Maranhão (Flora do Brasil, 2020).

The species of bryophytes in the researched area colonized substrates, such as corticolous, terrestrial, rupicolous, epixylics and casmofites. It was observed that the largest number of species colonized the corticolous substrate in the study area.

The interest of bryophytes in colonizing these substrate is justified by the availability of favorable habitats and microclimates, where live trunks are the most available substrates for colonization, followed by decomposing trunks and earthlings that are limited in their development, by the accumulation of as well as the low illumination at ground level (RICHARDS, 1984; PORTO, 1992; GRADSTEIN et al., 2001; CARMO; PERALTA, 2016).

In relation to the distribution of the collected species, bryophytes occur in all Brazilian phytogeographic domains, where the Amazon had the highest number of species, followed by the Cerrado, Atlantic Rainforest, Pantanal and Pampa.

IV. CONCLUSION

The research provided information on the bryophytes of the state of Maranhão/Brazil, with emphasis on a Cerrado fragment from the municipality of Caxias/MA. The 23 bryophyte species registered in the research represent 25.8% of the species known for Maranhão, which indicates that new studies should be encouraged to register species in new areas not yet exploited to fill knowledge gaps for the plant group.

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Creation and Implementation of a Municipal Science, Technology and Innovation System - An Experience Report

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Abstract— Science, Technology and Innovation (ST&I) has the power to disrupt the old and consolidated political, social, cultural and economic paradigms of society. For effective ST&I actions to take place in a society, the participation of the business sector, ST&I institutions and, above all, the constituted public administration is necessary. This experience report aims to describe the process used to create and implement the ST&I municipal system. A case study was carried out in Campina Grande, one of the largest and most developed municipalities in the interior of Brazil. The results of the study indicate that the integration between the public administration, business and academic sector as well as the effective participation of the ST&I institutions was essential for the creation of a legal ordering for ST&I that would meet the specificities of the municipality in question.

Keywords—ST&I Municipal System. Public policies. Innovation Process. ST&I Laws and Regulations.

I. INTRODUCTION

The technoscience revolution has caused a rupture or discontinuity over the old and consolidated political, social, cultural and economic paradigms of society. There is a change of mindset with greater engagement among academic sector, public people; business and administration with the purpose of improve the old paradigms, not only for raising economic gains, but for social inclusion through science, technology and innovation. This mindset change requires the individual citizen, the public power, and the private sector, as agents of social transformation, each one with its own rights and responsibilities, to change the mindset for achieving the goals of a ST&I-based society.

Assuming every agent of transformation must act according to their possibilities, we have that the public administration, in agreement to Brazilian law, must act according to the legal permissions. Therefore, there must necessarily be normative instruments that support its action and the use of public resources for this purpose, observing the reality of the state that has the tools for greater reach and impact of public policies for the development ST&I.

Therefore, considering daily life and business are developed within the municipalities, it is within this *locus* that these new practices must be implemented to develop the objectives pursued with this new society. In this scenario, the presence of the public administration as an agent of integration, promotion and development of ST&I. Accordingly, based on the Brazilian constitutional principle of legality, it is necessary to establish a legal ordering that enables multiple municipal agencies to act effectively in the ST&I area.

Observing for this reality and the need for legal ordering, the Complementary Law 141/2018, which instituted the "Municipal Policy of Science, Technology and Innovation" (a.k.a. ST&I Municipal System), was submitted to the Municipal Council of Campina Grande, one of more important city of Paraiba state as well as the northeast region of Brazil. This Complementary Law establishes incentive for innovation, scientific and technological development. Therefore, this law will consolidate itself as an instrument of the public administration action for the integration of ST&I environment in the academic, business and social institutions of the aforementioned municipality.

Starting from the motivation to transform the reality of Campina Grande through development of ST&I, the legal ordering started from a proposal to create a municipal fund aimed at financing projects of this nature. However, during the construction process, the initial legal ordering was expanded to allow the public administration to act more effectively in ST&I area. Actions as the management of this financial fund, establishment of partnerships with educational and research institutions, perform technology orders by the private sector, and transform the developed science in innovation for the life of the population.

The present study aims to demonstrate the collaborative process for construction of the legal ordering, as well as the legal instruments to implement this ST&I incentive policy. It is noteworthy there was an integrated effort by ST&I institutions, academic and business institutions, as well as the population to construct and implement the ST&I municipal system. We believe actions of this nature can contribute to the development of ST&I in this important Brazilian city. Campina Grande can effectively consolidate its role as a promoter of regional development, thus contributing not only to the improvement of its productive and academic sector as well as of all the municipalities which are part of its region.

Based on the inductive scientific method, the study was supported by a broad bibliographic review of references in ST&I area, as it seeks to conclude with the study, based on theoretical and practical assumptions (which is the very experience of elaboration and implementation of legislation in the municipality of Campina Grande) the impact of such a legal ordering at the municipal and regional level.

The remainder of this paper is organized as follows. Section 2 introduces basic concepts required to understand the experience report described in our study. Related work is discussed briefly in Section 3. Settings for construction of the legal ordering are described in Section 4. In Section 5, we present the main components of ST&I municipal system as well as the conceptualization and details of each of them. The main threats to validity observed in our study are discussed in Section 6. Finally, we present our conclusions and point out directions for future work in Section 7.

II. BACKGROUND

This section presents essential concepts related to ST&I as well as the Brazilian legal system in this area.

2.1 Innovation in Brazil in a World Context

In research by Cornell University and the World Intellectual Property Organization (WIPO), Brazil ranked 61st in the Global Innovation Index [1]. This index is based on seven pillars, five of which capture elements of the national economy that enable innovative activities: 1) institutions; 2) human capital and research; 3) infrastructure; 4) market sophistication; and 5) business sophistication. The other two pillars, in turn, capture real evidence of innovation outcomes: 6) knowledge and technological results, and 7) creative results.

The **Figure 1** provides a comparison of the seven pillars used to measure the Global Innovation Index between Brazil, countries with similar R&D expenditures, and China. Brazil occupied the 76th position in that same year. According to the 2014 report, all BRICS countries (with the exception of South Africa) were rated as 'efficient innovators', meaning they obtained innovation efficiency scores (calculated as the ratio of total innovation outputs and total innovation inputs) greater than or equal to an average of 0.74.



Fig.1. Innovation indicators in selected countries.

When considering all indicators analyzed, the quality of Brazilian universities deserves highlighting. This indicator is calculated as the average of the three best ranked universities in the country in the QS University Ranking. According to this criterion, Brazil obtained 23rd place in terms of quality of universities. Other criteria were analyzed and then we will demonstrate Brazil's position in each of them: high-tech manufactures (21st place), number of firms offering formal training (20th place; indicator where Brazil achieved its best placement), absorption of knowledge (25th place), and the H-index of cited documents (22nd place). Thus we can notice advances in several areas.

On the other hand, it is noteworthy the poor performance of Brazil in the 'business environment' indicator, in which the country was ranked 137th out of the 143 countries studied. This indicator consists of three sub-indicators: *ease of starting a business* (136th place), *ease of insolvency proceedings* (117th place), and finally, *ease of paying taxes* (131th place). It is evident this is an area that demands more public administration attention, whose role would be to create mechanisms to reduce the bureaucracy involved in the process of opening, maintaining and closing companies in the country.

We clearly note Brazil has advanced significantly in some areas within the context of science, technology and innovation. However, in many others the Brazilian people still lack many initiatives by the public administration as well as private initiative. To improve all these indicators, we need massive investment to create good conditions for the economic and especially social development of the Brazilian people. In the following, we will revisit the main initiatives in terms of research and development (R&D) investments in Brazil in the recent past.

2.2 R&D Investment in Brazil

Investments in R&D are of enormous importance for economic and social development [2]. These investments are responsible for developing the knowledge stock of organizations, and also have the function of identifying technological opportunities to be explored, both internally and externally to the organization [3]. In addition, R&D investments are positively related to the performance of organizations [4] and positively impact their innovative capacity [5].

Historically the amount of resources invested in R&D in Brazil is increasing. In 2013, the country invested an amount 84% higher compared to the amount invested in 2000. However, considering this was a period of significant growth of the Brazilian economy, it is clear the increase in expenditures in R&D as a percentage of GDP was much more modest, but also positive [2]. This indicator went from 1.04% in 2000 to 1.24% in 2013 [6], not yet meeting the 1.5% target set for 2010 in the Science, Technology and Innovation Action Plan (PACTI) [7].

The aforementioned plan aimed at "giving greater governance and articulation to the actions necessary for the development and strengthening of ST&I" in Brazil [7]. Among its goals for 2010, it was also the expansion of corporate participation in total R&D investments in Brazil, which should rise from 0.49% in 2006 to 0.65%. However, this target has not been met so far, as the private sector R&D intensity (percentage of GDP invested in R&D) in Brazil that year was 0.57%, falling to 0.52% in 2013. Aims to continue and deepen the PACTI, the federal government launched in 2012 the National Strategy for ST&I (ENCTI) [8]. This initiative highlights the importance of ST&I as a structuring axis for the country's development, establishing guidelines for the orientation of national and regional actions in the 2012-2015 timeframe [2].

If the R&D growth rate continues over the next few years, it will still take about 20 years to reach the level currently observed in European countries [2]. Compared to developed nations, investments in R&D in Brazil seem quite modest. In 2013 [6] Germany invested 2.85% of its GDP in R&D, while the United States invested 2.73% and China 2,08%. The market share of Brazilian companies in R&D investments (declining since 2005, when it reached 52.3%) represented, in 2013, only 42.3% of total expenditure [6], while in more developed countries 70% of these investments are made by private companies [9].

The lack of coordination between government, companies and universities has historically been one of the main characteristics of the Brazilian ST&I system. However, much progress has been made since the 1980s, due to government initiatives aimed at bringing the academic, public and private spheres closer together [10]. However, according to the **figure 1**, we realize the Brazilian scenario of ST&I have improved particularly in recent years. Such improvement was due to the creation of a federal legal ordering that significantly fostered ST&I initiatives. In the following section we will discuss the main government actions in this regard.

2.3 Legal Brands - Federal Laws

Investment in ST&I culminates in the growth of countries [12]. For doing so, the Brazilian public administration has been trying to intensify actions to foster an environment conducive to innovation in industry and academia, seeking to encourage the internalization of the culture of research and innovation in companies, the public service, and society in general[7]. To this end, it has created mechanisms over the last few years to promote and encourage research, development and innovation activities.

The Technological Innovation Law [13] played a key role in this process. Promulgated in December 2004, it created incentives for scientific and technological innovation in a productive environment, seeking technological autonomy and industrial development for Brazil. This law was fundamental in defining the types of cooperation agreements that could be signed between universities and companies. In its 16th article, this law establishes every scientific, technological and innovative institution (STII) must have a Technological Innovation Center, own or in association with other STII, in order to manage its innovation policy.

Decreed in November 2005, "Lei do Bem" (in English, *law of good*) granted a set of tax incentives to companies to conduct R&D aiming at technological innovation [11]. These incentives include: the deduction of up to 34% in *Corporate Income Tax* and *Social Contribution* on Net Income from investments in technological R&D of technological innovation; 50% reduction in the *Taxes over industrialized products* (IPI) on the purchase of R&D machines; and the *economic grant*, through science and technology promotion agencies, of masters or doctors employed in technological innovation activities in companies located in Brazil [11][12][13].

The Informatics Law, initially enacted in 1991 and improved at the end of 2004, grants tax incentives to companies operating in the areas of hardware and automation that invest in R&D [7]. These incentives are foreseen until the present year of 2019 and refer to the reduction of the IPI for computer components, automation and telecommunications produced in all regions of the country, except the Manaus Free Zone (i.e. special economic zone located in northern Brazil, state of Amazonas), which has specific legislation [11][14].

The aforementioned laws are examples of public administration actions to build an environment conducive to the promotion of ST&I-related activities in both the industrial and academic sectors. However, legal ordering is important, but often not enough. There is also often a need to change the culture and mindset of the actors involved in the ST&I development process. Example of actors are researchers, entrepreneurs, representatives of educational and research institutions, and public administration employees. This requires time and effort. In this context, there is the notion of ST&I systems and ecosystems, which arise from the union between public and private administration with a view to fostering and promoting technological development between the actors and society. Although these concepts seem synonymous, there are substantial differences between them. In the following section, we list in detail the concepts associated with ST&I systems and ecosystems.

2.4 ST&I Systems and Ecosystems

The concept of ST&I system is older, created in the 80's by Freeman [15]. In fact, this approach was created to replace the theory that understood ST&I activities as a linear process and no longer addressed all the complexity that surrounds the process. Therefore, the concept of ST&I system arises from the perception that technological development activities form a complex

process, resulting from the interaction of several actors, mainly institutional ones.

According to Freeman and Soete [15], **ST&I systems** are formed by the various interactions, analyzed in a broad sense, between public and private agents dealing with Science, Technology and Innovation, as well as the teaching and diffusion of technology. Similarly, Nelson and Rosenberg [33] cite that ST&I systems are a set of institutions whose interactions determine the innovative performance of national companies.

In addition, it is worth mentioning there are different configurations of ST&I systems: *national system*, *regional system*, *state system* and, finally, *municipal system*. Therefore, the national ST&I system considers the entire institutional, legal and policy framework of the country. We can say that the national system arises from the union of all regional systems. Regional systems arise from the union of state systems and so on.

In the following section, we will expose some of the main details associated with the Brazilian ST&I system. Consequently, the state and municipal ST&I systems will be characterized by the geographical proximity of its actors. This type of system has a smaller granularity in terms of geographical dimension. Finally, the *sectoral ST&I system* is concentrated on a specific sector of activity. This type of system does not take into account the geographical dimension for classification purposes.

On the other hand, the concept of **ST&I ecosystem** is newer and derives from the analogy with the biological ecosystem. In such a way, the metaphor was introduced by James Moore in 1993, suggesting that companies should be considered as part of a business ecosystem that involves a number of industries and no longer as units of a single industry. According to Lemos [16], the term ecosystem is widely used in management and economic discourse in order to describe heterogeneous groups of actors who work cooperatively and interdependently. Similarly, Jishnu, Gilhotra and Mishra [17] and Russell et al. [18] report the ST&I ecosystem refers to the interorganizational, political, economic, environmental and technological systems of ST&I, where catalyzing, sustaining and supporting business growth occurs.

According to Mercan and Göktas [19], the approach to ST&I systems does not explain the relationship between the innovation process and the innovative structure. Therefore, due to the static nature of the ST&I system model, the biology-based ecosystem approach was created. The ST&I Ecosystem considers the dynamic nature of ST&I activities. The concept describes the evolutionary characteristics of interactions between actors, their relationships with ST&I activities and their relationships with the environment in which they operate. The authors Russo-Spena, Tregua and Bifulco [20] differentiate the two concepts as follows in **table 1** described below.

		ST&I System	ST&I Ecosystem	
Community of scholars		Politics; economics; Innovation Economics	Technologic innovation; Strategy and business; Economics and regional studies; Entrepreneurship	
	Innovati on	Analyzing and Explaining Changes in Technology and Economic Growth	Understand the dynamics within companies and in the network of economic and social innovation activities	
Core Concepts Set	Context	Limited in a specific geographic area or industry	It is neither fictional nor industrial, but considered emerging and self-regulating, similar to a platform that provides modular resource structures for innovation.	
	Actors	Interacting economic, business and institutional actors, but maintaining their autonomy	Interaction of interdependent business, economics and institutional parties; more attention to peripheral and distant relations	
	Facilitators	Knowledge and learning favored by the institutions	Knowledge and technology blended and driven in a balanced approach based on cross-fertilization	
	Governance	Path dependent nature with a crucial role played by institutions	Resulting from the interaction of deliberate and unforeseen business-led processes through a dialectical process of negotiation	
Main ontological position		Complicated set of diverse actors, connecting within a set of predictable interactions aimed at balancing and depending on clear and established rules	Complex set with several actors, but with multiple unpredictable interactions, mediated by knowledge, in a state of imbalance. Rules are adjusted over time and based on tolerance of imbalance to convey innovation	

Table 1. Main differences between ST&I system and ST&I ecosystem.

As demonstrated, both concepts work with the interaction of various actors to promote ST&I activities. Therefore, in a more macro sense, ST&I systems are more formalized structures, often contained in law, eg Article 219 of the Federal Constitution provides for the country's National Science, Technology and Innovation System (SNCTI), with the aim of formalize the interaction between public and private entities to develop Brazilian ST&I activities. Thus, they represent the direct and indirect interaction of larger institutions, such as universities, public administration and companies. Soares [2] states that without a correct legal ordering of ST&I systems, the emergence and maintenance of ST&I ecosystems is not possible. In the following section we will trace in greater detail the emergence of SNCTI as well as its trajectory in terms of actions for development of ST&I in Brazil.

2.5 ST&I Brazilian System

There are several trajectories of evolution of the SNCTIs. These trajectories are directly related to the development strategies that each country adopts, and it is up to National Governments to play a leading role in articulating the constituent components of each ST&I system. On the other hand, private investments are fundamental for scientific and technological development, as observed in world statistics on R & D contributions. In this scenario, it is evident the evolution trajectories of the SNCTIs are those that strive for the continuous integration of government policies with business strategies. In addition to integration, we should highlight the expansion and consolidation of systems as fundamental processes that demand increasing efforts of

managers dealing with the theme. In a context of globalization, public policies and private initiatives from developing countries have been oriented towards shaping pairing paths based on both cooperation and international competition.

The evolution trajectory of the Brazilian SNCTI is marked by the country's need for pairing with the world's most advanced ST&I systems [2]. According to section **3.2** of this paper, we realize large investments have been made in recent years to accelerate national scientific and technological development, leading Brazil to stand out in various sectors of ST&I. The main actors in this system are the ST&I Institutions, public management entities at all levels (i.e. federal, state and municipal) and companies.

Many actors make up the SNCTI, some with broader levels of action, others with more restricted functions in

the system functioning. Several roles must be played by these actors: making strategic decisions, operating instruments, conducting research, designing programs, and more [2]. It is up to the political actors to define strategic guidelines that will guide the initiatives of the ST&I System. The decision-making of these actors derives both from the results of representative democracy (Executive and Legislative Powers), and from the choices within the sectoral representation entities made (entrepreneurs, workers and researchers). The funding agencies are in charge of mastering the instruments that will enable the decisions made by the political actors. System operators are responsible for carrying out the planned R&D activities. The representation of this frame of actors is shown the figure 2 described below.



Fig.2. Main components of Brazilian ST&I system.

Within the scope of the executive power, the performance of the State Secretariats of ST&I, which act as Regional Systems Coordinators, should also be highlighted. There are two instances of regional representation that deserve special mention: the National Council of State Secretaries for Science, Technology and Innovation Affairs (Consecti) and the National Council of State Research Supporting Foundations (Confap). These two instances are presented as forums for the articulation of State Governments policies aimed at scientific and technological development. Several joint initiatives have been undertaken involving federal, state and municipal actors, with the continued maturation of these relationships in favor of improving the SNCTI. The "carta de Salvador" (2004) reflects the advancement of cooperation among Brazilian states, considering the need

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to correct regional inequalities in the conduct of ST&I policies.

III. RELATED WORK

According to describe so far, this paper aims to narrate the authors' experiences in the process of creation and implementation of a municipal ST&I system. Therefore, this theme has received great attention from the last decade. For purposes of analysis of work related to the present, we will be limited only to works performed in Brazil and in cities which have characteristics similar to the municipality of Campina Grande (e.g. number of inhabitants, geographical area, economy, culture and installed infrastructure). Such decision aims only to reduce the universe of works as well as to better structure the information.

The creation of specific agencies for the ST&I sector within the administrative structures of the Brazilian states

is based on the pioneering experience of the state of São Paulo [21]. The São Paulo constitution of 1947 already provided for the support of scientific research and the creation of a foundation for this purpose. This project was held in that Assembly from 1948 and resulted in the establishment of the São Paulo State Research Support Foundation (FAPESP) in 1962. The work of junckes et al [22] shows that from this pioneering initiative, many other states followed the same action. This study presented the position of Brazil in relation to ST&I activities, identifying the performance of Brazilian states in policies for articulation and integration of their activities. In 2016, the authors claimed there were 18 states in all regions of the country with legal ordering aims at promoting ST&I, as well as three other states with legal ordering pending. Some establish ST&I systems based on the Triple Helix Concept.

At the municipal level, the city of Vitoria (Capital of Santa Catarina State) was the pioneer in establishing a municipal ST&I system [21]. In December 1991, a law that created the Municipal Council of Science and Technology - in addition to the Support Fund for Science and Technology of the Municipality of Vitoria (FACITEC) - was sanctioned. The system was comprised of secretary, council and fund and it was created to strengthen the local science and technology activities. Similar to what happened with the state of São Paulo, this initiative at the municipal level spread to other regions, so that in 2012 there were more than 150 municipal ST&I systems, distributed across 21 Brazilian states: São Paulo (30), Mato Grosso do Sul (28), Minas Gerais (14), Rio de Janeiro (10) and Santa Catarina (8) have the largest number of cities with municipal ST&I systems. A more detailed list can be found in the paper by Fonseca [23].

Analyzing works of municipal ST&I systems related to municipalities with similar characteristics to Campina Grande, we have the work of [24]. In this paper, the author and colleagues carried out a study aimed at building a municipal ST&I policy to operate between 2015 and 2025. For the preparation of this plan, the guiding question of the planning exercise was: "How will Campinas, a city of knowledge and innovation, in 2025?". From it, a series of discussions were held in different forums with representatives of the public administration, universities and ST&I institutions. The first step in the construction of the ST&I Strategic Planning was the definition of local strategic drivers by an analytical committee composed of fifteen people, these being the most relevant drivers of the local ST&I policy. The process also included stages in which the vision was elaborated, the SWOT matrix contemplating the

strengths, weaknesses, opportunities and threats for the city, the formulation of strategies, definition of indicators and goals.

Other related work [25] presents the definition of the overview for the promotion of ST&I activities in Santa Catarina (Brazilian State) from the identification and analysis of existing ST&I legal ordering within the municipalities, in convergence with the state and federal laws, especially in relation to the Legal Framework of Innovation. The study reveals the existence of municipal ST&I systems, besides the creation of councils and funds that deal with the subject. The search resulted in the identification of three ordinary laws and two complementary laws within the established parameters, Araranguá, for five municipalities: Chapecó, Florianópolis, Joinville and Luzerna. The municipal ST&I systems are composed according to the triple helix model, and complying with the Federal Constitution and the Legal Framework regarding the responsibility of the public administration in all spheres of promotion of ST&I aims to regional socioeconomic development.

Finally, there are some studies applying case studies in municipalities with the purpose of merely providing an overview of the municipal ST&I system, but without conducting an in-depth analysis on the creation and implementation of a legal ordering to standardize the ST&I actions in the municipality. The work [26] makes an analysis of the innovation system of the municipality of Guarulhos (a municipality of São Paulo State) and performed a comparative analysis with other French municipalities in order to point out the improvements to be implemented in Brazil.

IV. CONSTRUCTION OF THE LAW

This section presents the main concepts related to execution of this research. The details related to the scientific method, the activities and procedures for creating and implementing the ST&I municipal system are described below.

To understand the breadth and scope of this legal ordering (i.e. ST&I municipal system), it is necessary to observe material and motivational aspects for your proposition. The project has its origin in the discipline of Science, Technology and Regional Development of the Postgraduate Program in Regional Development of the State University of Paraiba (UEPB). The chair of this class provoked his students and, among the students of this class, there was a city councilman who was underwriting one project to create a Science, Technology and Innovation Fund. This fund aiming at sponsor solutions to the city's problems through R&D projects developed by academic and business sector. After a series of brainstorming with the teacher and students of this discipline, in August 2017, a public hearing was held at the Campina Grande City Council [27]. This public hearing was convened to discuss with the various municipal ST&I actors (e.g. ST&I institutions, universities as well as business sector) the need to create a legal ordering aims to implement a municipal ST&I system.

Immediately after the public hearing, a "workgroup" was created to provide technical and legal advice on the drafting of the legal system regarding municipal ST&I system. The working group consisted of about 8 people from different institutions. These people had different academic backgrounds and different professional experiences in the ST&I area. This multidisciplinary nature of the "workgroup" greatly facilitated the drafting of the legal system in question. Following the principle of collaborative building, the workgroup met many times, most of them with different guests, including representing of the state and federal public administration. After long discussions, it was concluded that the Fund should be supported by a broader legal ordering. At this point, the working group suggests the creation of a broader legal framework that, in addition to the municipal ST&I fund, would address the need for the establishment of a municipal ST&I system.

Following this change of perspective then arises the need for broad discussion among the various municipal ST&I actors. In addition, it is also necessary to consult the general population about the creation and implementation of the ST&I system. These discussions took place for about a year, being organized by the workgroup and held at various municipal ST&I institutions. The final outcome of this process was officially presented only in July 2018. After regular processing in the Campina Grande Municipal Council and some amendments to suitability, the project was approved only in December 2018. The **section IV.4** will further demonstrate details about all the steps performed in the process of creation and implementation of ST&I municipal system of Campina Grande.

4.1 The Municipality of Campina Grande

Campina Grande is one of the most important municipalities in the interior of Brazil, located in Paraiba State [28]. According to the American magazine Newsweek [29], this city was considered one of the main industrial centers of the Northeast Region as well as the main technological center of Latin America. The municipality's geographical position favors and contributes to its being a natural regional center for the distribution and reception of raw materials and labor among border states, with proximity to capitals such as Natal (Rio Grande do Norte state), João Pessoa (Paraiba state) and Recife (Pernambuco state).

According to estimates by the Brazilian Institute of Geography and Statistics (IBGE) [30], its estimated population is around 410.000 inhabitants, being the second most populous city in Paraiba state. When considering its metropolitan region, made up of nineteen municipalities, it has an estimated population of 640.000 inhabitants [30]. Having an estimated Gross Domestic Product (GDP), for 2015, more than 5 billion of reais, the second largest in the Paraiba state.

The main economic activities developed within the municipality are, by sector: (i) *Primary Sector*: mineral extraction, agricultural crops (highlighting the cultivation of common cotton and colored cotton - technology developed in the municipality and used worldwide) and livestock; (ii) *Secondary Sector*: manufacturing industries (highlighting the footwear industry, one of the largest in Brazil), hardware and software development; (iii) *Tertiary Sector*: retail trade, wholesaler and services.

Additionally, the city is an important university center, with 21 colleges and universities, three of them being public ones. It is also the city with, proportionally, the largest number of persons with PhD degree in Brazil, 1 to 590 inhabitants, representing about six times the national average [31]. Besides to higher education, the municipality is also featured in training centers for secondary and technical level. An evidence of the city's development is the ranking of the magazine "Você S/A" (an important Brazilian magazine in business area), which appears as one of the 100 best cities to work and career in Brazil, the only inland city among the chosen capitals in the country. The city is still considered the most dynamic city in the Northeast and the 6th in Brazil according to "The Gazeta Mercantil" (other important Brazilian magazine in business area) and was named as one of the 20 Brazilian metropolises of the future [32].

4.2 Internal and External Environment Analysis

The analysis of the internal and external environments in which Campina Grande is inserted can be extremely important for the formulation of strategies and action plans for the ST&I area. This analysis raises the political, legal, technological, economic and sociocultural forces that positively or negatively impact the creation and, subsequent implementation of the municipal ST&I system. For this analysis we used the SWOT Matrix, which stands for the terms Strengths, Weaknesses, Opportunities and Threats.

The Matrix is an instrument used for strategic planning, which allows collecting information that characterizes the internal (strengths and weaknesses) and external (opportunities and threats) environments, relevant to the planning process and to the execution of the plan. The purpose of the SWOT is enabling an objective and critical look at the opportunities, threats, strengths and weaknesses that the municipality has.

Table 2. Strengt	hs and weaknesses
Strengths	Weaknesses
 Good level of communication between the main development agents. Diverse and well- structured trade. Significant and consolidated set of diversified R&D Institutions (Agribusiness, ICT, etc.). Quality higher education. Easy access (highways, railways and airports). Important regional attraction pole. Existing urban infrastructure. Qualified labor. Diversified industrial park with presence of important global players. Expressive scientific and technological production. Recognized as a city of science, technology and innovation. 	 Long-term view of the Municipal Secretariat for Economic, Social and Tourism Development. High cost of local labor. Lack of a consistent long term strategic plan for ST&I. Absence of a program to stimulate the culture of citizenship and the sense of belonging. Absence of culture of innovative entrepreneurship. Low performance of the productive sector (companies) in ST&I. Low integration between government, productive sector and research institutions to stimulate the use of ST&I. High crime rate. Bureaucratic barriers in municipal land use and occupation legislation. Lack of establishment of neutral governance of the Local Innovation System, with active participation of all key actors. Technical and environmental problems in urban mobility.

In the internal environment, it is possible to verify several strengths. Campina Grande has a good level of communication and integration between the main ST&I

actors of the public and private institutions. It has diversified and well-structured businesses, high-level educational and research institutions capable of meeting the growing needs of skilled labor and generating new knowledge. The city has (i) a network integrating actors in the ST&I area, (ii) different physical infrastructure and logistics when compared to other Brazilian cities, (iii) diversified industrial park with the presence of global players, being nationally recognized as a ST&I city.

This aforementioned scenario makes Campina Grande a municipality differentiated from the vast majority of Brazilian cities. In relation to weaknesses that may impact or limit its competitiveness as a city of knowledge and innovation, and which should be understood as opportunities for improvement by the municipal administration and other actors involved, the high cost of local labor resides, incipient venture investment culture (e.g. angel investors, venture capital, and venture capital), absence of a culture of innovative entrepreneurship, problems in public safety aggravated by being a metropolis-sized city, restrictions on physical space for the implementation of new technology-based enterprises and problems in urban mobility.

In the external environment there are many opportunities that may favor the competitiveness and growth of Campina Grande. These include the ability to raise funds for financing and fostering innovative research with financial institutions and funding agencies, the marked growth of the economy in knowledgeintensive sectors in the region, and the privileged geographical location in the central region of Paraiba state. The municipality is undoubtedly a center of attraction for the establishment of public-private partnerships that can boost and enhance the city's growth in both the expansion and consolidation of infrastructure and the provision of services to society.

Table 3.	Opportunities	and Threats
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Opportunities	Threats
1) Fundraising capacity	1) High cost of living.
for financing and	2) Increased public and
fostering innovative	road insecurity.
research with financial	3) Competition with other
institutions and	cities with more
development agencies.	structured projects to
2) Strong economic	attract technology-based
growth in knowledge-	companies.
intensive sectors in the	4) Inadequacy of
region.	government projects and
3) Entrepreneurship	policies in the three
culture in the region.	spheres for ST&I.
4) Existence of policies	5) Complex legislation in

for creation Regional	all spheres of government.
System of Innovation.	6) Not establishing the
5) Incentives for the	SRI (Regional Innovation
establishment of	System), avoiding
(Public-Private	sustainable consolidation
Partnerships).	in a network of influence.
6) Geographic	7) Possibility of
localization.	downgrading the country's
	rating, driving away
	foreign investments.
	8) Non-renewal of the
	law and tax incentives for
	the ST&I areas

The *threats* may impact the growth and economic, social and environmental development of the municipality are related to the high cost of living in items such as housing, mobility and services, increased public insecurity and bureaucracy. Also weighing in this assessment is competition with other cities with well-structured projects to attract technology-based companies. These are recent threats, posing new challenges for city planning, and the limitation of water availability in the Region and the poor economic performance of the country, with impacts on risk assessment of investments in the country and the region, which may discourage or limit investments by large international groups.

4.3 Motivation for creating the ST&I system

Looking at this data of municipal development, it is clear that the city of Campina Grande has an incipient "ST&I system", being this city a national and international reference in several areas. In addition, there is a considerable structure consisting of several institutions such as Incubators, Accelerators and Fostering Companies and Startups, as well as a Technology Park.

Even with the entire city setting focused on ST&I (described in section 4.1), Campina Grande - as well as many other Brazilian municipalities - perish with public policies that effectively enable ST&I development. Given this scenario, the idea of creating a legal ordering to implement a ST&I municipal system arises, which has among its main objectives: (i) The strengthening of the existing "ST&I system"; (ii) Leverage the technical and legal infrastructure for local scientific and technological production; (iii) Encourage sustainable development through ST&I in a productive environment, reversing the benefits to the municipal population and the entire region.

This legislation will also allow it to increase the contribution of public and private resources in ST&I. By creating an area-specific legal ordering, private companies - as well as the municipal public

administration - will have more legal certainty to reverse resources in ST&I actions. Another relevant detail with the emergence of the law is associated with the increased promotion of ST&I ecosystems. This will be achieved by diversifying financial instruments to support ST&I activities, allowing greater sharing of resources between public and private entities.

4.4 Collaborative law-making process

As described in detail at the beginning of **section IV** of this document, the genesis of the debate on ST&I municipal system was the institution of a ST&I Municipal Fund. However, during discussions held at a public hearing, the prospects broadened for the introduction of a broad legal ordering that encourages ST&I development.

In order to address the creation of the legal ordering, the **figure 3** describes the process of creation and implementation of the ST&I municipal system. *Blue colored circles* represent people, ST&I institutions or artifacts generated through this process. The *green circles* represent the publicizing of the artifacts of this process through public hearings. The *red rectangles* represent adjustments in the artifacts of the process by the public and private sector as well as the regulatory agents (i.e. legislative, judicial and executive power).

It is worth noting all the *steps* in this process are numbered so that the numerical sequence makes it clear there is direct dependence between all these steps which will be described following in detail:

ST&I Legislative Committee (1) – The ST&I committee is a technical body created by the internal rules of Municipal Council of Campina Grande (MCCG). This committee is composed of elected alderman with active mandate and it has the purpose of discussing and voting on the presented laws. With respect to certain proposals or projects, the committee expresses itself by issuing technical and legal opinions on the subject, by means of opinions, before being taken to the Municipal Council for voting. Regarding other propositions, the committee decides to approve or reject the law without the need for passage through the Municipal Council. The alderman composition of this committee is renewed each year or legislative session. Finally, it is worth noting that the ST&I committee is also formed by a technical professionals that operates in several public and private ST&I-related institutions in the municipality.

Public hearing at MCCG (2) – Public hearings make it possible for alderman hearing the opinion of the population on a particular topic. They usually happen before a law is sanctioned. In the Campina Grande's case, these public hearings can be held in the Municipal Council itself or even in the neighborhoods. In addition to alderman, voters and entities, such as entities and companies, may convene hearings. When the hearing is requested, a notice should be published in at least two widely circulated newspapers. It is occurs aiming at publicizing such action. The alderman can select authorities, experts and interested persons to be heard. When the subject to be discussed has opponents and defenders, several sessions are called so that all parties can be heard. This was the case with this legal ordering. As described in figure 3, three public hearings were held to discuss the creation of the municipal ST&I system. All citizens can participate in public hearings, which serve to expose topics or make suggestions for specific subjects. Being a consulting activity, the manifestations occur orally or in writing. In the end, the proposals are sent for analysis by the alderman.

ST&I Workgroup (3) – Immediately after the previous step, a "*workgroup*" was formed to provide

technical and legal assistance for the constitution of the legal ordering. Thus, a representative part of the public and private ST&I institutions installed in the municipality made up this workgroup. Among others, this group had the following main responsibilities: (i) drafting the legal ordering document; (ii) technical and legal advice on operational and legal aspects regarding implementation of ST&I municipal system; (iii) creation and maintenance of communication channels with private and public ST&I institutions and the productive sector of the municipality; (iv) dissemination of the legal ordering in the media as well as in ST&I-related events. It is worth noting that this group was composed by about six people from four different public and private ST&I institution. This workgroup worked for several months providing this advisory work for free and committed.



Fig.3. Creation and Implementation Process of ST&I Municipal System.

Draft of the law (4) - For the writing of the draft Campina Grande ST&I system, the working group carried out a two-step systematic review on the legal ordering repositories: (i) Firstly, the workgroup retrieved state and federal ST&I-related legal ordering. These legal ordering were analyzed to understand the legal system around ST&I area. In this sense, the workgroup had the support of jurists specializing in the subject, providing effective support to carry out this activity. (ii) Finally, the workgroup retrieved municipal ST&I-related legal ordering of Brazilian municipalities (and also some of North America and Europe) that had similar

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characteristics to the Campina Grande. Then, the workgroup systematically analyzed the various components of all these ST&I-related legal ordering. Lastly, the working group deliberated on the feasibility of including / excluding these components in the municipal ST&I system. At the end of this process, a document was generated by the collaboration of workgroup and others independent consultants.

ST&I legal ordering (5) - Following the generation of aforementioned document, this one was submitted for the municipal attorney's office. This activity aims to identify possible inconsistencies or even legal flaws. The

document was then submitted to the municipal legislature - represented by the ST&I legislative committee - aiming at provides appropriate adjustments to the document. Finally, the document was submitted to the municipal executive power. In this activity it was verified the technical and economic viability of some of the components of the legal ordering.

Public hearing at MCCG (6) - After the generation of a legal ordering document - through an intense and constant series of debates with the community, public and private ST&I-related institution, executive, legislative and judiciary - this document was submitted to the Municipal Council of Campina Grande (MCCG). In a public hearing the document was placed in voting for the alderman, after about two months of appreciating the document, could express their opinion related to legal ordering in question.

Sanctioned Law (7) - After the public hearing was held in the municipal council, the result was favorable to sanction by the municipal mayor. A few months after the result of the public hearing, the municipal chamber of the city mayor made the necessary adjustments to implement the components of the ST&I municipal system. In order to comply with the objectives of this legal ordering, the municipal public administration will make efforts to promote the development of scientific, technological and innovator potential of the Municipality, in order to:

I - allow the transfer of financial resources including by means of refundable - to institutions members of the ST&I Municipal System, in order to develop and manage R&D projects;

II - promote the participation of the municipality in the creation and maintenance of R&D projects focused on innovative activities;

III - participate actively and strategically in risk reduction and distribution technologies involved in the innovative process;

IV - to foster the process of creating innovative enterprises through the facilitation, as appropriate, of procedures for opening and technology base or innovative companies;

V - Contribute to the formation and modernization of local ST&I infrastructure, including by facilitating the sharing or disposal of available public goods; and

VI - promote the broad participation of the local community in the diffusion of scientific culture as well as the formation of an entrepreneurial culture.

Public hearing at MCCG (8) - Following the sanction of the legal ordering described in the previous step, the last public hearing at MCCG took place. This activity was basically for the discussion of effective

actions to operationalize the main components of the ST&I municipal system. The section V will describe in detail the concept as well as the motivation for each of these components.

Constructing the aforementioned legal ordering to create and implement the ST&I municipal system within such a process model, in a collaborative way, represents a paradigm that is in full agreement with the goal of the municipal ST&I policy: to involve the city around an action composed of many actions that is above any partisan political bias and is a policy of state, not government, for the benefit of the community. Moreover, only legal ordering proposals - which are built in a participatory manner - have a real social identity and a sense of ownership.

V. THE MUNICIPAL LAW OF SCIENCE, TECHNOLOGY AND INNOVATION

The present legal ordering establishes incentive to the ST&I development, aiming at the consolidation of the innovation environments in the academic, productive and social sectors of Campina Grande, as well as to promote the economic, social and environmental development and the improvement of the public services. In order to achieve the objectives of this ST&I system, several components will be constituted to operationalize actions at the municipal level. The main components of this legislation are described in the **figure 4**. The following, we present the key artifacts that make up the ST&I municipal system.



Fig.4. Components of the ST&I Municipal System.

ST&I Municipal Fund – This fund is endowed with administrative and financial autonomy, with its own bookkeeping, accordance with the relevant legislation

implementing the repayable financial support (or not), innovative programs and projects of interest to the municipality, as well as characterized in accordance with its rules. The main objectives of this fund are to promote: (i) technological innovation in the Municipality, to encourage companies installed in it, and investments in scientific and technological research; (ii) technological and innovative activities for economic development, Campina Grande's social and environmental program, in the form of programs and projects; and (iii) research, development and innovation activities, with a view to technological, economic, social and environmental development of Campina Grande.

ST&I Council - This council is a deliberative body of direct community participation in the municipal administration, which will have the following responsibilities: (i) to formulate, propose and evaluate actions and public policies to promote the innovation for the development of the municipality, through governmental initiatives or in partnership with private agents, always preserving the public interest; (ii) promote the generation, diffusion and democratization of knowledge, information and new techniques, and encourage the introduction and adaptation to local reality of techniques already existing; and (iii) contribute to the ST&I policy to be implemented by the public administration, suggesting fundraising and allocation policies for the purposes of this law.

INOVACG Awards - The law institutes the annual "innovate Campina" award. This award aims to reward ST&I-related projects that bring direct benefits to Campina Grande. This award will be managed by the ST&I Council, which will regulate the concession in a specific public notice. This council shall be responsible for regulating the requirements of application of the award, as well as the procedures necessary to carry out the award ceremony.

"Innovation City" Stamp - The law establishes the mixed word and figurative mark, which characterizes the "City of Innovation", aims to identifying the participation of the entities that are part of the ST&I municipal System. In addition, this mark will serve to indicate the origin of services and products of the companies of Campina Grande. The mark may be used by companies and organizations participating in the ST&I Municipal System, Innovation Promoting Arrangements accredited by the ST&I Council and other entities authorized by the same Council. In a complementary way, this mark can be used in portals, prospectuses, projections, publications, posters, films and other elements of promotion, dissemination and information.

ST&I Municipal Plan Each municipal organizational unit - the direct or indirect administration will prepare an Annual ST&I Plan in its responsibility area, which will be presented to the ST&I Council, which will allocate resources for its execution. This plan will be published, in accordance with the legal ordering, to form partnerships with technology-based companies, research centers and other participants of the municipal ST&I system to promote sustainable development. Finally, this plan will include feasibility studies, projects research, market solution acquisition, solution experiments, performance and impact sciences and research into new solutions to the city's problems.

Governmental Sustainability Plan - The municipal organizational units shall develop the Sustainability Plan of its activities. This plan must contain measures and proposals supported by the municipal organizational unit budget for:

I - the rationalization of the use of natural resources;

II - social responsibility actions for municipal employees;

III - energy efficiency actions, investments in clean technologies;

IV - supply chain optimization;

V - Preservation of the environment, and recycling;

VI - respect for human rights;

VII - protection to human health and ergonomics in the workplace;

VIII - water preservation, basic sanitation and change in consumption patterns; and

IX - environmental compensation actions.

ST&I Municipal Program - The fiscal incentive through the ST&I municipal program is granted to the individual or legal entity established in the municipality, which is strictly in compliance with its municipal obligations, with the primary objective of promoting entrepreneurship innovative of interest to the municipality. The granting of resources of this "fiscal incentive" can be done by non-repayable financial support, repayable financial support, corporate participation, direct support through fundraising and through economic subsidies.

ST&I Promoting Arrangements - The ST&I municipal council will accredit, by own regulation, for the purpose of incentives, the Innovation Promoting Arrangements (IPA's) that are deemed of interest by the municipality. To be entitled to the incentives established by this Law, the applicant should be part of the IPA and accredited by the ST&I municipal council. Systematic information of cadastral and socioeconomic data is a prerequisite for participating in an IPA. These
arrangements should meet criteria and be proposed by the ST&I municipal secretariat, approved by the ST&I municipal council and regulated specific ordinance of the municipal public power.

ST&I network promotion - This network will be made up of units called Innovation Promotion Offices (IPO). One of which will be deliberative, coordinated ST&I municipal secretariat and many other decentralized through a specific legal instrument, in public or private institutions. This units will constitute a municipal network of institutions engaged in the promotion of ST&I effective actions, in favor of the sustainable development of the municipality. The Municipality may allocate service providers and interns on a regular basis as well as employees at the Innovation Promotion Offices (IPO). The main mission of this network is to (i) support the development of fundraising projects to activities and projects in line with the objectives of this Complementary Law, (ii) propose and implement projects that present themselves as opportunities for development for the municipality and (iii) integrate actions of the Network entities according to the needs of the city.

VI. THREATS TO VALIDITY

A key concept relevant to a discussion of research methodology is that of validity. There are three types of validity that can be discussed in relation to research and statistics. Thus, when discussing the validity of a study, one must be specific as to which type of validity is under discussion. Each of the three types of validity will be briefly defined and described below. Be aware that this represents a cursory discussion of the concept of validity. Each type of validity has many threats which can pose a problem in a research study. Samples, but not an exhaustive discussion, of threats to each validity will be provided. For a comprehensive discussion of the four types of validity, the threats associated with each type of validity, and additional validity issues see [36][37].

Internal Validity: It is the extent to which a piece of evidence supports a claim about cause and effect, within the context of a particular study. It is one of the most important properties of scientific studies, and is an important concept in reasoning about evidence more generally. Internal validity is determined by how well a study can rule out alternative explanations for its findings (usually, sources of systematic error or 'bias') [36]. The main threat of this category is related to the fact that the study represents an experience report. We do not present data or metrics that show the positive impact of lawmaking in any respect (e.g. social, eco-economic or political). Our intention was only to present a formal process for construction and implementation of the law. For this, several actors with different academic and professional backgrounds participated in this process with the aim of reducing any existing bias.

Construct Validity: Construct validity is used to determine how well a test measures what it is supposed to measure [36]. In other words, is the test constructed in a way that it successfully tests what it claims to test? Construct validity is usually verified by comparing the test to other tests that measure similar qualities to see how highly correlated the two measures are. In the present development phase of our study, this type of threat is not verified since we simply carry out an "experience report". However, in future work we intend to analyze some data and metrics to assess the impact of law enforcement on the municipality.

External Validity: It is the validity of applying the conclusions of a scientific study outside the context of that study [37]. In other words, it is the extent to which the results of a study can be generalized to and across other situations, people, stimuli, and times. The main threat of this category is related to the fact that the study was conducted in a municipality of Paraiba state. Thus state and other municipal laws were taken into consideration for the construction and implementation of the law. If any other municipality in Brazil or even in the world tries to replicate the process described in this experience report, some deviations may be required due to various aspects such as laws, economic, social, political and even cultural characteristics.

VII. FINAL REMARKS

The present research described the process of creating and implementing a legal ordering aims to establish incentive for ST&I-related activities in the business, academic and social environment. This legal ordering was built on collaborative work. Public and private ST&I– related institutions as well as the general population had wide openness to participate in this process. The main contributions of this experience report are (i) a comprehensive systematic review of the relevant Brazilian ST&I legal ordering, (ii) the formatting of a collaborative process for the creation and implementation of the ST&I municipal system through a proper legal ordering and (ii) the cataloging of an important set of components in a legal ordering for the creation and implementation of a ST&I municipal system.

We expect that the effective implementation of the ST&I municipal system can only occur with proper legal apparatus. This will provide security for public and private institutions to perform activities in the ST&I area.

In the specific case of the Campina Grande's ST&I system, their main purposes are the following:

- Promote technological and scientific innovation as a self-sustainable development in the Municipality, for income generation and new business opportunities;
- Stimulate the development of economically viable, socially fair and environmentally sustainable science and technology through government initiatives or in partnerships with private actors;
- Support the interaction between companies, governments and educational institutions, aims to leveraging economic and social development through new science and technology-based business practices;
- Adopt practices of "open innovation" and collective intelligence as a strategy for greater participation of society;
- Encourage the expansion of enterprises, as well as foster the creation and attraction of new projects through the use of financial and tax mechanisms as a development strategy of ST&I activities.

It is important to mention the legislation deals differently with the notion of development, making the city one of the first municipalities in the Brazilian Northeast to have municipal legal ordering that regulates an ST&I system. Additionally, since Campina Grande polarizes a region of dozens of cities, the promotion of ST&I through this regulation will promote regional development as these cities provide and consume products and services from this municipality.

Therefore, such public policy is in line with the various actions related to the innovative proposal on the role of the municipality in stimulating sustainable economic development. Still, components of this legal ordering described in details in this experience report have the objective of modernizing and speeding up the public services from the operationalization of some innovation actions within the public administration.

Finally, more than the technological and scientific progress itself, the legal ordering has as its major scope the elevation of the population's quality of life through the implantation and socialization of technologies developed at the municipal level. Consolidating the municipal and regional economy by creating new business formats, generating new jobs, and encouraging research and science from the earliest stages of the municipal education system. Further details on the construction and implementation of the law can be found in our *supplementary material* (only in Portuguese) [35]. We are available to discuss with the academic community as well as ST&I practitioners all steps described in this experience report.

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Sanity, Pathogenicity, and Transmission of Fungi associated with Seeds of Chia coming from the Southern Region of Tocantins

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Abstract— A seed of Chia (Salvia hispânica L.) has been growing, assuming significant values of consumption in the current society, due to its high nutritional power. However, its seeds can be targeted by the presence of fungi. The aim of this study was to evaluate the health, pathogenicity, and transmission of fungi associated with seeds in Chia culture in the southern Tocantins. For the work, Chia seeds were collected from the UFT experimental unit, Gurupi-TO, produced from the combination of five levels of phosphate fertilization (0, 30, 60, 90 and 120 kg ha⁻¹) and five levels of nitrogen fertilization, 30, 60, 90 and 120 kg ha⁻¹). The filter paper method (blotter test) was used to perform the mycobacterial survey. The pathogenicity and transmissibility of fungi associated with seeds were also tested. The genus detected in the superficial part of the seeds were: Cladosporium sp., Phoma sp., Fusarium sp., Alternaria sp. and Curvularia sp. The Chia seeds of the municipality of Gurupi-TO presented low incidence of fungi. There was no pathogenicity and transmissibility of the fungi detected in Chia seeds in the seedlings.

Keywords—Salvia hispânica L., pathogen, quality, disease.

I. INTRODUCTION

Salvia hispânica L is an herbaceous plant, originating from the mid-west region of Mexico to northern Guatemala. Culture with great potential, because it is considered a seed rich in fatty acids, omega-3, omega-6, carbohydrates, fiber and minerals, known mainly with the name Chia, belonging to the large group of the family Lamiaceae which are often medicinal, aromatic and part of the herbs used in cooking [1, 2].

Recently, the interest in Chia has been growing, assuming significant consumption values in today's society, particularly in Mexico and the southwestern United States, and still in South America. Although Chia is not widely known in Brazil, for the little time that Chia seeds were introduced in the Portuguese market. However, the consumption of this seed has aroused a growing interest in Brazil, mainly in the regions of the West Paranaense and northwest of Rio Grande do Sul began to gamble and to plant the culture of Chia in the last harvests, intending to present good Results [3–5].

The propagation of Chia culture is especially due to seeds, so the sanitary quality is a factor of great relevance, for better viability, germination, vigor, and production of Chia seeds [6]. Also, considering that better sanitary quality can reduce the incidence of diseases in culture. Among the existing records regarding agronomic management, the possible diseases caused by fungi are scarce due to the fact that it is a poorly explored culture. However, there are reports of diseases caused by fungi of economic importance that have affected the crop in the last harvests [7–9].

The presence of fungi in seeds, besides allowing the introduction of pathogens in areas of cultivation and causing diseases to agricultural crops, can also cause alterations in the metabolism of plants compromising their therapeutic properties and flavor.

Several species of fungi cause physicochemical alterations in the tissues of the seeds, causing loss of lipids, carbohydrates, proteins, and fatty acid increase, besides influencing seed germination [10, 11].

The detection of occurrence, associated pathogenicity, and transmission of fungi in seeds can facilitate the choice of disease control measures, enabling the elaboration of identification and control methodologies. However, there are few related studies on the presence of fungi in Chia seeds produced in Brazil. For this reason, the present work had as objective: to evaluate the sanity, pathogenicity, and transmission of fungi associated with seeds in Chia culture produced in the southern region of Tocantins.

II. MATERIAL AND METHODS

The experiment was carried out at the Laboratory of Phytopathology and greenhouse of Universidade Federal do Tocantins (UFT), Gurupi-TO.

The tests were made approaching 1 -Sanity, 2 -Pathogenicity, 3 -Transmission of fungi associated with seeds. Therefore, the seeds were collected in the experimental field of the UFT located at the coordinates with 11° 43' 45"S and 49° 15 W average altitude of 285 m. The climate of the region is of the mega thermic type with summer rains and dry winter [12].

For the tests, 25 samples of Chia seeds produced from the combination of five levels of phosphate fertilization (0, 30, 60, 90 and 120 kg ha⁻¹) and five levels of nitrogen fertilization (0, 30, 60, 90 and 120 kg ha⁻¹) were used in the crop 2015/2016 in the municipality of Gurupi-TO.

Test 1 – Sanity 1

For this assay, we used the filter paper method (*blotter test*) according to the Manual of Sanitary Analysis of Seeds (Brazil, 2009) [13]. The experimental design was completely randomized (CRD) with 4 replications, each one in a Petri dish containing 50 seeds of each treatment. The Petri dishes containing the seeds were placed in the freezer for 12 hours to inhibit the germination. After this period, the Petri dishes were transferred to incubation chamber at $25 \pm 2^{\circ}$ C and photoperiod of 12 hours for 7

days. At the end of this period, the fungi were surveyed from the individual analysis of the seeds with the aid of the stereoscopic optical microscope visualizing the morphological characteristics of the fungal structures, the fungi were identified as Based on specialized literature such as Ellis (1971) [14], Barnett & Hunter (1998) [15] and Watanabe (2010) [16]. The fungi found were isolated and cultivated in potato-dextrose-agar culture medium (PDA) for the pathogenicity assay. The fungi incidence data were expressed as percentages (%).

Test 2 – Pathogenicity

The pathogenicity of the fungi transported by the seeds was evaluated by inoculations in the aerial part of seedlings. To obtain the seedlings, Chia seeds were sown in pots of 8 dm3 containing as substrate the mixture of soil and sand autoclaved at 120°C for 1 hour, in the proportion 2:1. Each vase with 4 seeds, at 45 days after sowing, with the aid of a manual spray was made the inoculation of the suspension 106 spores/ml resulting from each fungal isolate (Cladosporium sp., Phoma sp., Fusarium sp., Curvularia sp. and Alternaria sp.), adjusted with Neubauer chamber. The suspensions were prepared from pure colonies of fungi cultivated in culture medium (PDA) incubated 7 days, under a temperature of $25 \pm 2^{\circ}C$ and photoperiod of 12 hours. Similarly, disc inoculations were made on the stems of the plants. Using as a witness a plant sprayed only with sterile water. The inoculated seedlings were packed in a moist and dark chamber for 48 hours. After this period, they were transferred to a greenhouse, where they remained for 10 days.

The evaluations of the symptoms were performed ten days after inoculation. Subsequently, indirect isolation of the fungus was performed, according to Alfenas & Mafia (2007) [17] with the purpose of confirming the causal agent, fulfilling Koch postulates. The experiment was assembled according to a completely randomized design (CRD) with 6 treatments (5 fungi + control), and 4 replications. Each repetition consisted of a plant.

Test 3 - Transmission of seed-associated fungi.

For the transmission test, 50 seeds of each treatment were sown in styrofoam trays. Previously disinfected with 1% sodium hypochlorite, one seed per cell, containing Nutrimax commercial substrate, autoclaved at 120°C for 1 hour. After sowing, the trays were transferred in a greenhouse and irrigated daily. The seedling evaluation was performed at 5, 10, 15, 20, 25 and 30 days. After germination, none of the seedlings presented symptoms characteristic of the diseases, so the Koch postulated was not made, which is a requirement solely for confirmation of the existing pathogen.

III. RESULT AND DISCUSSION

In the sanity test, a total of five fungi genera (*Cladosporium* sp., *Phoma* sp., *Fusarium* sp., *Alternaria* sp., and *Curvularia* sp.) associated with Chia seeds were detected. The results of fungal incidence are presented as percentages in Table1.

Table 1. Percentage of fungi associated with Chia seeds (*Salvia Hispânica L.*) detected by the filter paper method (blotter test) according to the Handbook of Sanitary Analysis of Seeds (Brazil, 2009).

SAMPLE (N-P)	CLA	FUS	ALT	CUR	РНО
0-0	15	2	1	1	0
0-30	8	2	1	2	0
0-60	5	2	0	0	1
0-90	8	0	1	0	0
0-120	10	2	0	0	0
30-0	30	5	0	1	1
30-30	16	4	2	5	0
30-60	9	4	0	1	0
30-90	16	0	2	0	0
30-120	20	3	0	1	1
60-0	15	2	1	2	0
60-30	15	0	3	1	0
60-60	10	1	1	2	0
60-90	14	9	1	0	0
60-120	15	1	0	2	0
90-0	14	3	1	1	1
90-30	31	1	1	0	0
90-60	14	2	1	1	0
90-90	34	5	2	1	1
90-120	36	5	2	3	0
120-0	16	6	0	0	0
120-30	21	4	0	0	0
120-60	15	3	1	1	0
120-90	6	6	0	0	0
120-120	8	2	3	3	0

In that: CLA: *Cladosporium* sp., FUS: *Fusarium* sp., ALT: *Alternaria* sp., CUR: *Curvularia* sp. e PHO: *Phoma* sp. N: Nitrogen P: Phosphorus.

Similar studies were reported by Almeida et al., (2016) [6] when evaluating samples of commercial Chia seeds, verified the presence of fungi: *Fusarium* sp., *Cladosporium* sp., *Bipolaris* sp., and *Aspergillus* sp. Jiménez et al., (2015) [18] when studying the same species *Salvia hispânica* L. also determined the presence of contaminating filamentous fungi in seven commercial samples of seeds evaluated observing the presence of the following fungi genera: *Aspergillus* sp., *Aspergillus niger., Aspergillus flavus, Penicillium* sp., *Cladosporium* and *Curvularia* sp.

In Brazil, the genera of fungi that most frequently attack the seeds of medicinal, condiment and aromatic plants, highlight the Aspergillus, Epicoccum, Mucor, Penicillium, Rhizopus and Trichoderma considered contaminants in seeds, Cladosporium, Curvularia and Pestalotiopsis, considered contaminants also however in some cases can cause diseases, Bipolaris, Alternaria, Fusarium, and Phoma, which have species that can cause important diseases, as the host involved [19].

For this essay, it was observed that in the Chia seed samples, from high and low Nitrogen (N) and Phosphorus (P) doses, the genus *Cladosporium* sp. presented the highest percentages of fungi. The fact that it was detected in 100% of the samples analyzed and the incidence of this pathogen in the seeds ranged from 5% to 36%. Observing

the highest incidence in the 90 doses of N and 120 P (Table 1).

Reis et al., (2007) [20], when evaluating six lots of commercial seeds belonging to the family of Lamiaceae, also evidenced the presence of Cladosporium sp., reaching more than 20% of incidence. Most fungi of the genus Cladosporium sp. are cosmopolitan and their distribution is commonly found in plants and seeds [21, 22]. Depending on the fungal species and host plant, there may be a lower or higher incidence and may cause important lesions or death in plants. High incidence levels of Cladosporium sp. are common in seeds from the field or during storage, causing damage to germination and vigor, especially when the treatment is not done in seeds [23, 24]. According to Braga et al., (2010) [25], the high or low incidence of Cladosporium sp may also be influenced by the drying period, environment conditions or storage period. It is important to highlight the fact that few are the studies addressing the occurrence of Cladosporium sp. in Chia seeds.

The second most frequent genus in the seeds evaluated was Fusarium sp and the seeds were from the 60-90 dose of N and P that presented the highest incidence (9%). This fungus is constantly associated with seeds of different plant species and its aggressive and rapid growth can cause the death of Seeds [26]. The Fusarium is considered pathogenic, because it causes reduction of the germinative capacity and diseases in the plant, this fungus presents a wide range of host and high economic expression, besides being producing mycotoxins [27, 28]. There are reports of the genus Fusarium sp. causing diseases in aromatic and medicinal plants (Mentha piperita L.) compromising different parts of the plants [29]. Several species of this fungus are sources of soil inoculum, causing problems such as seed rot, root necrosis, rot, mold, biochemical seed transformation, widespread wilting and seedling death [10, 30].

Other important genera found in the sanity test were *Alternaria* sp. and *Curvularia* sp. presenting similar percentages in the samples evaluated, with variation between the samples of 1-5% of incidence. Kruppa & Russomanno (2008) [31] affirm that in Brazil there are few records of diseases in plants of the family Lamiaceae caused by fungi. However, these authors evaluating 117 families found fungi in 71.8% of the samples evaluated, involving 24 genera, among them *Alternaria alternata* with high frequency, *Curvularia eragratides, Curvularia inaequalis, Curvularia bezel* and *Curvularia* sp. presenting low frequencies in seeds of basil, Sálvia, and Segurelha. These fungi are very common in seeds, most often are considered pathogenic fungi causing important

damage to plants or saprophytes not causing any impairment. According to Goulart (2004) [27], the genus *Alternaria* sp. is very common in seeds, being, in most cases, associated only as a saprophyte and depending on the incidence can cause impairment in seed quality. However several species of *Alternaria* sp. and Curvularia sp. are associated with diseases in many plant species [19, 32]. According to Machado (1988) [33], The pathogen maintains its viability and characteristics for a long time, allowing its dissemination in new areas quickly and with a high probability of causing disease after planting.

For the genus Phoma sp. In the sanity test, we observed a low percentage occurrence of these fungi in Chia seeds produced in high and low doses of N and P. There was an occurrence less than or equal to 1% among the samples evaluated. Different species of cultivated and wild plants have shown the similarity of fungi of the genus *Phoma* sp. [34]. This fungus has caused diseases in several species of plants, there are reports of species of Phoma sp. about symptoms in the stems and leaf in adult specimens of this host [35]. Machowicz-Stefaniak et al., (2008) and Zimowska (2008) [36, 37], evaluating the presence of Phoma exigua in sage, thyme, and lemon balm plants, observed inhibition in germination and necrotic stains on the stem and leaves. According to all the work reported above, the percentage of fungi found in Chia culture is low compared to other Lamiaceae families, where the highest incidence of this genus was observed. It was also observed that the control presented percentages not equidistant or equal to the higher doses than seeds produced in low or high doses of nitrogen and phosphorus did not interfere in the percentage of fungi observed. Justifying that the percentages of fungi present in the evaluated samples may be due to favorable climate conditions in their development, such as precipitation during the maturation and harvest periods that often occur in the region, or to successive cultivations of the same species or species belonging to the same family, in the same production field or due to storage. This is why the need for better management of productive fields, harvesting, and storage techniques is evident, in order to reduce the incidence of fungi and thus ensure a better sanitary quality of the seeds in Chia crop.

Pathogenicity of fungi associated with Chia seeds.

Regardless of the part of the plant in which the fungi *Cladosporium* sp., *Phoma* sp., *Fusarium* sp., *Alternaria* sp. and *Curvularia* sp. were inoculated, no pathogenic action was observed (Table 2).

 Table 2. Pathogenicity of fungi in plants of Chia (Salvia hispânica L.).

Fungus	Pathogenicity
Cladosporium sp.	-
Fusarium sp.	-
Alternaria sp.	-
Curvularia sp.	-
Phoma sp.	-
Proof	-

(-)non-pathogenic; (+)pathogenic.

In the inoculation of Phomopsis sp., Colletotrichum Gloeosporioides in seedlings of the species Sabiá (Mimosa caesalpinaefolia), no pathogenicity was observed. However, when testing the pathogenicity of Fusarium Solani and Pestalotiopsis sp., it was observed wilt and white-greyish leaf spots, respectively [38]. Reports of pathogenicity of fungi associated with Chia seeds, such as those described in the present study, were not found in the literature. However, further research on pathogenicity in the culture is necessary to verify these results. According to Aguaysol et al., (2015) [7], there is scarce information available on fungi that may affect Chia. However, these authors evidenced in the Chia culture in the municipality of Tucuman, Argentina the presence of white mycelium, corresponding to Sclerotinia sclerotiorum, disseminated pathogen via, seeds, causing symptoms such as Light brown coloration in inflorescences, fruit detachment, stem rot and formation of sclerotia in the inflorescences. González et al., (2010) [9] also observed in the provinces of Salta and Tucuman in Argentina different symptoms in Chia culture and identified their agents cause them, as generalized wilted associated with Fusarium sp., chlorosis of leaves produced by *Phytophthora* sp., purple staining in stems caused by Sclerotinia sclerotiorum carbonous spots on the stem caused by Macrophomina phaseolina and necrosis in leaves produced by Rhizoctonia Solani.

Transmission of fungi associated with Chia seeds.

According to Oliveira et al., (2013) [39], phytopathogenic fungi are transmitted via seed, causing seedling death. However, in the transmission test of the twenty-five samples evaluated from high and low doses of N and P, it was observed that 100% of the seeds emerged and did not present symptoms of diseases, indicating that the fungi present in the evaluated seeds did not were transmitted to the seedlings, this can be explained mainly by the low natural infestation of the seeds evidenced by the sanity tests. Suggesting that the presence of these fungi in the seeds is not directly related to the decrease in the rate of Chia germination. In healthy seedlings, when sectioned and plated in BDA medium, no latent pathogen was detected. Mendes et al., (2005) [38] and Nascimento et al., (2006) [40] evaluating seedlings of *Mimosa Caesalpiniaefolia* and *Pterogyne nitens*, observed that fungi associated with seeds (*Fusarium solani*, *Phomopsis* sp., *Colletotrichum*, *Gloeosporioides*, *Pestalotiopsis* sp., *Aspergillus* sp., *Penicillium* sp., *Fusarium Moniliforme*, *Alternaria alternata*, *Rhizopus* sp., *Cladosporium* sp. and *Phoma* sp.) were not transmitted to the seedlings.

Reports from several studies confirm that the presence of microorganisms, even pathogenic, in the seed, is not sufficient to ensure that it will infect the plant originating from this seed, because, there are several factors that can limit the efficiency of transmission of pathogens present in seeds such as - inoculum quality, soil physical factors, temperature, humidity, oxygen, survival time of the pathogen in the seed [33, 41]. What may have occurred with the pathogenic agents present in Chia seeds, which were not transmitted to seedlings due to lack of favorable conditions, however, the seed-pathogen and possible relationship, allowing the transmission and establishment of the disease in the field [42].

Another factor that may have influenced the absence of transmission of fungi present in the seeds may be due to disinfection made with sodium hypochlorite 1%. It is known that the inhibitory effect of sodium hypochlorite has the ability to penetrate the microbial cell, destroying it [43]. The microorganisms were probably found in the external parts of the seeds, which allowed a decrease in the incidence at the time of the disinfestation.

According to Botelho et al., (2008) [44], the fungi in the asepsis process have less survival capacity, however, for its total elimination, it is indispensable to consider several factors such as - location of the fungus in the seed, conditions in which the concentration of the product and immersion time in the solution.

In general, this report is interesting and has contributed valuable information in research on sanity, pathogenicit, and transmission of Chia seeds, allowing to broaden the information contained in the literature and thus to subsidize future studies such as described in the present study.

IV. CONCLUSION

Chia seeds from the municipality of Gurupi-TO showed a low incidence of fungi.

There was no pathogenicity and transmissibility of the fungi detected in Chia seeds in seedlings.

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Clinical and Epidemiological Aspects of Leprosy Cases Under 15 Years of Age, in the State of Rondônia in the Period 2011 to 2015

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Abstract— The present study analyzed the clinical and epidemiological aspects of leprosy cases in children under 15 years of age, in the State of Rondônia, from January 1, 2011 to December 31, 2015. It is an epidemiological research of the type Cross - sectional retrospective cross - sectional study, based on quantitative data extracted from the Information System of Notifiable Diseases Database (SINAN) of the Health Surveillance Agency of the State of Rondônia (AGEVISA - RO). During the study period, Rondônia diagnosed 260 cases of leprosy in children under 15, corresponding to 6% of the total cases in the state. 72.30% were aged between 10 and 14 years. The prevalence was males with 54.6% of the cases. The year of greatest detection was 2013 with 68 cases. The most frequent operational classification was multibacillary with 51.15%. Residents in urban areas accounted for 75.38%. Of the 52 municipalities in Rondônia, 69.23% detected cases of leprosy in children under 15 years of age. The most prevalent clinical form was Dimorphic with 43.07%. In the neurological evaluation of the patient at the time of diagnosis, 86.92% had zero degrees of disability, 75.7% had no affected nerves at the time of diagnosis, 62.69% had Bacilloscopy, had a negative result, 39.41% entered Services by spontaneous demand. 86.15% were discharged for a cure, and 72.30% were discharged from service with a zero degree of disability. Despite its decrease, the coefficient of detection of leprosy in children under 15 years of age in Rondônia maintains a very high level of endemicity and demonstrates difficulty in controlling the disease by the health authorities.

Keywords—Leprosy. Epidemiology. Children. Adolescentes.

I. INTRODUCTION

Leprosy is one of the oldest diseases of mankind, evidence of its origin is based on writings of different civilizations and lesions found in bones. The probable origin of the disease points to India, which, along with Africa, can be considered the cradle of leprosy (SANTOS, 2007). According to Gonçalves, Sampaio and Antunes (2008). Leprosy is identified, characterized and feared for its high deforming potential. [...] Peripheral nerve involvement is the main characteristic of the disease, which can lead to disability and disability, reducing their ability to work and limiting their social life, making them victims of stigma and prejudice (p.464). BRAZIL (2008) states that leprosy is a slowly evolving infectious-contagious disease, manifested mainly through dermatoneurological signs and symptoms: lesions on the skin and peripheral nerves, especially in the eyes, hands and feet. Leprosy is a slowly evolving infectious disease caused by Mycobacterium leprae, an obligate intracellular bacillus, which has affinity for the skin and peripheral nervous system, which can lead to deformities and disability, maintaining the stigma and prejudice of the disease. In 2009, sixteen countries in the world diagnosed a thousand or more cases of leprosy. Asia accounted for the highest detection rate of 9.39 cases / 100,000 inhabitants, followed by the Americas with 4.58 cases / 100,000 inhabitants, Brazil accounting for 93% of the cases reported in this continent, with 37,610 new cases . Brazil occupies the first place in the prevalence of leprosy and the second place in absolute number of cases in the world, behind only India. These data from 2009 still show a coefficient of detection in children under 15 years of 5.43 / 100 thousand inhabitants, parameters considered very high by the Ministry of Health (WHO, 2010). In the endemic countries, as in the case of Brazil, there are differences in prevalence among regions, states, microregions, and municipalities, concentrating on the places of greatest poverty. It is known that socioeconomic and cultural conditions have a great influence on the distribution and propagation of leprosy, presenting a close relation with the precarious conditions of housing, low educational level and also, with migratory movements that facilitate the diffusion of the disease (LANA, 2007). The states of Mato Grosso, Maranhão and Tocantins presented a high prevalence coefficient (between 5 and 9.99 cases per 10 thousand inhabitants), while all states in the South, Minas Gerais, Rio de Janeiro and São Paulo regions, in the Southeast region, together with Rio Grande do Norte in the Northeast, reached the goal of eliminating leprosy as a public health problem (BRAZIL, 2010). In 2012, 33,303 new cases were diagnosed, 2,246 (7%) in children under 15 years of age. The general detection coefficient (17.2 / 100 thousand inhabitants) is considered high. According to the reference parameters of this indicator, the states of Rondônia, Mato Grosso, Tocantins, Pará and Maranhão were classified as hyperendemic, with more than 40 new cases per 100,000 inhabitants in 2011 (BRAZIL, 2012). Leprosy can affect all age groups, but the reduction of cases in children

under 15 years of age is one of the priorities of the National Program for Leprosy Control (PNCH) of the Secretariat of Epidemiological Surveillance of the Ministry of Health, because when the disease manifests in children, indicates high endemicity, since it comes into early contact with the bacilliferous patient (PIRES, 2012). The persistence of high rates of endemicity of leprosy suggests that the children may be contacts of cases of leprosy not yet detected by the local / regional health systems. In conditions of high transmissibility and early exposure to the bacillus, the probability of illness increases, and thus, detection in this age group is taken as the epidemiological indicator of greater severity of the endemic (LANA, 2007). The disease is less frequent in children younger than 15 years; however in more endemic areas, early exposure, in home centers, increases the incidence of cases in this age group (BRASIL, 2009). According to Alencar et al (2008), one of the most important epidemiological indicators in terms of signaling the dynamics of recent transmission of leprosy is the occurrence of cases in children under 15 years of age. This indicator shows the existence of active human sources of infection. In view of the above epidemiological situation, some questions arise: Is leprosy endemic in Rondônia? Are cases under the age of 15 being diagnosed early? Is leprosy a slow-onset, infectious-contagious disease that can lead to dermatoneurological problems in children under 15? The detection of leprosy cases in children under 15 years of age in Rondônia maintains high levels of endemicity, with predominance of cases in the Dimorphic (Multibacillary) forms and with almost 10% of the cases diagnosed with important peripheral neurological deficits 13 (Grade I and Grade II), points to deficiency in surveillance and control, which leads to the belief that there is a possible lack of effective health policies aimed at the early diagnosis of leprosy.

II. MATERIALS AND METHODS

The present is an epidemiological research of descriptive cross - sectional retrospective, with methods of bibliographic research, documentary, and database analysis with quantitative approach. The instruments used for the study were the bibliographical review of scientific, methodological articles and books. Secondly, data collection, consisting of Leprosy Notification Cards, extracted from the SINAN Data Bunch, of the Health Surveillance Agency of Rondônia (AGEVISA-RO) was performed. The study has a quantitative approach, since data and numbers expressed by percentages are used. According to GIL (2002), the quantification in both information collection and statistical treatment (mean, standard deviation, percentage, etc.). It represents the intention of guaranteeing the accuracy of the results, avoiding distortions of analysis and interpretation, allowing a margin of safety regarding the findings.

The research was developed in the city of Porto Velho-RO, together with the State Coordination of Leprosy Control, of the Health Surveillance Agency of Rondônia (AGEVISA-RO), located in the Rio Madeira Palace, at Farqhuar Ave., 2986, Pedrinhas neighborhood, Porto Velho - RO. The Health Surveillance Agency of Rondônia (AGEVISA-RO) is a Public Unit of the State Executive Branch of Rondônia, which works on the surveillance of infectious and parasitic diseases and those prevalent in the Amazon region (eg Leprosy, Tuberculosis, Malaria, Dengue, Leishmaniasis, etc.), collecting information through notifications of cases of diseases of compulsory notification, by means of records made available to all Public and Private Units of the State Health Network, and subsequent typing, tabulation, analysis, interpretation of data , and the availability of bulletins and epidemiological reports to all professionals and managers of the State Public Health Network. The Agency also works with the acquisition, organization and distribution of pharmaceutical inputs for the treatment of infectious and parasitic diseases in the region, and organization of network "Immunization" throughout the State, as well as with the Am Vigilance biology (vector control).

The population studied is characterized by patients younger than 15 years of age, affected by leprosy in the State of Rondônia, and reported in the Notification Data Batch (SINAN) of the Health Surveillance Agency (AGEVISA-RO) in the period from 1 January 2011 to December 31, 2015.

For the development of the research were observed the provisions contained in Resolution 466/2012 of the National Health Council / Ministry of Health that determines procedures to be adopted on research involving human beings. In this Resolution 466, December 12, 2012, Section II, II-12 - research - formal and systematic process aimed at the production, advancement of knowledge and / or obtaining answers to problems through the use of scientific method, and subsection III, which deals with research involving human beings, must take into account ethical foundations, since the ethics of research implies: b) "Weighting

between risks and benefits, both known and potential, individual or collective, committing to the maximum benefit and the minimum of damages and risks "; (c) "guarantee that foreseeable damage shall be avoided". As data collection in electronic databases (AGEVISA / SINAN), we request the exemption of the Term of Free and Informed Consent (TCLE) to the participants of the research. The research project was sent to the CEP -Research Ethics Committee of this institution for analysis, whose approval opinion was issued through approval protocol # 1,546,797. Only then were the data requested and collected. The authorization of the director of AGEVISA was requested. The work was developed in order to guarantee compliance with Resolution 466/2012, referring to research involving human beings, submitting to the Research Ethics Committee (CEP). It was guaranteed the anonymity and reliability of the information collected, and it was not possible to identify patients, because of later data collected and published.

The data analysis is one of the most important parts of the research, since they represent if the data collected may or may not bring with it the conclusion of the research objectives. In this study, the information was analyzed by having them extracted from the database of (SINAN), together with the bibliographic survey on the objectives of the study, in a quantitative way, that is, through the use of graphs, tables or tables in the program Microsoft Office Excel, world, 2007. For statistical analysis we used percentages, and comparisons by means of a descriptive analysis of the results with the relevant literature.

III. RESULTS AND DISCUSSION

Epidemiological characterization was performed based on leprosy monitoring and evaluation indicators for all years of the study. The selected indicators were those recommended by the Ministry of Health (Health Surveillance Secretariat), according to Ministerial Order No. 149 of 2016, for evaluation and monitoring of leprosy: detection in children under 15 years of age (indicates active transmission); new cases with grade 2 of physical disability (indicates late diagnosis); proportion of female and male cases; area of residence, neural involvement, bacilloscopy, mode of entry and exit of services, and proportion of multibacillary cases and clinical form (indicates endemic expansion).



Chart 1 - Distribution of cases of leprosy, in children under 15, by age group according to Year of Notification

 $\textbf{Source: SINAN} - AG\!E\!V\!ISA/RO, \ 2016.$

During the study period, Rondônia registered 4,337 new cases of leprosy, 260 of which were in children under 15 vears of age, making up 6% of the number of new cases. When analyzing figure 1, we can observe a higher incidence of leprosy cases in children under 15 years of age in the 10-14 age group, corresponding to 188 cases out of 260 detected in the period evaluated, with a percentage of 72.30%. In a study carried out in Manaus-AM on the Epidemiological profile of leprosy in children under 15 years of age, in 1998-2005, when evaluating 4,541 cases of leprosy in the period, it was evidenced that 474 cases (10.4%) were in the age group from zero to 14 years, and of these, 307 (64.76%) were in the age range of 10 to 14 years (IMBIRIBA et al, 2008). The data found corroborate with the scientific findings of the pathology, that the incubation period is long, that is, from the contagion until the appearance of the signs and symptoms of the disease, they last in average from 2 to 7 years, although cases have been identified in the aged from 1 to 4 years, and from 5 to 9 years, these appear in lower percentage, 2.69% and 25% respectively. A large number of leprosy cases in age groups under 15 show hyperendemicity in Rondônia, as well as a deficiency in

surveillance and control of the disease, which suggests a possible lack of effective health policies aimed at the early diagnosis of leprosy.

Graph 2 shows the highest incidence of leprosy in children under 15 years of age in the male population, in a total of 142 cases out of the 260 detected in the study period, accounting for 54.6%. Palu et al., 2015, the same identified in his study on the scenario was epidemiological clinical profile of leprosy patients in the extreme west of Santa Catarina from 2004 to 2014, analyzing that of the 129 cases of leprosy reported, about 62% male. According to IMBIRIBA (2008), when evaluating the Epidemiological profile of leprosy in children under 15 years of age in Manaus-AM, leprosy in adults is more frequent in males and the risk of exposure is a determinant of this difference. Regarding the children, in the study it was observed a slightly higher percentage in males (50.2%). This is linked to the fact that they turn less frequently than women to primary care services and seek the health care system when the situation has worsened.





Source: SINAN - AGEVISA/RO, 2016

The analysis shows a higher incidence of leprosy cases in children younger than 15 years of age in 2013 compared to the other years, where 68 cases were identified, accounting for 26%. There is only a slight difference in the period from 2011 to 2012 of only 1 case. When comparing 2013 to subsequent years, there was a considerable reduction of 33% of cases between 2013 and 2014 (23 cases), and a reduction of 11% between 2014 and 2015 (5 cases). The study points to a national trend in reducing cases of leprosy. According to data from the Ministry of Health, in the period from 2006 to 2015, there was a 68% reduction in new cases of leprosy diagnosed in the country (BRAZIL, 2015).

There is a higher frequency of cases of leprosy in children under 15 years, in the multibacillary operational classification (51.15%) in the period studied. Only in the years 2011 and 2013 there were more paucibacillary cases. It was possible to observe only equivalence in the operational classification in the year 2014. The detection of cases classified as multibacillary, points to the late diagnosis of the disease, demonstrating deficiency in surveillance and control, which makes believe in a possible lack of effective health policies directed for the early diagnosis of leprosy. In a study conducted by Alencar et al (2008) to evaluate the epidemiological and operational aspects of leprosy in children under 15 years of age in Fortaleza-CE between 1995-2006, the paucibacillary form was the most frequent in all years, reaching 67% of the forms identified in 2006. Only in 2003 and 2007 was there an equivalence in this proportion, with a slight superiority in the number of cases of the multibacillary form. This scenario reflects the potentiality of disease with greater severity in the affected individuals. A similar result was found by Barbosa et al (2014), when evaluating the epidemiological and spatial characteristics of leprosy in the State of Maranhão, between 2001 and 2012, where it identified that 48.49% of the new cases were multibacillary forms.

Chart 3 - Distribution of leprosy cases in children under 15 years, by Operational Classification according to year of





Source: SINAN - AGEVISA/RO, 2016

The predominance of cases of leprosy in children under 15 years of age in the urban area is identified, with 75.38% (196 cases). The rural area corresponds to 20% (52 cases) and the peri-urban area (0.76%) (2 cases). There is also an important fact that shows the nonregistration by the person responsible for the notification in the area of residence, with 3.46% (9 cases) ignored / blank. Underreporting is often related to the lack of knowledge on the part of health professionals of the importance and procedures adopted by health surveillance systems. The occurrence of leprosy as well as other infecto-contagious diseases are usually present in urban conglomerates. Brazilian cities face serious problems regarding the lack of adequate housing, the provision of sanitation, the transportation system and other services, and even health care. A similar result was found by Miranzi et al (2010), when assessing the epidemiological profile of leprosy in a Brazilian municipality, in the period from 2000 to 2006, where 82.8% of the new cases of leprosy lived in the urban area. Data from the IBGE show that in the 1940s to 1960 the resident population by domicile zone in Brazil was more prevalent in rural areas. Since 1970 there is a significant demographic change for urban areas in Brazil, especially in medium and large cities (IBGE, 2001).

It should not be judged that migration to urban centers and the high rate of urbanization of the Brazilian population are the main causes of the spread of infectious-contagious diseases. Several factors are attributed to the maintenance or even increase of this type of disease in medium and large cities. Among them are the deficit of housing and infrastructure services, poor income distribution, high unemployment or underemployment rates, and of course, little investment in public health measures (Gomes, 2005).

There are occurrences of leprosy cases in children under 15 years of age in 36 municipalities (69.23%) of the 52 existing in the state of Rondônia. A higher occurrence of cases occurred in 6 municipalities (Ariquemes, Cacoal, Ji-Paraná, Porto Velho, Rolim de Moura and Vilhena), totaling 59.23% (154 cases). This fact can be justified because these cities are the most populated of Rondônia, having a better infrastructure in the health services, and serving according to the criteria of the State Agency of Health Surveillance (AGEVISA) as regional reference points for the diagnosis of leprosy in (GAB / MS 3,125 / 2010) (Ministry of Health) determines that only services with trained and experienced professionals can perform a diagnosis of leprosy in children under 15, due to the difficulty of age group.

An important fact to note is that in 16 municipalities (30.76%) of the 52 existing in Rondônia, there were no records of leprosy cases in children under 15 years of age in the study period. According to the Ministry of Health criteria, Rondônia is classified as a hyperendemic state, that is, it has a high detection coefficient (> 40 cases of leprosy per 100,000 inhabitants). The lack of notification of cases in these 16 municipalities may imply fragility in municipal health care services regarding health surveillance actions.



Graph 4 - Distribution of cases of leprosy, in children under 15, by Clinical Form according to year of notification

In the analysis of graph 4, the occurrence of leprosy cases in children younger than 15 years of age, distributed in the clinical forms Dimorphic (43.07%), Tuberculoid (28.07%), Indeterminate (20,38), Virchowian and 1.15% unclassified or unfilled clinical form in the notification. Similar data were also found in Alencar's (2008) survey

Source: SINAN – AGEVISA/RO, 2016.

on the epidemiological and operational aspects of leprosy in Fortaleza-CE, (2008), where 35.2% of the cases were in clinical form Dimorphic. Lima et al. (2010) identified 7 (12.5%) cases of leprosy in children under 15 years of age in a study carried out in São Luiz-Maranhão on the epidemiological profile of patients with leprosy treated at the Health Center in 2007 -2008, showed predominance in Dimorphic (58.5%) and Virchowian (19.6%). A large number of cases of leprosy in the age groups of less than 15 years, especially in the Dimorphic forms, in Rondônia, indicate hyperendemicity in the State, besides a deficiency in surveillance and control of the disease, which causes a possible lack of implementation of effective health policies aimed at the early diagnosis of the disease.

Regarding the patient's entrance into the health services, the presence or not of physical disability at the time of diagnosis, it is identified that 86.92% of patients with Grade Zero (without neural involvement of the face, upper and lower limbs), 7.30% of patients with Grade I (with decrease or loss of sensation in eyes, hands or feet), 1.53% with grade II (presence of visible deformities in the face, upper and lower limbs) and 4.23% unvalued and ignored / blank record. Imbiriba et al (2008) evaluated the Epidemiological Profile in children and adolescents, in the period 1998-2005, in Manaus-AM, that the degree of disability at the time of diagnosis was evaluated in 94.7% of the patients, resulting in proportion of 2.9% of cases with physical disabilities (Grade I and II) among the new cases detected in the period. A similar result was found by Romão et al (2013), when evaluating the epidemiological profile of leprosy in the municipality of Guarulhos-São Paulo, from 2004 to 2009, where 15.87% of the new leprosy cases presented Grade I and II of disabilities. Although in Rondônia there is a higher percentage of patients with Grade Zero (226 cases), it is noteworthy that 23 patients (19 with Grade I, and 4 with Degree II) entered the service with installed physical incapacity, evidencing a late diagnosis.

Graph 5 - Distribution of cases of leprosy, in children under 15 years, by Physical Impairment Assessment in the second diagnosis year of the notification.



Source: SINAN - AGEVISA/RO, 2016

In the analysis of the frequency of nerves affected by leprosy at the time of diagnosis, there is a higher percentage of patients without affected nerves in all years, making up 75.7% (197 patients) in the study period. It is also noted the occurrence of 19.61% (51 patients) with 1 to 3 affected nerves; 3.84% (10 patients) with 4 to 6 affected nerves, and 0.76% (2 patients) presenting 7 to 9 nerves affected by leprosy at the time of diagnosis. Neural involvement in leprosy is predominant in peripheral nerves with mixed functions (autonomic, sensory, and / or motor), being the facial, trigeminal and auricular nerves (in the face); radial, ulnar and medial (upper limbs), fibular and tibial (lower limbs), most affected by neural inflammatory processes (neuritis). Neurites are responsible for the installation of physical disabilities in leprosy and the development of physical deformities, maintaining stigma and prejudice in relation to the disease. Avanzi et al. (2016) reaffirm that the presence of disability at the time of diagnosis may indicate that it is being delayed, because they develop later, suggesting an ineffective control of leprosy, which when present in children younger than five years may be potentially incapacitating by the precocity of illness and the possibility of deformities.

It is important to note that 24.23% (63 patients) presented more than 1 (one) peripheral nervous trunk affected at the time of diagnosis, and may evolve during the course of treatment with the development of neural complications in leprosy. The patient's entry into the health service with already affected nerves clearly indicates the late diagnosis, sometimes provided by the non-mobilization of the health teams for the sensitization and exposure of the signs and symptoms to the general population, not active search of cases in the community, and failures in health surveillance actions in Rondônia.

When analyzing the performance of Bacilloscopy at the time of diagnosis, a greater percentage of patients with negative bacilloscopy were identified in all the years, making up 62.69% (163 patients) in the study period. It also shows the occurrence of 16.92% (44 patients) with positive sputum smear microscopy; 12.69% (33 patients) with no sputum smear at the time of diagnosis, and 7.69% (20 patients) with Ignored / Blank data. Hinrichsen et al (2004) assessed the epidemiological aspects of leprosy in the city of Recife-Pernambuco in 2002, and found that smear microscopy was performed in 392 patients (86.2%), and of these, 155 (34.1%) presented positive values (positive smear microscopy). Brazil (2008) determines that smear microscopy in leprosy is a complementary examination at the time of diagnosis, and its realization in all clinical forms of leprosy is not mandatory, since the Paucibacillary (Indeterminate and Tuberculoid) forms of Bacilloscopy are always negative, and the Multibacillary forms may present negative or positive smear microscopy (Dimorphic), and always positive (Virchowian). The examination is invasive, and painful, and the performance in individuals under the age of 15 years can be extremely traumatic, bringing important psychological repercussions that can affect the acceptance of the disease, the treatment, the self-esteem of the child, and the relatives.

Regarding the detection of the New Case (241 patients), there is a higher prevalence of Contact Examination in 2011, by spontaneous demand in the years 2012 to 2014, and referral in 2015. In the total period, 39.41% were on spontaneous demand (95 patients), 32.36% were by contacts (78 patients), 26.14% were referred by other professionals (63 patients) and 1.24% were by collective examination (3 patients). In a study conducted by Melão et al (2011) to evaluate the epidemiological profile of leprosy patients in the extreme south of Santa Catarina, from 2001 to 2007, 61.1% of patients entered the service by medical referral, 13% by spontaneous demand, and 3.7% by contact examination. The spontaneous demand for services that leprosy control actions,

whether at primary health care (PHC) or referral services, are not as effective. In order to have an effective control of the disease, it is necessary to provide and prioritize the diagnosis by Examination of Collectivity (through health care efforts) and by Contact Examination. The Ministry of Health defines that the most probable source of infection is the intradomiciliar contact. Therefore, the contact examination is imperative in leprosy control actions.

When analyzing the mode of exit of the patient under 15 years of health services, a greater percentage of patients receiving Cure per year in all years, accounting for 86.15% (224 patients) in the period of the study, is perpetuated. Ferreira et al (2005) identified a similar result when performing an epidemiological study of leprosy in children under fifteen years of age in the city of Paracatu-MG (1994 to 2001), since of the 45 patients diagnosed and treated, 100% were discharged for cure. In a study conducted by Oliveira et al (2014) on the epidemiological profile of leprosy in Maricá, Rio de Janeiro, 87.5% of patients were discharged for cure. In our study, we also observed the occurrence of 4.61% (12 patients) with an out-of-shape outflow; 2.30% (6 patients) Transferred to another State; 1.92% (5 patients) Transferred to the same municipality; 1.92% (5 patients) Transferred to Another Municipality; 1.53% (4 patients) receiving discharge due to abandonment, and 1.53% (4 patients) due to diagnostic error.

When analyzing the assessment of physical incapacity at discharge, a higher percentage of patients with Grade Zero was observed in all years, accounting for 72.30% (188 patients) in the study period. Note also the occurrence of 20% (52 patients) with Ignorado / Blank record; 3.46% (9 patients) with Grade I impairment (decreased sensitivity of the cornea, hands and / or feet); 3.07% (8 patients) Not Rated; and 1.15% (3 patients) presenting Grade II (with visible physical deformity) at the time of hospital discharge. Imbiriba et al (2008) evaluated the degree of incapacities at discharge from the study on Epidemiological Profile in children and adolescents between 1998 and 2005, in Manaus-AM, identifying the disability assessment in 365 patients (82, 7%), and showed that eight children (2.2%) had grade I and 15 (4.1%) grade II disabilities.

IV. FINAL CONSIDERATIONS

The data of the study reflect a great fragility of development and integration of leprosy control actions in the public health network in Rondônia. The character of neglected disease (according to a new nomenclature attributed to infectious diseases by the Ministry of Health), leprosy is a real fact in Rondônia. During the study period, Rondônia diagnosed 260 cases of leprosy in children under 15, corresponding to 6% of the total cases in the state. 72.30% were aged between 10 and 14 years. The prevalence was males with 54.6% of the cases. The year of greatest detection was 2013 with 68 cases. The most frequent operational classification was multibacillary with 51.15%. Residents in urban areas accounted for 75.38%. Of the 52 municipalities in Rondônia, 69.23% detected cases of leprosy in children under 15 years of age. The most prevalent clinical form was Dimorphic with 43.07%. In the neurological evaluation of the patient at the time of diagnosis, 86.92% had zero degrees of disability, 75.7% had no affected nerves at the time of diagnosis, 62.69% had Bacilloscopy, had a negative result, 39.41% entered services by spontaneous demand. 86.15% were discharged for cure, and 72.30% were discharged from service with a zero disability grade. Despite its decrease, the coefficient of detection of leprosy in children under 15 years of age in Rondônia maintains a very high level of endemicity and demonstrates difficulty in controlling the disease by the health authorities. As demonstrated in the study, we emphasize that 78.84% of patients enter the service with advanced clinical forms (Tuberculoid, Dimorphic and Virchowian); 24.23% with some degree of neural involvement, and 16.92% with positive sputum smear microscopy (infectious sources of the disease). An expressive number of patients entering health services by spontaneous demand demonstrates that leprosy control actions, whether at primary health care (PHC) or referral services, are not as effective. Brazil, and even Rondônia, has an extensive territory, and despite having a single political health system in force throughout the country, it coexists with a significant cultural diversity. New studies should be encouraged, especially in the northern region of the country, where conditions of access to health are still difficult, and unfavorable socioeconomic conditions, may lead to an increase in cases of leprosy in children under 15 years, and consequently, neural disorders, which may evolve with important physical disabilities, maintaining stigma and prejudice in relation to the disease. Therefore, a strategy of sustained and adequate control of the local endemic situation, with planning and using all the tools available and adequate according to the known scientific evidence, is essential, that achieves activities of information, education and communication of great reach.

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Implementation of Bayesian tests *pbayes* and *dbayes* for randomized block design in R code.

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Abstract— In the experimental statistic it is necessary to determine, after performing an experiment, which treatments differ wich other. In this context, Bayesian tests pbayes and dbayes allow the identification of these differences for data with or without balancing and for valid or not variance analysis hypotheses. The implementation of these tests in the context of completely randomized designs has already been performed in code R. Due to the importance of these tests, their extension to other designs is of great relevance. The purpose of the work is to expand them to a randomized block design. The implementation of the tests in R code for the randomized block design was successful. The programming was validated with three experiments: data with valid variance analysis assumption, balanced heterogeneous data and unbalanced data. The results were satisfactory, presented higher or equivalent sensitivity to traditional tests, evidencing the importance and versatility of pbayes and dbayes tests.

Keywords—Analysis of variance, Differences between averages, Experimental statistic, Heterogeneous data, Unbalanced data.

I. INTRODUCTION

A recurring problem in researchers' daily lives in several areas of knowledge is to determine differences between treatments by means of a pairwise comparison of means. To solve this problem for qualitative treatments multiple comparisons tests (MCP) are used.

Ronald Fisher developed the first method for the analysis of experimental data, called analysis of variance (ANAVA), by means of the test F [1]. It detects if there is difference between treatments, however, it does not designate which average differ from one another. The MCP are used for qualitative treatments, when the F test is significant and there are more than two treatments. These compare the differences between the means at the end of the experiment, analyze these differences and identify which of these treatments differ from one another [2-5].

Furthermore, the analysis of variance must satisfy four assumptions to be valid: independence and normality of residues, homogeneity of variances and additivity of the effects allowed in the model [6]. If some of these assumptions are not satisfied, the F-test is not valid and consequently traditional tests such as *Tukey* [7], *Duncan* [8], *Scott-Knott (SK)* [9] e *Student-Newman-Keuls (SNK)* [10] are not suitable for use as a statistical analysis technique.

Andrade et al [11] implemented in R code the *Bayes* function, which allows Bayesian tests (*pbayes* and *dbayes*) to be performed in the context of completely randomized design (CRD). These were proposed by Andrade and Ferreira [12] and can be used for both balanced and unbalanced data, with analysis of variance being valid or not, for both types of data.

Pbayes and *dbayes* tests are of great relevance in the statistical analysis, since unbalanced data cases and with one or more unsatisfied F-test, assumptions are recurrent. Therefore, it is important to implement these tests for other experimental designs, for example, randomized block design (RBD). This model allows local control beyond repetition and randomization. This control consists of the subdivision of the plots (blocks) in cases where the experimental conditions are heterogeneous, allowing greater homogeneity within the blocks. It is the most used

experimental design [13]. Therefore, implementation in this context is notorious.

II. METHODOLOGY

2.1 Bayes function in DBC

The *Bayes* function was programmed in R [14] code to perform the *dbayes* and *pbayes* tests in the context of a randomized block design. This is made up of three parameters, sample size to be simulated (N), *alpha* is the significance level and the file contains the data set.

To use the *Bayes* function, the file construction has the following order: treatments, blocks and data. Subsequently, there is the change of the names of these vectors, allowing them to be manipulated throughout the code. Then the file is automatically sorted by the function, organizing it incrementally in relation to the treatments.

After, the function then enables the installation and/or automatic loading of some packages required to perform the tests that analyze the assumptions of the analysis of variance. For this purpose, conditional structures have been developed that verify whether the package has been installed. If it has not been installed, installation and loading takes place. If it has already been installed, there is only loading.

For the case of balanced data, the function tests the normality of the residues through the Durbin-Watson test [15], the independence of residues using the *Shapiro-Wilk* test [16], homogeneity of variances by means of the *Bartlett* test [17] and the *Tukey add* [18] test verifies the additivity of the allowed effects in the model. In case of unbalanced data, the assumptions are not tested and performs directly the *pbayes* and *dbayes* tests.

In addition, the *qpostbayes* function generates a sample of size *n* of the multivariate *t* distribution, this step is essential for performing the *pbayes* and *dbayes* tests. By means of the Monte Carlos method, *k* chains of means based on the multivariate a *posteriori* distribution are obtained [12]. After, densities of the standardized amplitude distribution *q*, expression (1), are obtained by means of the same function. Finally, the harmonic mean of the variances (σ_h) according to the expression (2) is obtained and upper quantile 100a% (q_a) by the return of the function *qpostbayes*. Therefore, the least significant difference (*lsd*) is calculated according to expression (3).

$$q = \frac{m \acute{a} x(\mu_i) - m \acute{i} n(\mu_i)}{\sigma_h} \tag{1}$$

$$\sigma_{h} = \sqrt{\frac{1}{\frac{1}{k} \left(\frac{n_{1}}{s_{1}^{2}} + \frac{n_{2}}{s_{2}^{2}} + \dots + \frac{n_{k}}{s_{k}^{2}}\right)}}$$
(2)

$$\Delta = \sigma_h \cdot q_h \tag{3}$$

Furthermore, the *Yb* and *Syb* parameters of the *qposbayes* function (N, *Yb*, *Syb*, nu) allow the use of data with or without balancing. The parameter *Yb* is a vector whose entries are the means of each treatment. When there are unbalanced data the calculation of each mean differs with the amount of parcel of each treatment, as shown in equation (4). *Syb* parameter is a diagonal matrix. This matrix stores the values of the mean square of the error divided by the number of repetitions of each treatment, denoted by equation (5).

$$\sum_{i=1}^{n} \frac{d_i}{n_i} \tag{4}$$

where, d_i means the treatment data *i* and n_i the repeat number of the treatment *i*.

$$\begin{bmatrix} \frac{\text{Mean Sq}}{n_{1}} & 0 & \dots & 0\\ 0 & \frac{\text{Mean Sq}}{n_{2}} & \dots & 0\\ \vdots & \vdots & \ddots & \vdots\\ 0 & 0 & \dots & \frac{\text{Mean Sq}}{n_{k}} \end{bmatrix}$$
(5)

For the calculation of these parameters it is necessary a vector that stores number of repetitions of each treatment. This vector is called *nrt*.

2.2 dbayes test

The *dbayes* test calculates the difference between the pairs of the means and compares the absolute value with the least significant difference (*lsd*). The null hypothesis, $H_0: \mu_i = \mu_i$ ', is rejected when the modulus of the difference between the pairs is greater than the *lsd* [12].

2.3 Pbayes test

The *pbayes* test calculates the probability of the intervals to contain the value zero, if the zero is contained in the interval, the treatments are considered equal. These intervals are determined by the lower (LIⁱⁱ) and upper (LSⁱⁱ) limits according to expression (6) [12]:

$$\begin{cases} LI^{iir} = \mu_{ij} - \mu_{i'j} - q_j \sigma_h \\ LS^{iir} = \mu_{ij} - \mu_{i'j} + q_j \sigma_h \end{cases}$$
(6)

2.4 Validations

To validate *dbayes* and *pbayes* tests in the context of randomized block design (RBC) three experiments were used. Each experiment presents a different scenario in order to observe the behavior of the tests. In addition, some cases allow the use of other tests for comparison.

The first study consists of a data set provided by Johnson [19] which presents measurements of phosphorus pentoxide from five fertilizers analyzed in five laboratories. The interest of the experiment are the differences between fertilizers. In this data set all, the assumptions of the analysis of variance were met, so it was possible to compare the test results *dbayes* and *pbayes* with the traditional tests: *Tukey* [7], *Calinski* and *Corsten* (*CCF*) [20] and *Bootstrap* (*CCBOOT*) [21].

The second experiment consists of comparing fungicides used in the control of *Diplodia spp*. in seeds. The study consists of six blocks and eight treatments. This data set was provided by Steel and Torrie [22] and presents data with heterogeneous variances.

The latter study consists of unbalanced data provided by Milliken and Johnson [23]. The objective is to compare three models of girder divided into ten blocks. The data consist of the amount of force required to fracture the girder. In order to compare, the *Tukey-Kramer* test [24] was used.

III. RESULTS AND DISCUSSION

3.1 Bayes Function

Figure 1 shows the way that the user must create the file: treatment, blocks and data, respectively. The columns names apresented are already modify by the function *Bayes*, allowing the manipulation of these vectors.

	trt	bloc	У
1	Α	1	24
2	В	2	13
3	C	1	41
4	В	3	20
5	Α	3	12
6	C	2	32
7	В	1	10
8	C	3	9
9	Α	2	25

Fig. 1: Bayes function output in input file R code.

After the input of data, the ordination of them is required. On the figure 2 have the File organized by the function of ordination. Note that the disposition of data occur in crescent order compare to the treatments.

	trt	bloc	У
1	Α	1	24
9	Α	2	25
5	Α	3	12
7	В	1	10
2	В	2	13
4	В	3	20
3	C	1	41
6	C	2	32
8	C	3	9

Fig. 2: Output in R after the ordination.

However, using the function *Bayes* the ensuing packages must been installed and charged. On the Table 1 is presented the names of the packages and your finality.

Table 1: Packages used by the function Bayes.

Packages	Finality
lmtest	Realization of Durbin-Watson test
asbio	Realization of <i>Tukey add</i> test
multcomp	Realization of Multiple Comparison test
mvtnorm	Generation of data string
stringr	Tables formatting
dplyr	Data ordination
car	Data ordenation

Due of the number of packages required, as shown in Table 1, the *Bayes* function automatically installs and / or loads those packages. Therefore, have programmed a conditional structure that performs this installation and / or loading. This Structure facilitates the use of the function and allows the operation to the lay users of R.

Firstly, the analysis of variance was performed to data balanced. For this type of data, it is necessary to verify the

homogeneity assumptions of the variances, additivity of the effects allowed in the model, normality and independence of residues. Figure 3 shows the output of the R, presenting the assumption evaluated, the test used, the p-value found and whether the assumption was or was not met.

Test validity table					
Normality Independence of res Homogeneity Additivity	Test Shapiro dues Durbin-Watson Bartlett Tukey	p_value 0.270037 0.185493 0.029701 0.260154	Not Not Not	Result Violated Violated Violated Violated	

Fig. 3: Output of the Bayes function in R which presents the test results for the experiment provided by Steel and Torrie [22].

The Tables 2 and 3 show code sections to calculate the parameter Yb and Syb used as input to the *qpostbayes* function. In addition, the stretch of the nrt vector code that is used to calculate these parameters is presented in Table 4.

Table 2: Fragments of the R code developed forparameter Yb.

Table 3. Fragments of the R code developed for theparameter Syb.

```
for(i in 1:nlevels(file$trt))
{
    for(l in 1:nlevels(file$trt))
    {
        if(i == 1)
        {
        }
    }
```

```
mvariance[i,1]= vvariance[i]/nrt[i]
}
if(i != 1)
{
mvariance[i,1] = 0
}
}
```

Table 4.	Fragments	of the	R cod	e deve	loped	for the	vector
			nrt.				

```
for(i in 1:nlevels(file$trt))
  nrt[i]=0
  for(l in marker:length(file$trt))
     if(file$trt[marker] == file$trt[1])
       counter = conter + 1
     }
   for(i in 1:length(file$y))
     if(is.na(file$y[i]))
     {
       for(l in 1:nlevels(file$trt))
          if (l==1)
          {
            if(i<=pos[1])
               nrt[1]=nrt[1]-1
             }else
               if((i>pos[1-1]) && (i<=pos[1]))
               nrt[1]=nrt[1]-1
              ł
            }
```

After, the *qpostbayes* function generates *k* chains of means by the *Monte Carlo* method and generates the standardized amplitude of the *posteriori*. Subsequently, the harmonic mean of the variances (σ_h) and the upper quantile 100 α % (q_α) were obtained by the return of this function. The calculation of the least significant difference using these values is presented in Table 5.

Table 5. Fragments of the R code developed for thecalculation of lsd.

```
conf = 1-alfa
q$q=sort(q$q)
q$q[N*conf]
```

q\$sigh delta = (q\$sigh)*(q\$q[N*conf])

Posteriorly, the tests are performed Table 6 shows the code for the *dbayes* test. As a result presented to the user, *ns* indicates that there is no significant difference between treatments and * indicates that there is significant difference between treatments.

Table 6. Fragments of the R code developed to perform
the dbayes test.

```
for(i in 1:(nlevels(file$trt)-1))
{
   for(j in (i+1):nlevels(file$trt))
   {
     counter = counter +1
     Y = mean[i] - mean[j]
     Y = abs(Y)
     if(Y<delta)
     {
        dif.letters[counter]="ns"
     }else
     {
        dif.letters[counter]="*"
     }
}</pre>
```

Regarding to the *pbayes* test, the piece of code developed for this test is shown in Table 7. As with the *dbayes* test, the result presented to the user is given by *ns* and *.

 Table 7. Fragments of the R code developed to perform

 the pbayes test.

<pre>for(i in 1:nlevels(file\$trt))</pre>
{
for(j in i:nlevels(file\$trt))
{
if(i != j)
{
LI[,n] = Chain1[,i] - Chain1[,j] - Chain1[,kk]*q\$sigh
LS[,n] = Chain1[,i] - Chain1[,j] + Chain1[,kk]*q\$sigh
comp1[n] = i
$\operatorname{comp2}[n] = j$
n = n + 1
}
}
}

3.2 Bayes function validations

The *Bayes* function inputs (*N*, *alpha*, *file*) for the three experiments were N = 10,000, α = 0.05 and the file with the data for each case. The first experiment provided by Johnson [19] has all the assumptions of the analysis of variance satisfied. The output of the *Bayes* function in the context of a randomized block design (DBC), presents the evaluated assumption, the test used, the p-value found and whether or not the assumption was met, according to Figure 4.

Test validity table	
Normality Independence of residues Homogeneity Additivity	Test p_value Result Shapiro 0.45533 Not Violated Durbin-Watson 0.26989 Not Violated Bartlett 0.91866 Not Violated Tukey 0.41141 Not Violated

Fig. 4: Output of the Bayes function in R, presented the test results for the experiment provided by Johnson [19].

It was compared the results of the *dbayes* and *pbayes* t ests with the traditional tests *Tukey* [7], *Calinski* and *Cors ten* (CCF) [20] and *Bootstrap* (CCBOOT) [21], according to Table 8. This comparison was only possible because th e analysis of variance is valid.

Table 8. Comparison of the dbayes and pbayes tests with t raditional tests for the dataset presented by Johnson [19].

			Tests		
Treatments-	Tuke y	CC F	CCBOO T	dbaye s	pbaye s
G - F	*	*	*	*	*
$\mathbf{H} - \mathbf{F}$	*	*	*	*	*
$\mathbf{I} - \mathbf{F}$	*	*	*	*	*
$\mathbf{J}-\mathbf{F}$	*	*	*	*	*
$\mathrm{H}-\mathrm{G}$	ns	ns	ns	ns	ns
I-G	*	*	*	*	*
$\mathbf{J}-\mathbf{G}$	*	*	*	*	*
I - H	*	*	*	*	*
J-H	*	*	*	*	*
$\mathbf{J}-\mathbf{I}$	*	*	*	*	*

Analyzing Table 8 it is observed that all the tests used presented the same result. Therefore, the response of the *dbayes* and *pbayes* tests in this situation were satisfactory, presenting the same sensitivity as the traditional tests.

Regarding to the second experiment provided by Steel and Torrie [22], the analysis of variance is not valid; since the data present heterogeneous variances, according to the *Bayes* function output (Figure 3). Table 9 presents the results of the *pbayes* and *dbayes* tests. In this case, it is not possible to compare them with the traditional tests as in the first experiment, since the analysis of variance is not valid.

Table 9. Results of the dbayes and pbayes tests for the dataset presented by Steel and Torrie [23].

Tractmonto	_	Repetitions
Treatments	dbayes	pbayes
$\mathbf{B} - \mathbf{A}$	*	*
$\mathbf{C} - \mathbf{A}$	*	*
$\mathbf{D} - \mathbf{A}$	ns	ns
$\mathbf{E} - \mathbf{A}$	ns	ns
$\mathbf{F} - \mathbf{A}$	ns	ns
$\mathbf{G} - \mathbf{A}$	ns	ns
H - A	ns	ns
$\mathbf{C} - \mathbf{B}$	*	ns
$\mathbf{D} - \mathbf{B}$	*	*
$\mathbf{E} - \mathbf{B}$	*	*
$\mathbf{F} - \mathbf{B}$	*	*
$\mathbf{G} - \mathbf{B}$	*	*
H - B	*	*
D - C	ns	ns
$\mathbf{E} - \mathbf{C}$	*	*
$\mathbf{F} - \mathbf{C}$	*	*
$\mathbf{G} - \mathbf{C}$	*	*
H - C	ns	ns
$\mathbf{E} - \mathbf{D}$	ns	ns
$\mathbf{F} - \mathbf{D}$	ns	ns
G - D	ns	ns
H - D	ns	ns
$\mathbf{F} - \mathbf{E}$	ns	ns
$\mathbf{G} - \mathbf{E}$	ns	ns
H - E	*	ns
$\mathbf{G}-\mathbf{F}$	ns	ns
$\mathbf{H} - \mathbf{F}$	ns	ns
H - F	ns	ns

It is observed that the *dbayes* test presents a greater sensitivity than the *pbayes* test since it detected a greater number of differences between the treatments. The violation of the hypothesis of homogeneity of variances can affect the performance of traditional methods and compromise the results [25-27]. Therefore, it is observed the importance of *dbayes* and *pbayes* tests, since they are valid on such circumstance. Finally, Table 10 shows the comparisons of the *dbayes* and *pbayes* tests with the *Tukey-Kramer* test for the data set presented by Milliken and Johnson [23]. This study consists of unbalanced data and the Tukey-Kramer test [18] is valid under these circumstances.

Table 10. Comparison of the dbayes and pbayes tests with the Tukey-Kramer test for the data set presented by Milliken and Johnson [23].

Treatments	Tests			
	Tukey-Kramer	dbayes	pbayes	
2 - 1	ns	*	ns	
3 - 1	*	*	*	
3 - 1	ns	ns	ns	

According to table 10, it can be observed that the dbayes test presented a higher sensitivity than both tests compared, whereas the *pbayes* test had the same result as the *Tukey-Kramer* test [18]. Therefore, the *dbayes* test presents a better performance in unbalanced data than the *pbayes* test. However, the result of the *pbayes* test is also satisfactory, since it shows the same sensitivity as the *Tukey-Kramer* test [18].

IV. CONCLUSION

The *Bayes* function for the randomized block design (DBC) was successfully implemented in R code. Satisfactory results were obtained for the three cases: assumptions served with balanced data; assumptions not fully met; unbalanced data.

The *pbayes* and *dbayes* tests presented good performance for the DBC model. They presented results compatible with the traditional tests in the case of balanced data in which the assumptions are met and the superior performance of the *dbayes* test in relation to the *Tukey-Kramer* test [18] in the case of unbalanced data.

By means of the obtained results it was possible to perceive and to observe the importance of the *pbayes* and dbayes tests, since these can be used for cases in which the most popular tests are not valid. Therefore, the expansion of tests for other designs and analysis schemes is of utmost importance.

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The School's Role in the Social Training of Young People in High School in the Municipality of Santa Teresa, E.S.

A Atuação Da Escola Na Formação Social De Jovens Do Ensino Médio No Município De Santa Teresa, E.S.

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Abstract— The research aims at the actions developed within the school, showing the importance of the social formation aspect in the educational process of the student. The objective of this study was to diagnose the performance of the school in the social formation of high school youth in the municipality of Santa Teresa. The sample was probabilistic, applying questionnaires to students and teachers in four high schools in the municipality of Santa Teresa. The results revealed that the paradigms used have low performance in the social formation of students. Even considering the importance of the school in the formation of the young person, with respect to the personal relationship, behavior, attitudes and values in the family, social and school environment, we observe that it does not reach its objectives. We conclude that the school is not managing to lead young people to the standard demanded by the educational culture that aims at learning in other domains, with low performance in the social formation of young people of the municipality. **Keywords**— **Educational Paradigms, Social Values, Learning.**

Resumo— A pesquisa visa às ações desenvolvidas dentro da escola, mostrando a importância do aspecto formação sociais no processo educacional do discente. Objetiva-se diagnosticar a atuação da escola na formação social de jovens do ensino médio no município de Santa Teresa. A amostra foi probabilística, aplicando questionários a alunos e professores em quatro escolas de ensino médio no município de Santa Teresa. Os resultados revelaram que os paradigmas utilizados possuem baixa atuação na formação social dos alunos. Mesmo considerando a importância da escola na formação do jovem, em respeito ao relacionamento pessoal, comportamento, atitudes e valores no âmbito familiar, social e escolar, observamos que a mesma não consegue atingir seus objetivos. Concluímos que a escola não está conseguindo conduzir os jovens ao padrão exigido pela cultura educativa que visa à aprendizagem em outros domínios, com baixa atuação na formação social de jovens do município.

Palavras chave— Educação, Paradigmas Educacionais, Valores sociais, Aprendizagem.

I. INTRODUCTION

The research looks for answers about the activities carried out in schools, looking for actions that can act positively in the daily life of each being, just as our state of mind and the world of our emotions are linked to our day to day, also the actions within the school act in beings, interfering in their future actions.

In this research, we seek proof that the school can act in the attitudinal domain of the young, instilling in their being the learning sufficient for their social formation and diverting it from the intemperate that the world dispenses to him, and that leads him to tortuous paths, considering for this his personal relationship, conduct, behavior, attitudes and values and others that are attributed to him for a perfect formation.

In investigating the school's actions and actions in the social formation of young people, we understand that they can play a decisive role in this process, based on the daily observations quoted in the spoken and written press, where we encounter problems of different natures, acting in its formation, qualifying as main, the young people who are in high school.

Due to the social diversity observed and disseminated by the spoken and written press, in every corner of the globe, we come to question whether the school has acted objectively on this issue. In the school context, when the role of schools is really defined, it is observed that a work of awareness, educational study and social formation are starting points for the great mass of institutions that are concerned with the formation of the citizen.

As we observe our young people, carrying a great number of problems arising from the various issues that occur in their daily lives, and at the same time we saw other young people with exemplary behavior, we wonder what could be happening, because there are such diversities.

The problem occurs when we see that the school, considered as one of the main institutions active in the social formation of young people, appears modestly in this respect, the educational paradigms preached in these institutions are still little assimilated by students who often do not even know the because they go to school, some do not have the support of the initial formation or even the family for the necessary orientation for its educational and cultural development. To reach this level, it is necessary that an interior change takes place, so that educational diversities are minimized.

Transforming individuals who have a social formation that can not be believed, with inappropriate behavior, caused by social disruption, is not a task for a single institution, the family, the external community, the school and the church, together they have this task, considering that the human being is product of the environment in which he lives.

The purpose of this study was to determine the performance of the school in the social formation of high school students in Santa Teresa, Espírito Santo State, Brazil, justifying the existing educational situation and the educational paradigms used in high school students.

II. THE SCHOOL IN THE SOCIAL TRAINING OF YOUNG PEOPLE

As much as parents say they were young and that's why they know what their children think, in practice that's not the way it happens. The reason is simple: times are different, so expectations, desires, worries, the world and society are others. Of course, many parents know their children and know very well what they need. But in the case of education, the more the better. That is, it is fundamental to a good relationship and, especially, to meet the needs of the children, a broad knowledge of the universe in which they live.If for the parents this perception of the thoughts of the children is important, for the schools, this perception is also true. School and family work together in the education of young people, for this reason, actions need to be synchronized.

Câmara (2007) in a research carried out, explains that the indexes found reinforce even more the importance of family and school in guaranteeing a good future for the young. "Among nine choices, the family ranked first with 77% and the school second with 48%. As life goals, the interviewees pointed out firstly, with 66%, the item having health, followed by being professionally successful (47%), having children and educating them well (38%), having stable family life (30%), be free, independent (30%), be rich (19%), fun and travel (16%) and have an intense love life (11%).

When the research looks into the future, the school is again evident among young people: "31% bet on good educational background to be successful in the future, while 56% say that schooling is a quality needed to get a job". A demonstration that the attitudes of young people could change society for the better was verified in the same item. Among the 11 possible alternatives, only 3% of respondents opted for the answer "to have an advantage, to be smart" (CÂMARA, 2007).

The aspects that most concern parents in the education of their children were also researched. "Concern about drug use was pointed out by the survey as the main reason, with 52%. Second is the option "the son's friendships" (43%), and then "studies" (41%). Drug use, moreover, was also highlighted when respondents were asked about which subjects they would like parents to talk more about. This theme was indicated by 45% of the people, ahead of Sexual Education (34%) and Studies (30%) "(CÂMARA, 2007).

For Gonçalves (2008), seeking adequate education for the children, able to provide them with sufficient background to face the challenges of the world, "the ideal school is sought, with ideal teachers and a structure of equal size. In order to obtain the full satisfaction of this desire, some questions are put to the test, among which the main ones are: location, cost, infrastructure and pedagogical line adopted. In fact, the whole school environment contributes to the training of students, but it is the way of teaching that will transform them into conscious citizens, into thinking individuals, active in their branches of activity and, above all, more human. "

"Schools are more than buildings, labs or sports centers. They're people. People who carry and convey values, who influence our children in the way they perceive things around, learn and interact with them. By necessity or by choice, they are extensions of our homes and, for this reason, become co-responsible for the way future adults will act; moving to the proactive or reactive side. It is up to us, legal guardians, decision-makers, opinion makers, culture promoters, parents passionate and concerned about the well-being of our offspring, the role of participating and assisting in school guidelines. Suggest and charge what can be our greatest legacy to children: Education (in the unrestricted sense of the word). It is one of the main transforming agents of the world and therefore modified by it "(GONÇALVES, 2008).

Perrenoud (2001) points out that "school failure is also manufactured by the school itself, due to the format of the curriculum that the student has to adapt, making it often acquire an elitist character, thus increasing the pupil-norm relation school; however, it is perceived that only a few are destined the requirements to follow these norms to the letter"."Another question concerns the responsibility pointed out by the institution and its teachers, also, destined only to some students, to reach the apex of" teaching-learning-cultural formation ", disregarding the social, economic, psychological and pedagogical condition in which some others (the possible "excluded") are in the dynamics of the search for knowledge. Another factor is highlighted regarding the criterion and evaluative mode, which also emphasizes student-knowing hierarchization "(ESTEBAN, 2001; PERRENOUD, 1996).

Currently, the social psychology of education has emphasized more complex perspectives, emphasizing the social interaction before the teaching-learning processes and the school performance. According to Ovejero (1996) and Dauster (2001), "education is, above all, social, and because it is so, it occurs in relationships: teacher-student, pupil-student, teacher-teacher and even family-school However, when one speaks of "social in education", all the coercive processes experienced by the student, whether outside (for example, family stress, socioeconomic level, etc.) or within (difficulty of interpersonal relationships, school environment, among

others) of the school environment "(CURONICI & MCCLLOCH, 1999), as well as by the teacher and the entire educational institution. "Cooperation and social interaction between people are characteristics that are present in the school context and experienced extensively by the students, being able to positively influence learning" (OVEJERO, 1996; ROS, 1995). In this way, there may be a relationship between the type of cultural orientation, individualistic or collectivist, assumed by the young in society.

"By evaluating attitudes within the school, it is pertinent to consider the patterns of cultural orientation: individualism and collectivism, once one adopts one or the other, the individual will behave consistently with that pattern. Individualism expresses a tendency to success, to value one's own intimacy and a need to adjust to the social context, in order to obtain rewards. Collectivism defines a tendency toward cooperation and compliance with others; internally, people with a collectivist orientation maintain strong relations with each other, being able to share the same interests "(GOUVEIA, 1998, GOUVEIA et al., 1998).

"Nevertheless, both perspectives that focus attention on the intrinsic aspects of the students, and the relationships that they establish with the others, should be considered as well as the personal values of the students that can indicate their more general and specific goals, as well as those that promote social norms and less material concern" (FORMIGA et al., 2001).

III. SOCIAL TRAINING

If we draw a parallel with data obtained by the National Confederation of Bishops of Brazil (CNBB, 2006), we can see the great disparity of income among young people. "We were told that 56.7% of the young people lived in families with a per capita income of up to a minimum wage, in our research we found the percentage of 37.5% for the municipality of Santa Teresa, showing a better socio-financial level of this city".

According to CNBB (2006), "22.6% of the girls were mothers between the ages of 15 and 19, 49% of the unemployed were between 15 and 24 years old, 72% of the young people who died in 2002 were external 45.8% homicides, 78% of this violence is related to drug trafficking that vitiated the young people at the tip of the distribution, and users of tobacco and alcohol. In rural areas, 16% of Brazilian youth live, situations of violence related to drug trafficking and juvenile prostitution are phenomena that reach young people in this environment".

According to a survey carried out by Hanson (2002), "the main protective factors for drug use include: the family (by establishing affective bonds between

members, monitoring adolescent activities and friendships, building appropriate social behavior); strong involvement with school and / or religious activity and availability of conventional information on drug use".

"Trafficking in the favelas and surrounding areas leads to favorable conditions for drug use, as well as greater consumption, implying a permissive environment for the use of illicit substances" (NEWCOMB, 1995). "Another risk factor would be adolescence itself, cited as the period of greatest chance for the onset of substance use" (DUPONT, 1987; SANCHEZ & NAPPO, 2002). This finding puts adolescents, at least in theory, susceptible to drug use. Several authors agree with this statement, when they identify the age range of the beginning of drug use within adolescence, that is, "between 10 and 19 years" (KANDEL & LOGAN, 1984; DE MICHELI & FORMIGONI, 2001; SANCHEZ & NAPPO, 2002), And in the case of Brazilian students, the beginning of this consumption occurs mainly between 10 and 12 years (GALDURÓZ et al., 1998).

Although the importance of religiosity was cited as an "element in the recovery and treatment of dependents of psychotropic substances" (CARTER, 1998), the number of studies pointing to it is "an important factor in preventing the initial consumption of drugs for adolescents "(DE MICHELI & FORMIGONI, 2001). Still according to these authors, "the evaluation of religiosity is usually performed by parameters that involve attendance at a" church ", religious practice and belief in God or the precepts of religion. Thus, an inverse association was proposed between the religiosity of the adolescent and the initial use of psychotropic substances, that is, the more religious the less adolescent would be his interest in consumption "(MILLER, 1998).

Authors such as Cabanas (1996), Puig (1998), Buxarrais et al. (1990) and Martinez & Puig (1994) "reached the proposition of ethics as a transversal theme in schools". According to Cabanas (1996), "the central question of ethics is to answer the question: what compels us to be good? That is, it is ethics that allows us to seek criteria to define what it is to be good, right or morally right and that provides us with explanations for our sense of moral duty. To this question, which compels me to be good, different answers can be given, anchored in various philosophical or ideological positions; and it is when we respond that we find moral values". According to Lacey (1998), "social values designate the characteristics judged to constitute a good society", or, as Laudan (1984) states, "social values designate the characteristics considered constitutive of a good society." According to Cabanas (1996), "for some philosophical positions, values are the ultimate criteria for setting goals or ends for human

actions and do not need further explanations beyond themselves to exist. That is, we should be good because goodness is a value, honest because honesty is a value, and so on with other values such as solidarity, tolerance, piety, which have a natural, universal and obligatory character in our existence. For other positions, the values are determined by particular cultures and in function of certain historical moments, varying, therefore, according to each society and period of its existence. Human actions would thus be evaluated according to local customs; something considered one day as right and just might at one time be considered wrong or unjust".

A research carried out by Shimizu (1998) in which "forty teachers of the initial grades of the public network were interviewed in a city in the interior of São Paulo, it was verified that they knew very little of the psychological theories that could give them a basis for some type of moral education and who used, for the most part, common-sense opinions to decide what is moral, immoral or how to educate morally. Thus, in this research, a great part of the teachers stated that the morality of their students comes from familiar examples, from religious influences and little importance was given to the school itself in this formation: it is as if there was a belief that, in moral, family is everything, School Nothing".

In the Piagetian view and authors inspired by it, "moral education or education in values could never take place in the form of imposition of values, however good they may be, or left to the free choice of each one" (PIAGET, 1996) argues that in moral the means used in teaching are as fundamental as the ends.

Lahire (1997) contributed "to the analysis of family influence on school success or failure in terms of settings, defending the idea that family school mobilization does not always automatically lead to success and that, therefore, the profitability of school mobilization depends on specific family configuration and personal investment of subjects in relation to their school life".

According to Puig (1998), "the elements that contribute to the construction of the moral personality are: means of moral experience, socio-moral problems and individual moral resources. The education of morality is an additional element in the idea of integral education, since this dimension of the human being constitutes a facet of the personality as much as the intellectual, the corporal, the affective and the artistic".

For Dayrell (1992), "it is the social relations that truly educate, that is, form, produce individuals in their singular and deeper realities. No individual is born a man. Therefore, education has a broader meaning, it is the process of producing men at a certain historical moment".

Dayrell (1992) cites that "education occurs in the most different spaces and social situations, in a complex of experiences, relationships and activities, whose limits are fixed by the material and symbolic structure of society at a given historical moment. In this broad field of education, institutions (family, school, church, etc.) are included, as well as the diffused daily work, neighborhood, leisure, etc. " Social formation can not be seen as an attribute of only one institution, in the current conception of social formation, it is unfeasible that it is expected that individual institutions will achieve total success, since good formation is acquired from several learning obtained from different institutions.

IV. METHODOLOGY

The research was carried out in all high schools in the municipality of Santa Teresa, E.S., with questionnaires made with teachers and students of these schools. Therefore, there was no pre-established criterion for choosing the universe or samples, because the municipality had only four schools, all were used to make the research better representative and in a way that geographically covered the entire area of the municipality, considering urban and rural areas, students from all economic and social backgrounds, and teachers from different districts of the municipality.

In this way, the research was done in a universe of 4 schools (100%), with a population of 1351 students, using a sample of 1000 questionnaires applied (74%), and for a population of 120 teachers in the schools of in the municipality of Santa Teresa, 84 forms were applied (70%).

		Total	Questionnaires	Total teachers	Questionnaires
		students	applied		applied
Federal	Agrotechnical	322	197	41	28
School of Santa Teresa					
Pinto Coelho School		648	492	34	24
Polyvalent School		309	251	35	25
São Francisco School		72	60	10	07

Table 1 -	Questionnaires	applied	in schools
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Source: author's data

In this work, we tried to explore relationships that may exist among variables such as age, sex, place of residence, type of school, purchasing power and family educational level, determining the performance of educational paradigms in terms of learning moral, ethical, attitudes, relationships, respect and conduct, in the social formation of students.

In order to evaluate and express in quantitative terms the degree and the meaning of the relation between variables, one can use correlation coefficients. "There are several types of correlation measures and their choice depends on the type of variable we are using and their scales of measures" (COHEN et al., 2000).

In the questionnaires in secondary schools, variables and issues such as participation, importance, change, action and help were used to quantify the performance of the school in the process of social formation of the youth.

The interviews with teachers, from a logical sequence of questions, evolve according to the objectives of the research, being that each following question filters the previous question, linking them to the proposition of the work.

The data collection was done during the classes of the students and teachers of the schools of the municipality, and the students and teachers that were present during the field research days participated in the interview and filling out the questionnaire.

From the field research, between questionnaires and interviews, we were able to compare the data, considering the predicted variables, and probabilistically analyze the performance of the school in the social formation of the young people under study.

According to Oliveira (1997), in a scientific paper, "procedures such as statistical series, written representation, semi-tabular representation, tables and graphs, result of the treatment of these graphs" are used, however, due to the methodological characteristics qualitative methods of data description were favored, and quantitative data extracted from the questionnaires applied to the students were also used.

The data of this research were processed and organized taking into consideration the variables and the answers obtained from the questionings, where through the percentage of answers, we qualify the level of performance of the school in the process of social formation of the young high school in the city of Santa Teresa.

For the cataloging of the results we used the proportionality of the answers and the comparison of the results obtained in the questions to the students and the teachers.

V. ANALYSIS AND DISCUSSION OF RESULTS

Considering the variables determined for the research, after cataloging all the proposed questions, there was not a considerable variation in the number of answers, considering the question age, sex and type of school, but a very large correlation between family income and level of study.

The questionnaires were made showing the educational evolution of the municipality of Santa Teresa, since 53.3% of these students have semi-illiterate parents, without a study or with incomplete 1st grade, in exchange for the 40.2% of the national IBGE sense of 2009.

Observing among the students residing in the interior, especially the rural ones, we obtained the index of choice for what to do after graduating, "work with parents", of 3.6% of options, it was mentioned that 86% rural area and 14% in the city, showing that the agricultural issue has a role in deciding the future of some young people. 64.5% want to continue their studies, 15.8% still do not know what they want and 15.2% want to work.

The topic of drugs is a very controversial topic to be treated within a school, considering that students who use drugs will not always answer affirmatively to this question. Considering the number of positive responses and justifications, the diversity found in each school and its clientele, we can consider that the index of users in the schools surveyed is not significant, or that may interfere in the results of this research. Among the reasons cited by the students that made it stop with drugs, we should point out that 27% of those cited, used drugs only out of curiosity and did not continue in addiction, external influence becomes of great importance for this decision where they were cited friends, the church, family or girlfriend, the desire to stop and not have liked also had great importance in this regard.

In relation to what students think about school, family and church institutions in the social formation of young people. It is observed the importance given to the church, with 57% of the indications, followed by the family with 32% and the school with only 11%.

This result implies that the family and the school are not able to act in a meaningful way in the social formation of the young, leaving this role to the church that in their services seeks to show the religious paths included in them the social aspects that transform in a way those who believe and adhere to religious dogmas and perform in a satisfactory way the role of social formation.

It is unanimous the teachers' thinking about the value that the school has for the construction of the citizen, but the same can't be said of the student. Teachers cite the fact that the students only give due importance to the school, once they start their work day and observe that the position they occupy is related to the grade they have reached. Among the major problems observed by teachers when students arrive at school in their first year of high school, are family problems, reaching a percentage of 24.1% each. Among the main lessons the school offers its students respect (13.3%), relationship (12.4%), and moral values (10.6%), which are the most cited, followed by discipline (9.6% %), professionalism (8.8%) and conduct (8.0%).

As to the importance given by teachers to family, school and church institutions, 100% of teachers indicate that family, school and church matter in the social formation of young people, with a 93% acquired by the student. Considering what teachers think about religion at school, 63% of respondents believe that students with a religious base can achieve better student development rates, 7% say that the church can play a part in student development and 30% respond that the church has no role in student learning. On the integral formation of the students and the participation of the school, only 7% of the teachers mention that the school fulfills its role, leading us to believe that the school is not able to act in a satisfactory way in the social formation of the young people.

In relation to the institution that most contributes to the formation of young people, teachers consider that the family with 90% of the indications is the main institution, followed by the school (7%) and the church (3%). We also emphasize in the interpretation of this result, the diversity when we observe the students' response to the same question. Students put up the church with 57%, while teachers only 3%, the school is cited by 11% of students and 7% of teachers and the family is cited by 32% of students and 90% of teachers.

Considering the place where the research was carried out, this diversity can be explained due to the difference between the cultural class of the students and the teachers. It is observed that teachers, who have a higher level of schooling and have structured families, place the family as the main institution for the good social formation of our young people, whereas the majority of students with characteristics of low class, parents with low school level, who can't give their children the desired education and who do not participate in the student life of their children, valuing religious issues, leave the church's moral and social teachings in order to replace the family in this educational task. The students' responses indicate that the school can't perform satisfactorily in this regard, since most of the students will attend it by sheer obligation, to receive the benefits of the government or because they are of the age of attendance and school, without worrying about the future that awaits you. The disagreement, lack of interest, lack of motivation and lack of perspective cited are concrete evidence that the school is just another activity to be fulfilled by most of our young students.

Considering the contribution made in the cultural formation of young people, the school appears with 51% of the citations, the family 32% and the church 17%, implying that their participation in the production of knowledge is much stronger than in the social formation of the young.

Asked about learning to influence the social formation of young people. 93% of the respondents say yes and justify their response, citing that it directs the young person, acts as an example to be followed, provides means for the correct formation and cites that young people are influenced by the environment from the relationship they have in school. 7% answered that the school does not change anyone's personality.

According to the teachers interviewed, the school is able to intervene in the social formation of the young people who attend it in the areas of discipline, conduct, respect, relationship, ethics, values teaching, responsibility, personality, cooperation, commitment, dignity, determination and citizenship are likely to occur with young people, with changes that may occur in the period in which they are attending school.

Considering the questions of the questionnaires, a representative evolution was made based on the answers that represent the objective of the research. From the data considered representative, we did a relationship where we found an index that, according to the criteria used in Brazilian education, is below the average for approval.

Graph 1 gives us data to conclude the objectives, where we can observe that the midpoint is at the level of 49.6%, which is deciphered in Table 1, explained in painting 1.

The above qualification, with an average point of 49.6%, alerts us to the fact that in Brazilian schools, no student is approved with an average lower than "5.0", and that this value is considered as unsatisfactory for their approval, a parameter that induces us to consider low for the performance of the school on the young.



Graph 1 - Percentages of the main points where the school acts on young people

Source: author's data

A qualificação acima, com ponto médio de 49,6%, alerta-nos ao fato de que nas escolas brasileiras, nenhum aluno é aprovado com média inferior a "5,0", e que este valor é considerado como insatisfatório para aprovação dos mesmos, parâmetro que nos induz a considerar baixo para a atuação da escola sobre os jovens.

We observed by the interviewees that respect, relationship and moral values figure as the most quoted items, followed closely by discipline, professionalism and conduct. The citation of the teachers emphasizing the importance of attending school, as essential for the formation, is based on the interview with them, who mention that they were able to reach higher-than-average cultural indexes from the school and that the school was the main factor of this achievement.

Painting 1 - Statement of Chart 1

А	It shows that only 11% of students believe that
	school is the institution that most helps in the good
	training of young people.
В	It shows that 53% of students are able to recover
	from problems in school work.
С	It shows that 100% of the teachers consider that the
	school was active in its social formation.
D	It shows that only 7% of the interviewees consider
	the school as the main institution for the good
	training of our young people.
E	It shows a percentage of 32% for the school's
	contribution to the social formation of our youth.
F	It shows a percentage of 51% for the contribution
	of the school in the cultural formation of our youth.
G	It shows that 93% consider that the learning
	acquired in the school is a factor of action in the
	social formation of our young people.

Source: author's data

Important consideration should be made regarding the research, since it was carried out for the municipality of Santa Teresa, in the state of Espírito Santo, and may have different results in capitals or municipalities with different characteristics.

Youth disengagement with the school is visible, family influence, the need to enter the world of work or even to return home to help with the tasks of the field are fundamental factors for the young person leaving school.

VI. CONCLUSION

The values preached at school can act decisively, acting in the social formation of young people, but what was detected in reality, is that the action of the school is obstructed by several factors directly linked to the student class, in which, school work is considered to be of low absorption by young people, and that these are not acting satisfactorily in the social formation of the young people who attend it.

The lack of student base and the condition that leads students to school, disinterest in studies and lack of perspective for the future are fundamental for students not want to go to school, allied to the family's agricultural influence that causes young people complete only basic education, to return to work in the countryside, make school a secondary factor in their lives.

In spite of forming the socialization of the individual, the family, considered as the first link of social formation, has in many cases left these principles, through disinformation of the parents or socio-economic conditions, not fulfilling their social role, causing the church, which is increasingly sought after, has a fundamental importance in the social formation of young people, and the school, even with paradigms that lead to this formation, has not satisfactorily reached this goal.

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Bioethanol Production and Statistical Modeling from Fruit Residual Biomass Potential

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Abstract— This work aims to describe an experimental procedure for the synthesis of bioethanol by the alcoholic fermentation of organic matter, from the use of discarded fruits. Based on the procedures performed on the statistical analysis of factorial experiments was used to verify the influence of the independent variables: the amount of must and fermentation time, in relation to yield response. The alcoholic fermentation was obtained from the pulp of apples (Malus communis) and tangerines (Citrus reticulata), as well as by microorganism (Saccharomyces cerevisiae). As a result, the maximum yield value was around 17.5% v.v⁻¹, which gives fruit residues a high potential for use in bioethanol production. The statistical evaluation was used to optimize the input condition and the value of 19.06% v.v⁻¹ has been estimated. Thus, this text presents a model of economic viability and its environmental importance due to the use of organic waste.

Keywords—Biofuels, Experimental production, Residual biomass, Statistical analysis.

I. INTRODUCTION

Nowadays, the world's energy resources are expanding, due to the increasing demands of the capacity to transform the productive factors combined with the continuous change in consumption habits and in the face of the increase of the world population on Planet Earth. However, specialized agencies warn of the depletion of traditional energy resources, and more than that, they warn of the danger of the continued use of traditional energy sources based on fossil sources (AKKARI, RÉCHAUCHÈRE, et al., 2018). These intensifications of production mean overburdening the environment, which is clear evidence of its contribution to global imbalances. In other words, overloading energy resources means overburdening all other resources on the planet, exerting significant pressure on the use of common goods in the economy (ZILBERMAN, 2017). Therefore, guaranteeing energy efficiency and at the same time not overloading the environment is the problem to be faced by the world in the coming years, thus evidencing the search for renewable energies that cause fewer negative externalities to the environment (MME, 2015).

The use of renewable energy, especially based on solar photovoltaic, wind and biomass sources, corresponds to a technological innovation that breaks the existing paradigm because it is a new method of production, sustainable and non-aggressive of the environment. In this context comes bioethanol, a liquid biofuel derived mainly from renewable biomass that presents some important differences in relation to petroleum-derived fuels. Among these are the high oxygen content, which accounts for about 35% by weight of bioethanol, low toxicity and high biodegradability, which in general allow for cleaner combustion and increased engine performance (BUCKERIDGE e SOUZA, 2017).

Biofuels are classified according to their process of production and can be qualified as first or secondgeneration biofuels. The first generation being produced from the raw material saccharide and starch, such as sugarcane, corn, and soybeans, also used as food for humans and animals, second-generation biofuels come from industrial waste, agricultural waste or urban waste (BUCKERIDGE e SOUZA, 2017; BAJPAI, 2013). Among the main advantages of second-generation bioethanol production is the absence of a threat to food production, as well as the agricultural land (BAJPAI, 2013). The synthesis may be derived from the enzymatic hydrolysis of polysaccharides contained in lignocellulosic matter, followed by the fermentation of fermentable (EHTESHAMI, VIGNESH, et al., 2016). sugars However, these three processes can be performed SHF - separate independently: hydrolysis and fermentation; combined SSF simultaneous _

saccharification and fermentation; or SSCF simultaneous saccharification and co-fermentation (BAJPAI, 2013).

The organic waste to produce biofertilizers used in agriculture, and obtaining biogas and bioethanol for energy cogeneration, is expressed by different methodologies for this purpose, in specialized literature. Azevedo et al. (2007) evaluated the production of bioethanol from the persimmon juice and observed that the factors of the initial concentration of inoculum, soluble solids and initial pH did not influence the alcoholic fermentation of the organic matter. In the study presented by Lima et al. (2015) in terms of efficiency and yield of the process of obtaining cellulosic ethanol by means of the alcoholic fermentation of the hydrolyzed liquors with the use of the yeast Saccharomyces cerevisiae. These authors obtained maximum yield and efficiency values of 0.445g of ethanol/g of bagasse and 87.1% for the hydrolyzed liquor with the addition of cashew juice. Ylitervo (2008) used dried oranges peels to produce bioethanol by enzymatic hydrolysis with the application of the Mucor Indicus fungus, hydrolyzing and converting into sugars, in the bioethanol production by two fermentable sugar process, and has been obtained a yield of 0,36g/g after 24 h.

In contrast, a large amount of biomass residues with high potential for energy generation is wasted each year, because about 35% of Brazil's agricultural production goes to waste and, consequently, the country is among the ten countries that more wasted food (GOULART, 2008). A study by the Food and Agriculture Organization (FAO) estimates that each year about 1.3 billion tons of food is wasted or lost in the world, equivalent to one-third of global production. In fact, apples alone are 3.7 trillion units annually (EMBRAPA, 2017; FAO, 2013).

All processing of fruit and vegetables produce waste which, when treated for recovery, is generally used as fertilizer or animal feed. However, with the growing worldwide concern about preservation and environmental impacts, more sustainable means of agricultural production and alternative energy generation are sought. With this, several biotechnological processes have been developed to transform agroindustry waste into products of economic value, adding usefulness to a disposal item (BUCKERIDGE e SOUZA, 2017; BRUNELLE, DUMAS e SOUTY, 2014). In this context, we have been experimental bioethanol alcoholic proposed an fermentation process and to validate this synthesis by statistical optimization, aiming the reuse of discarded fruits.

II. MATERIALS AND METHODS

The organic material was collected on July 15, 2018, where 7 kilograms of fruit were collected (Fig. 1). The fermented fruit was produced on a bench scale, and for the production, procedures were used a batch reactor with a capacity of 500 ml. Else, a reflux distillation processor was used with independent temperature controllers and water flow condensation chamber, in addition to the transfer of manually controlled internal stages. For these experiments we used: apples (*Malus Communis*) e tangerines (*Citrus reticulata*); yeast (Biological yeast); sucrose; and, distilled water.



Fig. 1: Organic material collected

2.1 The preparation of the substrate (must)

The preparation process begins with the washing of the fruits and the extraction of the juice (must) containing water, alcohol and the solid by-products was obtained with the aid of a domestic blender used to grind and homogeneously mix the matter.



Fig. 2: The fermentative must in preparation

To expand the scale for the works in the future, the microorganism *Saccharomyces cerevisiae* was used because it is the most economically viable. The planning indicated a volume of around 6 (six) liters needed for the development of the ten trials. So, in the process of must preparation, we used 5 liters fruit pulps mixing 1-liter distilled water. After this, we also add 500 g sucrose to favor the more rapid growth of the microorganisms, the number of yeasts was added in the concentration of 10 g.L⁻¹, totaling 60 g. This solution was mixed and transferred to the storage containers.

2.2 Fermentation

In this stage, the conversion of sugars into ethyl alcohol (ethanol) and carbon dioxide (CO₂) occurred. The

process has been completed by storing the must in a coupled vessel of a three-piece vacuum chamber, subjected to an ambient temperature of 28°C, and containing a valve that was used to collect the must according to the fermentation time previously determined. The fermented samples were collected at intervals in the range of 33.1 to 134.9 hours under fermentation conditions.

2.3 Distillation

At first, the fermented mixtures were filtered to separate any solid residues from the liquid. After this, the broth was poured into the distillation boiler, where an element inside the vessel heated the substance so that the alcohol boiled and rose in the form of steam through the distillation column, all this process was done with the aid of the panel GT-6000 from Marcraft. To maximize the alcohol content of the samples the vessel temperature was controlled and remained between the boiling points of alcohol and water, 78.3 and 100°C, respectively, with a total process time of about 4 hours.

2.4 Calculation of the variable studied

The yield calculation was developed from Equation (1). Where v_{EP} represents the volume of ethanol produced and v_{MF} is the volume of the fermented must.

$$Yield = V_{EP} / V_{MF} \times 100 \tag{1}$$

2.5 Statistical methods

Systematic sequencing of factorial experiments, from the levels of the variables worked, were specified, applying a planning 2^2 with four factorial points, counting on four more axial points and two central points, totalizing 10 trials.

For the analysis of the results, we have been used the computational software's MINITAB® v.18 and STATISTICA® v.10. By means of these can be possible to obtain the multiple linear regression, based on the experimental plan (central planning), the need to adjust the model and its adequacy through analysis of variance (ANOVA), to validate the relationship between the variables. We also verified the hypotheses of normality and constant variance (homoscedasticity) of the residues, in order to admit if the proposed model satisfies them. The generation of the response surface graphs was suggested for a better visualization of the effects found and verification of the optimal point revealed in the experiments that represents a maximum value in the response. Based on the optimization of the process, the ideal conditions for input variables were established, being able to estimate the maximum yield (%) v.v⁻¹.

III. RESULTS AND DISCUSSION

Table 1 shows the real and coded levels of input variables obtained with the planning.

Table 1: Shows the real and coded levels of input variables obtained with the planning.

			_	-	
Variables	Level - 1,414	Level -1	Median	Level +1	Level + 1,414
Quantity of must (mL)	337,86	400	550	700	762,13
Fermentation time (hours)	33,1	48	84	120	134,9

Once these conditions were maintained, the Central Composite Planning (CCP) for each variable was elaborated in two levels of work plus two points (alpha), defined as points of extreme variation. So, each variable is studied whereas three previously defined levels (-1, 0, +1) and two other levels added ($-\alpha$ and $+\alpha$), such parameters were used in order to obtain a delineation, where the variance and covariance matrix is diagonal and the estimated parameters are not correlated with each other (SMUCKER, KRZYWINSKI e ALTMAN, 2019). In Table 2, is presented the planning matrix with the coded values of two input factors and answers acquired on the accomplishment of the experiments in relation to the levels studied.

Table 2: Factorial design matrix 2^2 with coded values and experimental yield data (%) v.v⁻¹ of production

Trails	QM (mL) (coded)	TF (h) (coded)	R (%) v.v ⁻¹
01	-1	-1	13,3
02	-1	+1	13,7
03	+1	-1	16,6
04	+1	+1	17
05	-1,414 (-α)	0	11,5
06	1,414 (+a)	0	17,5
07	0	-1,414 (-α)	13,3
08	0	1,414 (+a)	13,5
09 (PC)	0	0	10,2
10 (PC)	0	0	10,2

QM – Quantity of must; TF – Fermentation time; R – Yield; PC – Central Point.

According to the Policy N° 64/2008 (BRAZIL, 2008), fermented fruit is the liquid with an alcoholic strength in the range of 4,00% to 14,00% in volume and 20°C. These values are directly proportional to the yield (%) v.v⁻¹ of production. The highest value of alcoholic yield found in

this study was 17,5% v.v⁻¹ (experiment 6). Therefore, is necessary to analyze the percentage concentration of alcohol obtained in the final product, which has been not considered in the present study, and will also be possible to attribute the high alcohol content to these conditions. Result higher than found by Dantas & Silva (2017) that used the alcoholic fermentation of *Spondias tuberosa* and the yeast *Saccharomyces cerevisiae* has been found alcoholic yield of 12,54% v.v⁻¹.

In this work, the maximum result $(17,5\% v.v^{-1})$ is much higher than that found by Gomes, Lima, Rabelo, Oliveira & Silva (2010) also for fermented of *Spondias tuberosa*, being 11,6% v.v⁻¹ of alcohol. However, being much lower than found by Pereira, Gallina, Banczek, Maia & Rodrigues (2016) that used *Cyperus esculentus* as raw material and the enzymatic route for the hydrolysis, found at the maximum of their experiments the value of 29,08% v.v⁻¹ of alcohol. The variations of these results are due to the fact of the different processes, types, and concentration of the inoculum, as well as the temperature used in the experiments, among others.

When a Multiple Linear Regression Model (MRLM) is proposed to statistically evaluate a certain procedure, one of the objectives is to find the simplest and bestpresented model. For a better analysis, it is necessary to consider that by adding more terms in the systematic part of the model, we increase the Quadratic Sum of Regression (QSReg), remaining to know if such increase is significant, in order to verify if the addition of the extra terms contribute to the best description of the variable studied (ALTMAN e KRZYWINSKI, 2015). However, it is necessary to request an ANOVA table corresponding to the reduced model (Table 3) in comparison with the table of the complete model, presented in Table 4.

Source	Degree of freedom (GF)	Quadratic sum (QS)	Root Mean Square (RMS)	Test F	<i>p</i> -Value
Regression	2	28,5921	14,2961	2,87	0,123
QM (linear)	1	28,4456	28,4456	5,71	0,048
TF (linear)	1	0,1466	0,1466	0,03	0,869
Error	7	34,8439	4,9777	-	-
Lake of fit	6	34,8439	5,8073	-	-
Pure error	1	0,0000	0,0000	-	-
Total	9	63,4360	-	-	-
(%) Explained variation	R ²	R ² (Adjusted)			
	45,07	29,38			

Table 3: ANOVA	short form	(no	additional	terms
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The ANOVA of this model shows an R² value than expected for predictive models and the values-p found is above the set level of significance ($\alpha = 0,005$). Also, it is noted high value of the lack of adjustment, allowing the understanding that such model needs adjustments as the studied variable. Table 4 presents the model by adjusted configuration submitted to additional terms.

Table 4: ANOVA complete model	(with the addition of terms)
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Source	Degree of freedom (GF)	Quadratic sum (QS)	Root mean Square (RMS)	Test F	<i>p</i> -Value
Regression	4	60,0821	15,0205	22,39	0,002
QM (linear)	1	21,7510	21,7510	32,43	0,002
TF (linear)	1	15,5978	15,5978	23,25	0,005
QM (quadratic)	1	27,4400	27,4400	40,91	0,001
TF (quadratic)	1	16,5069	16,5069	24,61	0,004
Error	5	3,3539	0,6708	-	-
Lake of fit	4	3,3539	0,8385	-	-
Pure error	1	0,0000	0,0000	-	-
Total	9	63,4360	-	-	-
(%) Explained variation	R ²	R ² (Adjusted)			
	94,71	90,48			

The adjusted model can be used for predictive purposes since the descriptive values-p are below the fixed significance level and the quadratic mean of the lack of adjustment (0.8385) allows to state that the model does not present statistical evidence for to make a new adjustment. The coefficient of determination (R² adjusted) was satisfactory at a significance level of 95%, indicating the high significance of the model studied. The adjusted R² value (90.48) means that 90.48% of the total variation around the mean is explained by the regression KRZYWINSKI, 2015; (ALTMAN е CHARNET, FREIRE, et al., 2008). Therefore, it is understood that there is no need to formalize a hypothesis test to compare Quadratic Sum of Regression (QSReg), due to the perceptible improvement of the model after an additional term. The respective statistical coefficients of the empirical mathematical model are described by Equation (2), where the values in bold correspond to the statistically significant parameters.

Yield (%) = $46,26 - 0,1072 \text{ QM} - 0,2427 \text{ TF} + 0,000109 \text{ QM}^2 + 0,001467 \text{ TF}^2$ (2)

In Equation (2), the linear term of the fermentation time variable is not in bold, because the value-p of this term was below the measure of the significance level set ($\alpha = 0,005$), indicating a negligible contribution of this term to the model.

In fact, once these formulations have been established, it is necessary to evaluate the suitability of the adjustment made. For this propose, we examined the distribution of the residual values, calculated as the difference between the predicted values, according to the current model, and the observed values, as can be seen in Fig. 3. An analysis of the normality and constant variance (homos cedasticity) assumptions of residues is also important. Thus, Fig. 4 and Fig. 5 were also proposed for better visualization of these results.



Fig. 3: Graph of predicted values vs. observed values







Fig. 5: Diagram of the residual's vs predicted values

By analyzing the previous graphs, we can present that the set of observed values (model residuals) are very close to following a theoretical distribution. In the visual interpretation of Fig. 3 and Fig. 4, it is observed that the points are distributed close to the straight identity. And the residues also meet the assumptions of constant variance (homoscedasticity), as seen in Fig. 5 (BIAZUS, SOUZA, et al., 2005).

Based on the results obtained, it is relevant to examine the surface and contour plot of the dependent variable as a function of the factors. The surface is satisfactorily described by Equation (2), which is shown in Fig. 6. This verification allows obtaining the regions of greatest (maximum) and minor (minimum) results of the studied response.



Fig. 6: Response and boundary surface: yield (%) v.v-1 (%) depending on the quantities of must and fermentation time

Fig. 6 shows the highest percentage yield value found (17,5% v.v⁻¹), maintaining a quantity of must at the level 1,414 ($+\alpha$), which is equivalent to 762,13 mL and fermentation time ratio corresponding to 84 hours (center point), coded values of Table 2 (experiment 6) and quantified in Table 1, are the levels that maximize the bioethanol experimental production of this work.

According to the specialized literature (BOTHAST e SCHLICHER, 2005; NICHOLS, MONCEAUX, et al., 2008; QUINTERO, MONTOYA, et al., 2008), the fermentation requires a total time of 48 to 72 hours and reaches a final ethanol concentration of $10-14 \% 46 \text{ v.v}^{-1}$.

In addition, it is emphasized that the samples were exposed to the flame test, which consists of setting fire to the obtained solution to verify if it starts with combustion with a certain facility. All the tests were successful and have been observed that the alcoholic concentration of the bioethanol solutions was at considerable concentration levels. Fig. 7 presents the optimized condition of the bioethanol production process using the applied methodology.



Fig. 7: Optimum yield values of must (mL) and fermentation time (h)) optimized for yield (%) $v.v^{-1}$ in the bioethanol production process

The optimal conditions determined in the optimization of this process were 732.13 (mL) for the quantity of must and 127.7 (hours) of fermentation time. The independent variables in such optimized conditions (according to Fig. 8), presented an approximate yield value of $19,07\% \text{ v.v}^{-1}$.

In this sense, the conditions of these variables are within the range of experiments performed (line projected in green), demonstrating that the optimization occurred successfully.

IV. FINAL CONSIDERATIONS

The use of apples (Malus communis) and tangerines (Citrus reticulata), as raw material to obtain bioethanol from the alcoholic fermentation process, presented high economic viability and significant potential from an environmental point of view for the use of organic residues. Since these fruits were collected directly from the garbage collection. The result consistent with the experiment, report that such raw materials can be used to produce bioethanol and this conclusion is based on the high 17,5% v.v⁻¹, which confers to the fruit residues a competitive potential considering ethanol coming from the sugar cane, however without additional expenses for agricultural inputs, such as planting, harvesting, transportation, among others. The implementation of a factorial planning in the study of the production was efficient and relatively simple to use as a strategy of optimization and analysis about this process, being able to be considered relevant to the development of researches as to the use of products or byproducts derived from industrial sources or which can be processed for clean and renewable energy generation.

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The construction of the Sobradinho Dam and the relocation of the residents of Velha Sento-Sé to Nova Sento-Sé/Bahia

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Abstract — The riverside communities of the municipalities of Sobradinho, Casa Nova, Pilão Arcado, Remanso and Sento-Sé in the State of Bahia have suffered socio-environmental and cultural impacts because of construction of hydroelectric dams on the São Francisco River, causing psychosocial damage to people, in addition to some environmental degradation. The main goal of this paper is to describe from memory the process of relocation of the residents of the old Sento-Sé village to the new city after the construction of the Sobradinho dam (1973). This way, it is intended to recount a historical reminiscence, recalling a socioenvironmental and cultural context of the time of the flooding of this city that no longer exists tangibly. In the preparation of this article, semi-structured interviews have been conducted, based on reconstructed memories and reminiscences of the residents of that city, periodicals, documents from institutional sources and photographic images of the flood period. This research also produced a memorial record, a video-documentary called "Ecologia e Memória de Sento-Sé", recorded in 2019 and available on YouTube, referring to a period in the history of the São Francisco Valley.

Keywords - Socio-environmental Impacts, Hydroelectric, Memory, Ecology, São Francisco River.

I. INTRODUCTION

The construction of the dams was originated in Mesopotamia, Egypt, and China, thousands of years ago when men were building barriers and waterways to control floods and provide water for irrigation of plantation (CULLEN, 1964). Nowadays, hydroelectric plants are used to produce electricity to supply populated cities around the world. In recent decades, the ecosystem and the world population have been significantly affected by the construction of dams and is estimated that approximately 45,000 dams have been built, compromising more than 60% of all rivers on the planet (GIONGO; MENDES; SANTOS, 2015).

The construction of hydroelectric dams has also caused the involuntary relocation of communities around the world, resulting in large, multifaceted and complex phenomena for a single approach, already recorded in various research on dams that have generated numerous impacts both in the region where they are located and at the inter-regional, national and global levels (SILVA, 2010).

The process of implementation of dams and hydroelectric dams, in addition to large structures built by man, represents the symbolism of a particular developmental ideology and an attitude taken towards nature, which is to treat it merely as a concrete structure generating energy, trade, water, flooding and dispersion of communities (SILVA; SANTOS; OLIVEIRA, 2017).

When it comes to Brazil, it is seen that the construction of hydroelectric dams has provided the formation of extensive reservoirs flooding considerable areas of rural and urban spaces. Starting in the second half of the 20th century, the Brazilian government decided to orient energy policy towards hydroelectricity production, using the country's potential of water resources as its main argument. With respectable technical choices and investments, they have built hydroelectric power plants and dams throughout the territory, facilitating specific areas such as the Southeast, Northeast and South regions, where the potential for energy generation was higher, according to national and international economic contexts (LETURCO, 2016).

In the 1970s, the conception of energy policy was based on the construction and implementation of large hydroelectric projects, with the justification of being the primary source for the supply and energy sufficiency of the country. In this sense, the Brazilian territory is considered privileged, considering the extension of freshwater reserves and river flows, sufficient for the electric power generation (DERROSSO; ICHIKAWA, 2014).

Menezes and Marques (2018) state in their researches that, in Brazil, more than one million people have been expelled from their lands as a result of the construction of hydroelectric plants. It is estimated, therefore, that these enterprises have been directly responsible for the displacement of 40 to 80 million people in recent years around the world.

These authors (2018) consider that the problems faced by populations affected by dams are numerous and emblematic. However, the eyes are more frequently directed to the most visible factors, i.e., the commodification of natural assets and violent degradation of the environment, resulting in significant social and ecological vulnerability.

Faced by the problem, the objective of this article is to describe from memory the process of relocation of residents of the old city of Sento-Sé to the new one, which occurred after the construction of the Sobradinho dam in 1973. Therefore, it is intended to narrate historical reminiscence, remembering the socio-environmental and cultural context of the time of the flooding of the city. In the preparation of this paper, semi-structured interviews were conducted, which were based on reconstructed memories and memories of the dwellers, in addition to periodicals, documents from institutional sources and photographic images of the flood period. This research also produced a memorial record, the video-documentary called "Ecologia e Memória de Sento-Sé", recorded in 2019 and available on YouTube, available at https://www.youtube.com/watch?v=Rp4ImFPughU.

II. MATERIALS AND METHODS

This research has been conducted in the municipality of Nova Sento-Sé, located in northern Bahia, on the banks of the Sobradinho Lake, in the São Francisco region. The data have been collected through semi-structured interviews with 12 interviewees, who reconstructed by heart the memory of the construction of the Sobradinho dam and the relocation of the residents of the old Sento-Sé to the new Sento-Sé, based on the memories they have experienced. In this study, data and information were collected in newspapers of the time, documents from institutional sources and photographs of the flood period.

Subsequently, the interviews were transcribed with the utmost attention to choose with essential details that would recall the city and its residents with data that will be considered necessary for new generations.

After the data collection through semi-structured interviews, the information obtained was analyzed using Bardin's Content Analysis (CA) (2016), originating this article as a final product.

III. RESULTS AND DISCUSSION

3.1 THE HISTORY OF DAMS ON THE SÃO FRANCISCO RIVER

At the beginning of the 20th century, by the year 1913, the first hydroelectric plant of the Northeast – Angiquinho – was inaugurated on the side of the São Francisco river in the State of Alagoas, by the industrialist Delmiro Gouveia, which supplied a factory of lines and wires and supplied energy to the former city of Pedra (today, Delmiro Gouveia). The hydroelectric plant was deactivated in 1960 by the Companhia Hidroelétrica do São Francisco (CHESF), because of a flood (MENEZES; MARQUES, 2018).

In the early 1920s, the Ministry of Agriculture, through the Geological and Mineralogical Service, carried out studies on the use of the São Francisco River in the stretches between Juazeiro-BA and Paulo Afonso-BA. The conclusion of the study indicated feasibility for the installation of hydroelectric power plants, enabling the industrialization of the Northeast and the irrigation of riverine areas (SILVA, 2002).

On October 3, 1945, Pres. Getúlio Vargas signed Decree-Law No. 8031, authorizing the creation of CHESF by the Ministry of Agriculture. On the same date, Decree-Law No. 8032 was signed, allowing the Ministry of Finance to launch credit of 200 million cruzeiros for the subscription of company shares, and Decree-Law No. 19706, which granted the license to CHESF for 50 years (SILVA, 2002). This company made continuous use of the hydroelectric power of the São Francisco River between Juazeiro, in the State of Bahia, and Piranhas, in the State of Alagoas to supply power to public service concessionaires and thus distribute it in no small part of the Northeast.

In 1946, the Constituent Representatives decided to solve the problems of the São Francisco Valley, planning long-term agricultural projects to develop the region and regularize the waterways. It has used the water potential of the São Francisco River and thus promoting industry and irrigated agriculture in the area (CULLEN, 1964). According to Cullen (1964), the São Francisco River originates in the Canastra ridge, in the State of Minas Gerais, with an average altitude of 1,400.0 meters, running 2,200 km to the parallel of Remanso-BA. The navigable stretch extended for 1,300 km between Pirapora-MG and Juazeiro-BA, totaling 300 km within a total water basin of 640,000 km.

Menezes and Marques (2018) explain that the interest in the inhabitable places of the Franciscan regions was due to very particular characteristics: it is the only natural perennial watercourse to cut part of the semiarid areas of Northeast Brazil (70% of its sub-basins and tributaries), being characterized as the main route of attraction of the different social groups that have settled or passed by its margins.

According to Silva, Marques, Wagner, and Menezes (2018), the construction of the Sobradinho dam in the sub-medium part of São Francisco region was a process of exchange in an attempt to compensate them for the recognized losses or onus of the progress, causing a re-territorialization of several communities in its surroundings.

In addition to the Sobradinho dam, other projects such as the Itaparica Dam, which began being constructed in 1979 and completed in 1988, also emerged. The barrier has caused profound changes and reformulations in the ways of life and the cultural traditions acquired in the coexistence with the river. The economy was organized through watering and irrigated agriculture (MENEZES; MARQUES, 2018).

According to the studies of Araújo, Aguiar Netto and Salles (2016), the Xingó Hydroelectric Power Plant, managed by CHESF, began its construction in 1987 and its operation in 1994, although the full service was to occur in 1997.

Besides of the dams and hydroelectric dam' projects, the Brazilian government initiated the task of transposing the waters of the São Francisco River, which destroyed environments favorable to health and life in the semiarid region. The project caused environmental transformations, changes in socio-cultural relations, and directly affected the traditional means of life and work (GONÇALVES; SILVA; SCOTT; GURGEL; COSTA, 2018). With the transposition of the São Francisco River, the Pedra Branca and Riacho Seco dams were being planned, which will have consequences for the submedium cities of the São Francisco Valley, the municipality of Orocó and will directly affect the Trukás people in Cabrobó-PE and the Tumbalalá in the Bahian cities of Abaré and Curaçá (MENEZES; MARQUES, 2018).

Melo (2016) points out that the riverside dwellers of the cities of Santa Maria da Boa Vista, in the State of Pernambuco, and Curaçá, in the State of Bahia, are resistant to the installation of the dam of Riacho Seco, once the environmental and social costs are very high. Additionally, the displacement of riverside families, modification of the fertilization of the banks, damaging floodplain agriculture, a decline in the biodiversity of flora and fauna and drastic change in the river water regime, among others.

3.2 A HISTORY OF THE SOBRADINHO DAM

The construction of the Sobradinho dam began in September 1971 by the Companhia Hidrelétrica do Vale do São Francisco (CHESF). In February 1977, there was a partial damming of the São Francisco River, which was completed in January 1978. The construction area of the Sobradinho dam covered an area of 4,214.0 km2, with the expropriation of thousands of rural and urban properties (SILVA; MARQUES; WAGNER; MENEZES, 2018).

The news concerning the construction of the Sobradinho dam has spread and called the attention to the relocation of the riverside people living in that region. According to a report in the newspaper "A Tarde", published on October 20, 1971, the Brazilian government has chosen the area of Sobradinho because it considered that the lands in that region were arid and had a weak and underdeveloped population.

The CHESF has promised to develop the region and explore the waters of the São Francisco River. In the cities affected by the Sobradinho Dam, where "the urban" has echoed "the rural" par excellence. And, in this unusual way, one of the most genuine characteristics of the riverside dwellers stands out, that is, the particular combination between the rural and the urban, between the river and the city, a way of being, living and thinking the world, whose principles and determinations are specific, that is to say, traditional (MAGALHÃES; CUNHA, 2017).

The creation of the Sobradinho Lake cannot be summarized to a merely technical question. It is necessary to consider the socio-environmental and cultural issues and seek to understand the environment as physical nature since man appropriates natural resources to perform its social reproduction. According to the researcher of Human Ecology, Begossi (1993, p. 2), to study the "[...] relationship of man with the environment includes other factors (such as economic, social and psychological) leading human ecology to transcend the ecology of nature". After 40 years of the construction of the dam, the development project was implemented, and it should be measured the impacts of the work to identify ecologically, the subjects, men and women, who developed modes of production and had their practices modified and transformed with the relocation (AMARAL, 2012).

Table 1: Families Affected by the Sobradinho Dam

ORIGIN	FAM ILIES AFFECTED	PERCENTAGE
RURAL AREA		
Juazeiro	223	2.8
Sento-Sé	3,597	45.2
Xique-Xique	86	1
Casa Nova	2,847	
Remanso	1,983	61.3
Pilão Arcado	326	10.3
Total	3,234	

Source: Marques (2018).

The construction of the Sobradinho dam was aligned with the plan for internationalization of the Brazilian economy proposed by the military government to create infrastructure works in the context of the "Brazil, a Great Power" project and meet the policy of expansion of the electric sector in the Northeast Brazil, planned since the mid-1940s by CHESF (ESTRELA, 2004).

According to Assy (2014), the State was only present in the region of those who dominated the locality, that is to say, the mayors in the affected cities who used to extort and oppress the dwellers. The power relationship was executed daily without any mediation, ignoring both territory and people that initiated different forms of violence over the centuries.

Silva (2010) enlightens that the Brazilian dictatorial government, at the time of the construction of the dam, exercised Sobradinho centralized and unquestionable power, arriving in the region as a stranger and presenting a model of development for those communities that could make only disbelief in silence. The energy of economic capital was also involved in the process, offering great possibilities for transformation. The power was demonstrated by the portentous logistical apparatus placed in the field through the executing company, which often provided the dwellers a monologue in which the interlocutor was given a choice to accept the terms immediately or later, with evident significant losses.

IV. THE IMPACT OF DISPLACEMENT OF THE PEOPLE OF SENTO-SÉ > HISTORY OF THE SOBRADINHO DAM

The research on the human impacts of damming processes in some communities and cities along the São Francisco River valley has populations as main characters in these developmental narratives. Compensatory measures such as the release of funds, payment of compensation for land and other assets, allocation of populations in rural resettlement projects, construction of new cities, such as Remanso, Casa Nova, Sento-Sé, Pilão Arcado, Glória, Petrolândia, after the construction of the Sobradinho and Itaparica dams, were not sufficient to generate quality of life for these populations (MENEZES; MARQUES, 2018).



Fig.1: The town of Sento-Sé demolished to wait for the waters of Sobradinho Dam.

Source: Private Archive Family Sento-Sé

The relocation of riverside communities presumes other economic and socio-cultural transformations. In the affected families, it used to emerge feelings of rootlessness and de-territorialization. Close relatives that were buried in that place, the house that once belonged to their ascendants, the navel of the eldest son that was buried in their home backyard, memories submerged in the water and the construction of a new scenario in the name of progress (CLEMENT; LONGHI, 2016).

Those affected by the Sobradinho dam evoke memories of the day when the old Sento-Sé was transferred to the new municipal headquarters. In an interview recorded on April 13, 2019, Jackson Coelho, a former member of the city council, recalls that the last day of transference occurred on October 10, 1976. On that day, he witnessed the last blue Chevrolet truck leaving the city transporting the furniture of the municipal government, documents from the court of law, notary and the post office. The population has left deceased relatives, destroyed houses and their history. By then, it was over the old Sento-Sé, immersed in the waters of the Sobradinho Lake. During the outlet of the truck through the dusty roads of old Tombador, the city officers have displayed fireworks to celebrate the changing.



Fig.2: Aerial view of Old Sento Sé Source: Private Archive Family Sento-Sé

The memorable narratives, as points Halbawachs (2004), are produced from the social frameworks of relations constructed in social groups and have a relationship with what one wants to keep in his mind.

The past comes out and intertwines with immediate perceptions, displacing them and therefore occupying the space of consciousness. The nature of reminiscence is social, and for this reason, it appears by the effect of any entangled collective thoughts. If we are unable to attribute them an exclusiveness, it tends to become independent, and this way it demands support to validate a fundamental question about the collective memory, as a social fact that would be the anchorage for individuals (HALBWACHS, 2004, p. 57).

The context of that time concerning human rights displays necessarily a (re)constitution of what would be real social justice, and how it should be conceived differently from those now established as modern western-centric paradigms. In this sense, to think about the possibility of a "humanized development" firstly requires (r)establishing the narratives on this issue and not from the expansionist center (ALBANO, 2018).

According to Estrela (2004, p. 52), the interventions in the middle basin of the São Francisco River, precisely in its portion in the State of Bahia, has resulted in a profound transformation in its space as "(...) the secular rupture of the isolation of the region and the connection to the most dynamic centers of the country, with urbanization and the formation of a middle class linked to service sectors and a state bureaucracy".

The State intended to develop the region and a breach the isolation. However, the work has caused significant

changes in the dwellers' lives, most of whom lived in rural areas, depending on the rain-fed agriculture and the outflowing ones, cultivating the fertile lands bathed by the São Francisco River (ESTRELA, 2004).

José dos Santos, a former chairperson of the Union of Rural Workers in Sento-Sé at the time of the displacement, in an interview granted on April 16, 2019, recalls that on June 18, 1975, Hermógenes Campos sent a letter to the coordinator of the Sobradinho Reservoir Implementation Center (SRIC), Norman Barbosa Costa. He questioned the ownership of the land – once it was an object of purchase and sale – and the amount of compensation of the dwellers of that area.

According to CHESF's reply sent to the Union, landowners without public securitization would be compensated for their cultivation, accessions, and improvements. The possessors would also have an alternative of relocation, transference to Bom Jesus da Lapa Settlement Project or stay on the edge of the lake. Landowners with public securitization would get compensation based on the value of the "bare land" (referring to the value of the land), as well as crops and improvements.

In 1975 the bishop of the city of Juazeiro-BA, D. José Rodrigues, launched a campaign against the Sobradinho Project, encouraging the refusal to the agro-villages of Lapa (Serra do Ramalho). In radio programs, in the pulpits and various interviews, the bishop has boasted that CHESF triggered compatriots' diaspora, displacing thousands of affected families to areas in São Paulo, Rio de Janeiro and Brasília (CIRES, 1974).

The "flood" in the riverside villages of Pilão Arcado, Remanso, Casa Nova and Sento-Sé has caused the expropriation of more than a thousand dwellers to the Serra do Ramalho. Other residents have left when they have gotten the first signs that the waters would rise and that "the lake would drown the river". This relocation would only have a guiding force if the interested parties approved a schedule and conditions plan, which never happened in the process of construction of the Sobradinho dam (ESTRELA, 2004).

Professor Veraldino Nunes, in an interview granted on April 13, 2019, recalls that there was a farewell party on the day the old Sento-Sé would be abandoned, a celebration allusive to the feast of St. Joseph's Day, whose procession ran through the main streets of the city. Soon after the mass, an auction was held to raise funds for the church's charitable works and the construction of a church in the new town.



Fig.3: Issue of the newspaper "Caminhar Juntos"

Source: Acquis of Bishop D. José Rodrigues, State University of Bahia

Braga (2014) elucidates that the oral account allows us to understand the upsurge of social relations formed and re-signified after the construction of the Sobradinho dam. This construction has affected the mentality of those who experienced the trauma of being relocated. Accordingly, this paper has intended to understand, far beyond the social conflicts that involved the occupation of the territory, the memory mechanisms that reveal the requisites to preserve the place of residence of the historical subject for the reconstitution of its social trajectory. Thus, this article sought to understand, in addition to the social conflicts that involved the occupation of the territory, the memory mechanisms that reveal the necessity to preserve the place of origin of the historical subject for the reconstitution of its social trajectory.

Interviewed on April 14, 2019, the retired teacher, Marlene Cruz do Nascimento, remembered the day the old Sento-Sé moved to the new municipal headquarters. The farewell has brought tears, pain, suffering, and traumatic memories to the dwellers of the city. By then, there were people who, as soon as they arrived at the new dwelling space, died or went mad as a result of the homesickness they felt for their native land, as well as showing opposition when they received a compensation paid by CHESF, a derisory amount released to families affected by the construction of the Sobradinho dam. Since it was considered below market value, many families were unable to reestablish their real estate assets in the new city.

Pollak (1989) expounds that studying collective memories firmly constituted, such as a national memory, preliminarily implies the analysis of its function. A memory, this selective operation of events and interpretations of the past one wishes to safeguard, becomes part of a somewhat conscious attempt to delimit and emphasize feeling of belonging and social boundaries among collectivities of dissimilar sizes, such as political parties, unions, churches, villages, regions, clans, families, nations, and so forth.

The allocation of land has come to be one of the most aggravating factors that those relocated from Sento-Sé has experienced. According to the newspaper "Caminhar Juntos" (1978), the division of the land on the edge of the Sobradinho Lake has caused the questioning by many families that, even after four decades, still seek justice to compensate the loss of their properties submerged by the water of the dam.

The Sobradinho dam was one of the most significant cases in Brazil, in terms of the flooded area and the displaced population. In contrast to other cases, it was intended to demonstrate the relative nature of the effects and the mediations that constitute them. Thus, neither the technological options embedded in large projects contain in themselves the determination of events, nor the populations directly affected, given the same technological options, will tend to proceed in a similar way (SIGAUID, 1992).

V. CONCLUSIONS

The construction of the Sobradinho dam is a subject that, until now, is permeated with many controversies and countless questions. In both parts of relocated cities and riverside communities that have been flooded, causing socio-environmental impacts, damage and trauma to those affected, as has been the subject of many socioenvironmental and cultural research on the hydroelectric station and damming.

Nowadays, the riverside dwellers relocated by the construction of the Sobradinho dam query why some communities near the shores of the Sobradinho Lake have never been benefited from electric power since other distant cities are reached by the production of energy produced by the plant. Some families also claim compensation from the CHESF.

Those relocated from Sento-Sé and other communities affected by the construction of the Sobradinho dam still experience the trauma mainly caused to older people, who, because of the homesickness they felt for the place they used to live, became depressed and died. In addition to the socio-environmental impacts caused to the ecosystem by the degradation of fauna and flora, the residents felt the changes in daily life such as the reduction of fish in the São Francisco River, the routine of working with agriculture and dealing with the herds of goats, sheep and cattle, which has been harmed.

During the research through oral tradition and memory, it

has been noticed that the relocated dwellers often recognize that there were social and environmental impacts that caused sanitation problems, fish reduction, lack or poor quality of water that interfere directly in their lives. In this community, it was observed that the storytellers are agents of local knowledge, constituting as references for local identity, to explain a present and project a future.

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A multi-criteria Approach to the Problem of Managing the new Product Development Project Portfolio

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Abstract— The management problem of the New Product Development Project Process (PDNP) is recurrent in the literature, as it reflects a question that exists in R&D companies, which is to decide which product project portfolio which will minimize the necessary development costs while maximizing the return for the organization. In this context, the present study aims to use two multi-criteria approaches - TOPSIS and PROMETHEE II using the Analytic Hierarchy Process (AHP) method to establish, in a non-partial way, the weights and to determine which approach yields the best profit for NPDP, and raise the question of which approach is most appropriate for this problem. In addition, a practical example was proposed that shows the impact between the different orderings present in the work, to assist in achieving the goal. As a result, it was possible to obtain a study in which the non-compensatory approach is better for the practical example, making the present work the beginning of deeper studies on the subject.

Keywords— New Product Development Process (NPDP). Preference Ranking Organization Method Enrichment Evaluations II (PROMETHEE II). Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

I. INTRODUCTION

NPDPs in companies that value innovation are subjected to numerous stages and selective filters in order to compete for processing resources (DREI, 2018). Kaminski (2001) points out that the goal of new product development is to transform market needs into economically viable end products, encompassing a group of activities that essentially encompasses all departments of the company.

Thus, the decision to proceed with a specific project is not always easy, given the number of scenarios that these multiple products can generate (DREI, 2018). Rozenfeld et al. (2006) states that using the concept of the Development Funnel, or Innovation Funnel, brings benefits when having multiple products under development simultaneously. Fig. 1 illustrates this funnel.



Fig. 1: Development Funnel

Source: Adapted from Rozenfeld et al. (2006).

Among the three macro phases - pre-development, Development and post-development - exposed (ROZENFELD et al., 2006), the Development phase is the most important for NPDP. This is because there are disputes of resources, continuation and even cancellation of projects, so it is the phase in which much of the decision making. Noting that innovation and ability to understand market requirements are important in many industry sectors (COSTA, 2010) and that decisions made at the beginning of the development process, when there is great uncertainty, amount to 85% of final product costs (ROZENFELD et al., 2006), it is necessary to think of methods that help in decision making and project selection in the development phase.

According to Costa (2010) and Rozenfeld et al. (2006), several methodologies have been adopted in order to propose improvements in the strategic performance of new product development. In view of this, the purpose of this paper is to compare two distinct multi-criteria approaches, one compensatory and one noncompensatory, to determine which approach yields the best profit for NPDP.

The problem of determining an optimal portfolio for NDPs is recurrent in the literature, whether it is focused on the strategic approach, present in Junior et al. (2006), or even using other resolution methods, such as stochastic dynamic programming, present in Figueiredo e Loiola (2012) and Figueiredo e Loiola (2017). Moreover, the present problem has also been approached from the multicriteria point of view, present in Bortoluzzi et al. (2018), but using different constraints and methods of the present work, and the issue of different approaches with and without compensation is not raised.

Thus, the differential of this paper is to present two methods - a compensatory and a non-compensatory one with their criteria based on the work of Drei et al. (2018), raising the question about which best approach for this case. In this line, the main contribution presented will be to compare the existing abortions in the multi-criteria, raising the best return through a restriction of number of projects. As a secondary contribution, the study brings a comparison between these two multi-criteria methods through a practical example.

After summarizing and presenting the problem in Section 1, Section 2 will deal with how the problem decisions were made as well as its methodology. Section 3 will expose the application of the chosen methods, as well as a practical example to illustrate the comparison between them, together with their results and, finally, the discussions and conclusions will be presented in Section 4.

II. METHODOLOGY AND DECISIONS

In this section we will present the steps that led to the construction of this article. Since the objective was to

treat the problem with a multi-criteria approach, it was necessary to define the evaluation criteria, the weights and, finally, which methods would be used.

2.1 Criteria

The criteria used in the multi-criteria methods were taken from Drei et al. (2018). We chose to use the study cited as the basis, because it performed a detailed literature review, taking into consideration criteria that are actually used in real companies and, consequently, in the decision-making of the NPDP.

It is noteworthy that not all parameters present in the work cited were used, since it addresses the problem with an approach from the standpoint of stochastic dynamic programming, unlike the present study. Thus, the criteria that best fit the execution of the multi-criteria approach were chosen.

2.1.1 Expected Return

The return on a project is a dear feature, as it determines how much profit a company can make, given the amount of resources that have been allocated to that NPDP (LI et al., 2015; LI et al., 2016; TIAN et al., 2016).

Therefore, the expected return will be taken into account as a criterion of maximization, through a monetary measure, in the multi-criteria models, however it will not be analyzed in a timely manner, taking into account each stage of project development, but in a global way, that is, how much return is expected at the time of project launch.

2.1.2 Runtime

Another important feature is the runtime of a NPDP. Companies dealing with R&D value projects that have a shorter time to launch, as the faster a product is launched, the greater the chance to stand out and serve customers before a competitor (LI et al., 2015; LI et al., 2016; TIAN et al., 2016).

Thus, the runtime is also a minimization criterion present in the multi-criteria methods of work, being arranged by the sum of all periods, along the development funnel, necessary for the NPDP to be launched.

2.1.3 Development costs

There are different ways to interpret resource needs in new product development. The most recurrent is the allocation of nonrenewable resources in each project, i.e. the financial cost of each project that can be seen in Loch and Kavadias (2002), Stummer and Heindenberger (2003), Carazo et al. (2010), Li et al. (2015), Li et al. (2016), Tian et al. (2016) and Figueiredo e Loiola (2017).

It is notorious that companies work on a limited budget, so choosing to allocate a certain amount of resources directly affects NDPs within the innovation funnel. Therefore, to bring this feature into the model, the development cost will be taken into account as a minimization criterion, through a monetary measure, not only of one form, but of different modes of production, which have different resource needs, thus bring different improvements. Are they:

- 1. **Continue Mode:** Common mode of developing a product project that has a default feature requirement (DREI et al., 2018).
- 2. Enhance Mode: A mode that introduces more investment into a NPDP and therefore decreases its development time. It is more expensive than Continue Mode (DREI et al., 2018).
- 3. Accelerate Mode: Mode that introduces more investment in some NPDP and, consequently, decreases its development time, as well as uncertainties about that project. It is more expensive than Enhance Mode (DREI et al., 2018).

Importantly, multi-criteria methods will evaluate the cost of the modes mentioned as a whole, i.e., regardless of the return and time of project development, the objective is to evaluate the cost that a project adds in relation to its three modes and not the influence of one on the other.

2.1.4 Divisibility

Finally, the last criterion used is divisibility, which is the ability to freeze a project, that is, to stop investing financial resources on it, either for a momentary resource constraint, or even delaying launching purposely, in order to increase the return forecast (LI et al., 2015; LI et al., 2016; TIAN et al., 2016).

Therefore, the freeze criterion will also be assigned as a problem maximization criterion, interpreted by a binary variable, which assumes 1 if the project is divisible and 0 if not.

2.2 Analytic Hierarchy Process (AHP)

To generate the weights, we used AHP, which is a Multi-criteria Decision Support Method (MDSM) based

on evaluating alternatives in terms of additive preference (BELTON; STEWART, 2002).

Thus, it is not necessary to create weights from an arbitrary and even biased preference system, as AHP relies on the Absolute Measurement Method (SAATY, 1980). This means that each criterion is compared pairwise, generating numerical values for each performance level of one criterion over another (BELTON; STEWART, 2002). This scale is arranged by Saaty (1980) as follows:

- 1 Equally preferable;
- 3 Weakly preferable;
- 5 Strongly preferable;
- 7 Very strongly preferable;
- 9 Absolutely preferable.

This analysis, in turn, generates a preference matrix from one criterion to another, and then the eigenvalue λ_{max} and eigenvector of that matrix must be found. With the eigenvalue, it is necessary to test the consistency of the preference matrix by the following formula (BELTON; STEWART, 2002):

RC = CI/RI'

Where, according to Saaty (1980), RI' is a tabulated value that is associated with the amount of criteria (n), and CI is given by the formula:

$CI = (\lambda_{max} - n)/(n-1)$

If RI > 0.1, the preference matrix is inconsistent and must be redone. However, if RI \leq 0.1, the matrix is consistent, then the eigenvector associated with λ_{max} is the weight vector (w) related to the preference matrix (BELTON; STEWART, 2002), and should be standardized so that the sum of the weights is equal to 1.

Thus, the preference matrix for the project criteria was made, respecting the following priority:

Expected Return P Development Cost P Runtime P Divisibility.

2.3 Multi-criteria Methods

Multi-criteria methods are used as a collection of formal approaches that seek to explicitly consider various

criteria to help an individual, or group, explore decisions that matter (BELTON; STEWART, 2002. Following this line, two methods were chosen to show multi-criteria development in relation to the NPDP portfolio problem.

2.3.1 Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The first method used was TOPSIS, which is to determine an alternative that is as far as possible from the negative ideal solution, while as close as possible to the positive ideal solution (JUNIOR; CARPINETTI, 2015).

To do this, TOPSIS normalizes the alternative values for each criterion and then multiplies that value by its given weight. Then determine the positive and negative ideal solution (JUNIOR; CARPINETTI, 2015):

$$A^{+} = \max_{j} n_{i,j}, \quad \forall j \in Alt$$
$$A^{-} = \min_{j} n_{i,j}, \quad \forall j \in Alt$$

That done, we calculate the distance between the alternative scores and the ideal solutions (JUNIOR; CARPINETTI, 2015):

$$D_i^+ = \left[\sum_{i=1}^n (n_{i,j} - n_j^+)^2\right]^{\frac{1}{2}}.$$
$$D_i^- = \left[\sum_{i=1}^n (n_{i,j} - n_j^-)^2\right]^{\frac{1}{2}}.$$

Finally, we find the approximation coefficient, which is the overall performance of the alternative (JUNIOR; CARPINETTI, 2015):

$$CC_i^+ = \frac{D_i^-}{D_i^+ + D_i^-}.$$

To determine the ordering, the alternatives are sorted in descending order of the approximation coefficient.

2.3.2 Preference Ranking Organization Method Enrichment Evaluations II (PROMETHEE II)

The second method used was the PROMETHEE II. which works with the preference between one alternative and another. Thus, alternative comparison matrices are made for each criterion present in the model, in order to determine individual preference an (BELTON; STEWART, 2002).

Thus, arrays are created in which the alternatives receive 1 if they are preferable in the criterion under consideration and 0 if they are equally preferable or not preferable. After that, the matrices are multiplied by the stipulated weight, in order to represent the impact of that preference, as shown by Belton and Stewart (2002):

$$P(a,b) = \sum_{i=1}^{m} \frac{w_i P_i(a,b)}{n-1}.$$

Then we find the positive and negative ranking from the preferences found above, summing the value of the rows and columns, respectively (BELTON; STEWART, 2002). Therefore:

$$\phi^+(a) = \sum_{b \neq a} P(a,b).$$

 $\phi^-(a) = \sum_{b \neq a} P(b,a).$

For PROMETHEE II, there is an extra step that determines a single Φ (a) through the difference between the found values (BELTON; STEWART, 2002). Like this

$$\phi(a)\ =\ \phi^+(a)-\phi^-(a).$$

Thus, the results found are organized in descending order of order. Finally, it is noteworthy that PROMETHEE still has different ways to apply its preferences, however, in this study; all were used in the usual way.

III. APPLICATION OF METHODS AND RESULTS

3.1 Weight calculation

Runtime

Table 1 shows the comparative preference matrix between the criteria, created from the AHP method.

	Expected Return	De ve lopment cost	Divisibility	Runtime
Expected Return	1	3	7	5
Development cost	0.33	1	5	3
Divisibility	0.14	0.20	1	0.33
Runtime	0.20	0.33	3	1

Table 1 - Preference for AHP

Source: Authors.

After calculating the eigenvalues and eigenvectors of the matrix, λ_{max} assumed the value of 4,104. Thus, with

CI = 0.03 and RI'(n = 4) = 0.9, RC equals 0.0385, which is less than 0.1, so this array has consistency, so the associated eigenvector assumes the weights shown in Table 2.

Table 2 - Weights by AHP

	Weights	Normalized Weights
Expected Return	4.82	0.57
Development cost	2.23	0.26
Divisibility	0.47	0.06
Runtime	1	0.12

Source: Authors.

Finally, as the Development Cost criterion is divided into three sub-criteria that will be used in the models, a proportion of the weight obtained by AHP was distributed, in order to respect the characteristics of each execution mode. Like this:

- Weight Continue = 20% of Weight Development Cost;
- Weight Continue = **0.05**.
- Weight Enhance = 30% of Weight Development Cost;
- Weight Enhance = **0.08**.
- Weight Accelerate = 50% of Weight Development Cost;
- Weight Accelerate = **0.13**.

3.2 Example projects

To execute the MDSM and obtain the sequencing of each method, six projects were randomly generated, with the aid of Excel software, satisfying the characteristics of each work criterion. The equations exemplify the formulas used:

- Expected Return = RANDBETWEEN (60.000, 120.000);
- Continue Mode Cost = 10% of Expected Return;
- Enhance Mode Cost = 20% of Expected Return;
- Accelerate Mode Cost = 30% of Expected Return;

- Divisibility = RANDBETWEEN (0, 1);
- Runtime = RANDBETWEEN (3, 20).

Therefore, Table 3 shows the designs used in the methods, as well as their values and, finally, the weights for each criterion.

Project	Expect	Contin	Enhan	Accelera	Divisib	Runti
S	ed Return	ue Mode	ce Mode	te Mode Cost	ility	me
			Cost			
P1	\$74,44	\$7,444.	\$14,88	\$22,334.	0	4
	7.00	70	9.40	10		
P2	\$106,9	\$10,69	\$21,38	\$32,075.	0	10
	17.00	1.70	3.40	10		
P3	\$94,49	\$9,449.	\$18,89	\$28,347.	1	3
	2.00	20	8.40	60		
P4	\$85.70	\$8,570.	\$17,14	\$25,711.	0	11
	6.00	60	1.20	80		
P5	\$86,08	\$8,608.	\$17,21	\$25,826.	1	15
	7.00	70	7.40	10		
P6	\$114,9	\$11,49	\$22,99	\$34,493.	0	16
	79.00	7.90	5.80	70		
W	0.57	0.05	0.08	0.13	0.06	0.12

Table 3 – Product Projects

Source: Authors.

3.3 TOPSIS Method

To develop TOPSIS, Excel software was used to assist in the mathematics present in the step-by-step method. Thus, a priori, the Project matrix presented in subsection 3.2 was normalized, respecting the criteria of maximization and minimization, and then each option was multiplied by the weight that corresponds to its criterion (Table 4).

Table 4 – Standardized Projects

Project s	Expect ed Return	Contin ue Mode	Enhan ce Mode Cost	Accelera te Mode Cost	Divisib ility	Runti me
P1	0.07	0.05	0.07	0.11	0	0.11
P2	0.11	0.04	0.06	0.11	0	0.10
P3	0.10	0.04	0.07	0.11	0.06	0.11
P4	0.09	0.04	0.07	0.11	0	0.10
P5	0.09	0.04	0.07	0.11	0.06	0.09
P6	0.12	0.04	0.06	0.10	0	0.09

Source: Authors.

Taking these values, and following the TOPSIS method, it was possible to find the ideal positive (A^+) and negative ideal (A^-) solutions:

 A^+ = (0.12, 0.05, 0.07, 0.11, 0.06, 0.11)

 $A^{-} = (0.07, 0.04, 0.06, 0.10, 0.00, 0.09)$

Thus, to determine the rank of each alternative, one must calculate their distances from A^+ and A^- , shown in Table 5.

Projects	\mathbf{D}^+	D.
P1	0.06861526	0.026551429
P2	0.05821885	0.034839111
P3	0.02138686	0.064441224
P4	0.06460016	0.017250291
P5	0.03774901	0.057032394
P6	0.06202432	0.040755304

Source: Authors.

And finally, the approximation coefficient of each alternative is given, presented in Table 6.

Table 6 – Approximation Coefficient

Projects	CC ⁺
P1	0.27899917
P2	0.37438074
P3	0.75081742
P4	0.21075375
P5	0.60172557
P6	0.39653094

Source: Authors.

Therefore, the ordering given by the TOPSIS method, using the criteria and alternatives presented, is as follows:

P(3) > P(5) > P(6) > P(2) > P(1) > P(4).

3.4 PROMETHEE II Method

The PROMETHEE II method was developed with the aid of Visual PROMETHEE software, version 1.4.0.0. Table 7 shows the adapted input of the alternatives and criteria inserted in the software.

Table 7 – PROMETHEE	II	input	adapted
---------------------	----	-------	---------

	Expect ed Return	Contin ue Mode Cost	Enhance Mode Cost	Accele rate Mode Cost	Divisi bility	Runti me
Unit of	Moneta	Monetar	Monetary	Moneta	Yes/N	Time
Measureme	ry	у		ry	0	
nt						
PRIO RITY						

Min/Max	Max	Min	Min	Min	Max	Min
Weight	0.57	0.05	0.08	0.13	0.06	0.12
Priority	Usual	Usual	Usual	Usual	Usual	Usual
type						

STATS						
Min	\$74,44	\$7,444.	\$14,889.	\$22,33	0	3
	7.00	70	40	4.10		
Max	\$114,9	\$11,497	\$22,995.	\$34,49	1	16
	79.00	.90	80	3.70		
Average	93,771.	9,377.1	18,754.2	28,131.	0.33	9.83
	33	3	7	40		
Standard	13,666.	1,366.6	2,733.28	4,099.9	0.47	4.95
Deviation	39	4		2		
OPTIONS						
P1	\$74,44	\$7,444.	\$14,889.	\$22,33	No	4
	7.00	70	40	4.10		
P2	\$106,9	\$10,691	\$21,383.	\$32,07	No	10
	17.00	.70	40	5.10		
P3	\$94,49	\$9,449.	\$18,898.	\$28,34	Yes	3
	2.00	20	40	7.60		
P4	\$85.70	\$8,570.	\$17,141.	\$25,71	No	11
	6.00	60	20	1.80		
P5	\$86,08	\$8,608.	\$17,217.	\$25,82	Yes	15
	7.00	70	40	6.10		
P6	\$114,9	\$11,497	\$22,995.	\$34,49	No	16
	79.00	.90	80	3.70		

Source: Authors.

Visual PROMETHEE, as explained in the subsection 2.3.2, sets the preference matrices and, as noted, all the criteria used in this study are usual, so Table 8 shows the Φ^+ , Φ^- and Φ obtained in each alternative.

Table 8 – PROMETHEE II Output

Projects	Φ^+	Φ^-	Φ
P1	0.35	0.61	-0.26
P2	0.57	0.39	0.18
P3	0.61	0.38	0.23
P4	0.37	0.60	-0.23
P5	0.45	0.54	-0.09
P6	0.56	0.40	0.06

Source: Authors.

Therefore, the order given by the PROMETHEE II method, using the criteria and alternatives presented, is as follows:

P(3) > P(2) > P(6) > P(5) > P(4) > P(1)

3.5 Method Comparison: Practical Example

To further demonstrate the comparison between the ordering difference of the two methods presented, a hypothetical situation was created in which only \$ 50 % \$ of the NDPs would actually be produced. Thus, only the first three projects of each order were selected for launch, which are:

• TOPSIS Method: Launching the P(3), P(5), and P(6) projects;

• PROMETHEE II Method: Launching P(2), P(3) and P(6) projects.

In addition, it was also determined that for all projects, the Accelerate Production Mode would be used to obtain a faster return on the launched projects, as well as reducing the combinations between Modes, setting only one option. Thus, the equations show the profit generated by the TOPSIS method and for the PROMETHEE II (PII), respectively:

- Total TOPSIS Cost = \$28,347.60 + \$25,826.10 + \$34,493.70;
- Total TOPSIS Cost = \$88,667.40.
- Total TOPSIS Return = \$94,492.00 + \$86,087.00 + \$114,979.00;
- Total TOPSIS Return = \$295,558.00.
- Total TOPSIS Profit = 206,890.60.
- Total PII Cost = \$32,075.10 + \$28,347.60 + \$34,493.70;
- Total PII Cost = \$88,667.40.
- Total PII Return = \$106,917.00 + \$94,492.00 + \$114,979.00;
- Total PII Return = 295,558.00.
- Total PII Profit = 221,471.60.

Given that the profit obtained by the PROMETHEE II method is higher than that of TOPSIS by \$ 14,581.00 \$ and considering that the approximations made to the example could simulate a real situation in a multi-criteria decision making process in companies, it is valid to state that for the case , the PROMETHEE II non-compensatory method outperformed the TOPSIS compensatory method.

IV. DISCUSSIONS AND CONCLUSION

The present work aimed to study the problem of deciding a NPDP portfolio, through the multi-criteria approach, using two distinct methods, one compensatory - TOPSIS - and the other non-compensatory - PROMETHEE II - exposing the distinction in the final order, even if the alternatives and criteria used are the same for both.

Thus, it is possible to affirm that the article achieved its objective, with its main contribution, since the methods achieved different priorities, as regards the product projects under development. Thus, in addition to the multi-criteria approaches being applicable to this decision, it is noted that, for the proposed case, there is a better return obtained by the non-compensatory method.

Of course, as a practical example, the result is very simple to ensure that all NPDP problems return a more profitable profit when using non-compensatory methods, but this work is the basis for further research about the theme.

Concerning the secondary contribution of the work, which was the practical example showing the impact of the ordering distinction of each method; it also achieved its goal, since there was a distinct return for each situation, showing that choosing a method multi-criterion directly influences the NPDP portfolio problem. However, it is noticeable to note that the approximations were assumptions made theoretically, that is, without grounding in information from any real company.

Thus, for future work, it is recommended that the data, both of the projects and the approximations made with the constraints of a company, be practical, i.e., provided by some organization, in order to generate more credibility, both for comparison between the multi-criteria methods, as well as the criteria used.

Finally, the most important thing is to continue the proposal, in order to compare other compensatory and non-compensatory methods, studying them more deeply about the NPDP, to determine, not which is the best method, since each NPDP will have its characteristics, but what is the best approach to such a problem.

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Water Wave Modeling Using Complete Solution of Laplace Equation

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Abstract— Analytical solution of Laplace equation using variable separation method, consists of two velocity potentials. However, only one component has been used. This research used both velocity potential equation components. With the potential equation, water wave surface equation and the related wave constants were formulated using kinematic free surface boundary condition and surface momentum equation. The characteristic of water wave surface that was produced was observed, both in deep water and shallow water. **Keywords**— **Complete Solutionof Laplace Equation**, **Water wave surface equation**.

I. INTRODUCTION

The completion of Laplace equation using variable separation method in Dean (1991), produces two potential velocities, i.e. cosine and sine components. However, the application only exists in the cosine component in formulating various characters of water wave. This research does not discuss the use of the second component in Dean (1991), rather it studies the characteristic of water wave surface if the two velocity potential components are used simultaneously, i.e. water wave surface equation is formulated using a complete velocity potential.

The formulation begins by formulating the final form of the two velocity potential components. Then, in each velocity potential, water wave surface and wave amplitude equations were formulated. Using wave amplitude equation and surface momentum equation, equations for wave number k and wave constant G were formulated.

It is obtained that the two velocity potential components have similar wave number k, wave constant G, but with different water wave surface equations. As the final water wave surface is the superposition or the sum of the two water wave surface equations.

The characteristic of the water wave surface equation consists of maximum wave amplitude in a wave period, wave length, correlation between wave amplitude and wave height and other produced water wave surface profile was studied.

II. TOTAL VELOCITY POTENTIAL EQUATION

The form of Laplace equation solution (Dean(1991)), after periodic boundary condition was performed against time *t* is $\varphi(x, z, t) = A \cos k x (Ce^{kz} + De^{-kz}) \sin \sigma t$

$$+B\sin k x(Ce^{kz} + De^{-kz})\sin \sigma t$$
.....(1)

Where $\sigma = \frac{2\pi}{r}$ is angular frequency, whereas *T* is wave period.Constant*k* was obtained by performing lateral periodic boundary condition and wave number $k = \frac{2\pi}{L}$ was obtained where *L* is wave length. Therefore, in (1) there is only one value of wave number *k* and one value of wavelength *L*. Based on the linear characteristic of Laplace equation, then(1) can be written as,

 $\varphi(x, z, t) = \Phi_A(x, z, t) + \Phi_B(x, z, t) \quad \dots (2)$ Where,

$$\varphi_A(x, z, t) = A \cos k \, x \left(C e^{kz} + D e^{-kz} \right) \sin \sigma t \tag{3}$$

 $\varphi_B(x, z, t) = B \sin k \, x \left(C e^{kz} + D e^{-kz} \right) \sin \sigma t \tag{4}$

In (2), (3) and (4), the values of constants A, B, C and D should be determined.

Equation (3) was performed at flat bottom (Dean (1991)) $\varphi_A(x, z, t) = G_A \cosh(h + z) \cos k x \sin \sigma t$ (5) was obtained Similar procedure was performed in(4), $\varphi_B(x, z, t) = G_B \cosh(h + z) \sin k x \sin \sigma t$ (6) was obtained As has been mentioned, the two velocity potentials have similar wave number k. There should have been one wave constant, i.e. $G = G_A = G_B$, but to ensure, a proof will be done in the following chapters. In the previous researches Hutahaean (2019 a, b) formulated equations for wave number k and wave constant Gusing kinematic free surface boundary condition (KFSBC) and surface momentum equation. So is the case with this research, KFSBC equation and surface momentum equation will be used to formulate equations for wave number k and wave constant G. At the same time, this research is a improvementon the procedure of KFSBC integration against time t, in Hutahaean (2019a,b).

III. THE FORMULATION OF WAVE NUMBER kAND WAVE CONSTANT G_A USING Φ_A .

3.1. Water wave surface equation

The first step in formulating equation for wave number k and wave constant G is the formulation of water wave surface equation to obtain wave amplitude equation. The formulation was performed using KFSBC. KFSBC equation using weighted total acceleration is (Hutahaean (2019 a,b,c)),

$$\gamma \frac{\mathrm{d}\eta}{\mathrm{d}t} = w_{\eta} - u_{\eta} \frac{\mathrm{d}\eta}{\mathrm{d}x} \quad \dots\dots(7)$$

Where γ is weighting coefficient with the value of 2.87-3.14 (Hutahaean (2019 c)). $\eta = \eta(x, t)$ is water wave surface elevation against still water level (z = 0), u_{η} is water particle velocity at horizontal-*x* direction at the water surface $(z = \eta)$, whereas w_{η} is the water particle velocity at vertical *z* direction at the surface water. Using (5), equations of particles velocity at horizontal and vertical directions were obtained, i.e.

$$u(x, z, t) = -\frac{d\Phi_A}{dx}$$

= $G_A k coshk (h + z) sinkx sin\sigma t...(8)$
 $w(x, z, t) = -\frac{d\Phi_A}{dz}$
= $-G_A k sinhk (h + z) coskx sin\sigma t$
...(9)

(8) and (9) were performed at $z = \eta$ and substituted to (7),

$$\gamma \frac{\mathrm{d}\eta}{\mathrm{d}t} = -G_A \operatorname{ksinhk}(h+\eta) \operatorname{coskxsin\sigma t}$$
$$-G_A \operatorname{kcoshk}(h+\eta) \operatorname{sinkxsin\sigma t} \frac{\mathrm{d}\eta}{\mathrm{d}t} \dots (10)$$

Water wave surface equation was obtained by integrating (10) against time t. It's visible that (10) is a non-linear function against time t which is difficult to complete its integration. However, there are two arguments to make it

simple, where the two arguments produce similar conclusion.

The first argument is that the velocity potential equation was obtained using variable separation method, i.e. velocity potential Φ that is regarded to have a form of $\Phi(x, z, t) =$ X(x)Z(z)T(t), where X(x) is only a function of x, Z(z) is only a function of z and T(t) is only a function of time t. In this case $Z(z) = \cosh k (h + z)$. In relation with this, η on the right side of the equation, both $\ln \sinh k (h + \eta)$ or in $\cosh k (h + \eta) \operatorname{and} \frac{\mathrm{d}\eta}{\mathrm{d}x}$ are not the function of time t, even though $\eta = \eta(x, t)$. Hence (10) can be written as,

$$\gamma \frac{\mathrm{d}\eta}{\mathrm{d}t} = -G_A k$$

$$\left(coskxsinhk(h + \eta) + sinkxcoshk(h + \eta) \frac{\mathrm{d}\eta}{\mathrm{d}x} \right) sin\sigma t$$
.....(11)

The second argument is that for a periodical function against time *t*, the element

$$-G_{A}k\left(coskxsinhk\left(h+\eta\right)+2sinkxcoshk\left(h+\eta\right)\right)$$

 $\eta \left(\frac{a\eta}{ax}\right)$ should be a constant number against time *t*, which is strengthened with the formulation of velocity potential as a function of periodical time is just *sinot*. From the two arguments, the integration against time in (11) was completed only by integrating the *sinot* element, obtained

$$\eta(x,t) = \frac{G_A \kappa}{\gamma \sigma}$$

$$\left(coskxsinhk(h+\eta) + sinkxcoshk(h+\eta) \frac{\mathrm{d}\eta}{\mathrm{d}x} \right) cos\sigma t$$
.....(12)

At the characteristics point, where in this research the characteristic point is a point where $coskx = sinkx = cos\sigma t = sin\sigma t$, (12) can be written as

$$\eta(x,t) = \frac{G_A k}{\gamma \sigma}$$

$$\left(\sinh k \left(h + \eta\right) + \cosh k \left(h + \eta\right) \frac{d\eta}{dx} \right) \cos kx \cos \sigma t \quad \dots \dots (13)$$

The form coskx was selected because the first term of the elements in the parentheses is more dominant than the second element because of the presence of $\frac{a\eta}{dx}$ element in the second term. It is defined a wave amplitude equation,

$$A = \frac{G_A k}{\gamma \sigma} \left(\sinh k \left(h + \eta \right) + \cosh k \left(h + \eta \right) \frac{d\eta}{dx} \right) \dots \dots (14)$$

Using (14) the water wave surface equation becomes $\eta(x,t) = Acoskxcos\sigma t$

Water wave surface equation was obtained at the velocity potential component Φ_A , i.e.

$$\eta_{0A}(x,t) = Acoskxcos\sigmat \qquad \dots \dots \dots \dots (15)$$
$$\frac{\mathrm{d}\eta_{0A}}{\mathrm{d}x} = -kAsinkxcos\sigma t$$

From (14),

$$\begin{split} A_{\eta,1A} &= \frac{G_A k}{2\gamma\sigma} \sinh k \left(h + \eta_{0A}\right) \qquad \dots \dots (16) \\ A_{\eta,2A} &= \frac{G_A k}{\gamma\sigma} \sinh k \left(h + \eta_{0A}\right) \frac{\mathrm{d}\eta_{0A}}{\mathrm{d}x} \qquad \dots \dots (17) \\ \eta_A(x,t) &= \frac{G_A k}{\gamma\sigma} \left(A_{\eta,1A} \cosh x + A_{\eta,2A} \sinh x\right) \cos \sigma t \dots \dots (18) \end{split}$$

So,water wave surface equation consists of 4 (four) equations, i.e. (15), (16), (17) and (18), where wave amplitude in (15) is as input or known number.

3.2. Equation for k and G_A .

The next step is formulating equations for wave number k and wave constant G_A . The equation to calculate the two parameters can be obtained using (13) and surface momentum equation. (13) is differentiated against horizontal-x axis.

$$\frac{\mathrm{d}\eta}{\mathrm{d}x} = -\frac{G_A k^2}{\gamma\sigma}$$

$$\left(\sinh k \left(h+\eta\right) + \cosh k \left(h+\eta\right) \frac{\mathrm{d}\eta}{\mathrm{d}x}\right) \sinh x \cos \sigma t \dots \dots (19)$$

Bearing in mind that there are two variables that need to be calculated, then two equations are needed. As the second equation is surface momentum equation, where convective velocity is ignored.

$$\gamma \sigma G_A k \cosh k (h + \eta) \sinh x \cos \sigma t = \frac{g G_A k^2}{\gamma \sigma} \left(\sinh k (h + \eta) + \cosh k (h + \eta) \frac{\mathrm{d} \eta}{\mathrm{d} x} \right) \sinh x \cos \sigma t$$

The equation is divided with $G_A k coshk (h + \eta) sinkxcos\sigma t$ for sinkxcos σt which is not the same with zero and remembering that in deep watertanhk $(h + \eta) = 1$

$$\gamma^{2}\sigma^{2} = gk\left(1 - \frac{d\eta}{dx}\right)$$

Substitute $\frac{d\eta}{dx}$ with (19),
$$\gamma^{2}\sigma^{2} = gk\left(1 - \frac{G_{A}k^{2}}{\gamma\sigma}\left(\sinh k\left(h + \eta\right) + \cosh k\left(h + \eta\right)\frac{d\eta}{dx}\right)\sinh kxcos\sigma t\right)$$

Keeping in mind (14),

$$\gamma^2 \sigma^2 = gk(1 - kAsinkxcos\sigma t)$$

The left side of the equation is constant number, therefore the right side should be constant, maximum value of $sinkxcos\sigma t = 1$ is used

 $\gamma^2 \sigma^2 = gk(1 - kA) \dots (21)$

This equation is an equation to calculate wave number k in the deep water. This equation has a maximum wave amplitude value and at the same time is a critical wave steepness for a wave period, i.e. in a large wave amplitude, (1 - kA) = 0 can occur, or

$$A_{max} = \frac{L}{2\pi}$$
(22)

The calculation of (22) can be done if wavelength *L* is already known. In the case that wavelength is not known, the equation for wave amplitude maximumcan be obtained by bearing in mind that (23) is a quadratic equation for wave number k, with a real root if the determinant is greater than zero. Wave amplitude maksimum was achieved at determinant valuedequal to zero, $d = g^2 - 4gA\gamma^2\sigma^2 = 0$, so obtained

By equating A_{max} with (22) and (23), critical wavelength in a wave period was obtained, i.e.

$$L_{min} = \frac{\pi g}{2\gamma^2 \sigma^2} \dots \dots \dots (24)$$

(22), (23) and (24) only apply for just one component, in this case is Φ_A .

As has been stated that from the two velocity potentials Φ_A and Φ_B , there is only one value of wave number k, therefore it can be estimated that by using Φ_B the form of wave number equation that is similar with (21) will be obtained.

As an equation for G_A , surface momentum equation (22) and water wave surface equation (15) were used and were performed at characteristic point.

$$G_A = \frac{gA}{\gamma\sigma cosk\left(h + \frac{A}{2}\right)} \dots (25)$$

IV. THE FORMULATION OF WAVE NUMBER kAND WAVE CONSTANT G_B USING ϕ_B .

4.1. Water wave surface equation.

Particle velocity equations to horizontal and vertical directions were formulated using Φ_B , in (6).

$$u(x, z, t) = -\frac{\mathrm{d}\Phi_B}{\mathrm{d}x}$$

= $-G_B \, k \cosh (h + z) \, coskxsin\sigma t..(26)$
 $w(x, z, t) = -\frac{\mathrm{d}\Phi_B}{\mathrm{d}z}$

 $= -G_B k sinhk (h + z) sinkx sin\sigma t...(27)$ Substitute (26) and (27) that was performed at $z = \eta to$ (7),

$$\gamma \frac{\mathrm{d}\eta}{\mathrm{d}t} = -G_B k \mathrm{sinh} k (h+\eta) \mathrm{sink} x \mathrm{sin} \sigma t$$

 $+G_B k coshk (h + \eta) coskx sin \sigma t \frac{d\eta}{dx} \dots (28)$

As has been performed in previous section, the right side of equation (28) can be written as,

$$\gamma \frac{\mathrm{d}\eta}{\mathrm{d}t} =$$

 $-G_B k \left(sinhk (h + \eta) sinkx \right)$

$$-\cosh(h+\eta)\cosh(x-\frac{d\eta}{dx})\sin\sigma t$$

...(29)

Then, it was integrated against time t. n(r, t) =

$$\eta(x,t) =$$

 $\frac{G_B k}{\gamma \sigma} \Big(\sinh k \, (h+\eta) \sinh k x \Big)$

$$-\cosh k(h+\eta)\cosh x \frac{\mathrm{d}\eta}{\mathrm{d}x} \cos \sigma t$$
....(30)

At the characteristic point, (30) can be written as

$$\eta(x,t) = \frac{G_B k}{\gamma \sigma} \left(\sinh k \left(h + \eta \right) - \cosh k \left(h + \eta \right) \frac{\mathrm{d}\eta}{\mathrm{d}x} \right) \sinh x \cos \sigma t$$
.....(31)

Selected to use *sink x* because the term in the parentheses on the right side is more dominant than the second term where there is $\frac{d\eta}{dx}$. Defined a wave amplitude equation, $A = \frac{G_B k}{\gamma \sigma} \left(sinhk(h + \eta) - coshk(h + \eta) \frac{d\eta}{dx} \right) \dots (32)$ Water wave surface equation becomes

 $\eta(x,t) = Asinkxcos\sigma t$

From (32) water wave surface equation was obtain from velocity potential component Φ_B is

$$\eta_{0B}(x,t) = Asinkxcos\sigma t \qquad \dots \dots (33)$$

$$\frac{\exists \eta_{0B}}{\exists x} = kAcoskxcos\sigma t$$

$$A_{\eta,1B} = \frac{G_B k}{\gamma\sigma} sinhk (h + \eta_{0A}) \qquad \dots \dots (34)$$

$$A_{\eta,2B} = \frac{G_B k}{\gamma\sigma} sinhk (h + \eta_{0B}) \frac{\exists \eta_{0B}}{\exists x} \qquad \dots \dots (35)$$

$$\eta_B(x,t) = \frac{G_B k}{\gamma\sigma} (A_{\eta,1B}sinkx - A_{\eta,2A}coskx) cos\sigma t$$

$$\dots \dots (36)$$

Thus, water wave surface equation that was obtained with Φ_B also consists of 4 (four) equations, i.e. (33), (34), (35)

and (36), where wave amplitude in (33) is as an input or known number.

4.2. Equation for
$$k$$
 and G_B .

(31)was differentiated against horisontal-
$$x$$
 axis,

$$\frac{\mathrm{d}\eta}{\mathrm{d}x} = \frac{G_B k^2}{\gamma \sigma} \left(\sinh k \left(h + \eta \right) - \cosh k \left(h + \eta \right) \frac{\mathrm{d}\eta}{\mathrm{d}x} \right) \cosh x \cos \sigma t$$

.....(37)

Next, surface momentum equation was performed where convective velocity was ignored,

$$\gamma \frac{du_{\eta}}{dt} = -g \frac{d\eta}{dx}$$
(38)
 $\frac{du_{\eta}}{dt}$ was obtained from (26) whereas $\frac{d\eta}{dx}$ from (37) and an equation was obtained,

$$-\gamma \sigma G_{B} k \cosh k (h + \eta) \cosh k \cosh \sigma \sigma t = -g \frac{G_{B} k^{2}}{\gamma \sigma}$$
$$\left(\sinh k (h + \eta) - \cosh k (h + \eta) \frac{\mathrm{d}\eta}{\mathrm{d}x}\right) \cosh k \cosh \sigma t$$

The two terms of the equation were divided with $-G_B k \cosh (h + \eta) \cos k x \cos \sigma t$, and keeping in mind that in deep water $tanhk (h + \eta) = 1$,

$$\gamma^2 \sigma^2 = gk \left(1 - \frac{\mathrm{d}\eta}{\mathrm{d}x} \right)$$

Substitute(37)

$$\gamma^{2}\sigma^{2} = gk$$

$$\left(1 - \frac{G_{B}k^{2}}{\gamma\sigma}\left(\sinh k\left(h+\eta\right) - \cosh k\left(h+\eta\right)\frac{\mathrm{d}\eta}{\mathrm{d}x}\right)\cosh x\cos\sigma t\right)$$

Bearing in mind (32) and by taking $coskxcos\sigma t = 1$, $\gamma^2 \sigma^2 = gk(1 - kA)....(39)$

Equation for wave number k, i.e. (39) by $\operatorname{using} \Phi_B$ is the same as wave number equation formulated using Φ_A , i.e. (21), so it is proven that at potential velocity that is the superposition of two velocity potentials, each component has similar wave number.

Furthermore, the equation for wave constant G_B was obtained using surface momentum equation performed at characteristic point, obtained,

$$G_B = \frac{gA}{\gamma\sigma cosk\left(h + \frac{A}{2}\right)} \quad \dots (40)$$

Compare to (25), the two velocity potentials have similar wave constant $Gi.e.G_A = G_B = G$.

V. SUMMARY

The description in Chapter III and Chapter IV shows that both velocity potentials have similar wave number equation and wave constant, so that both have similar wave number k and wave constant G. Similarly,

1. Wave number equation from (21) and (39)

$$\gamma^2 \sigma^2 = gk - gAk^2$$

1. Wave constant *G* equation from (25) and (40),

$$G = \frac{gA}{\gamma\sigma \cosh k \left(h + \frac{A}{2}\right)}$$

2. Water wave surface equation has a slightly different form.

a. Water wave surface equation of
$$\Phi_A$$

 $\eta_{0A}(x,t) = Acoskxcos\sigma t$ (15)
 $\frac{d\eta_{0A}}{dx} = -kAsinkxcos\sigma t$
 $A_{\eta,1A} = \frac{Gk}{\gamma\sigma}sinhk(h + \eta_{0A})$ (16)
 $A_{\eta,2A} = \frac{Gk}{\gamma\sigma}sinhk(h + \eta_{0A})\frac{d\eta_{0A}}{dx}$ (17)
 $\eta_A(x,t) = \frac{Gk}{\gamma\sigma}(A_{\eta,1A}coskx + A_{\eta,2A}sinkx)cos\sigma t$ (18)
b. Water wave surface equation of Φ_B
 $\eta_{0B}(x,t) = Asinkxcos\sigma t$ (33)
 $\frac{d\eta_{0B}}{dx} = kAcoskxcos\sigma t$
 $A_{\eta,1B} = \frac{Gk}{\gamma\sigma}sinhk(h + \eta_{0B})$ (34)
 $A_{\eta,2B} = \frac{Gk}{\gamma\sigma}sinhk(h + \eta_{0B})\frac{d\eta_{0B}}{dx}$ (35)

 $\eta_B(x,t) = \frac{Gk}{\gamma\sigma} \left(A_{\eta,1B} sinkx - A_{\eta,2B} coskx \right) cos\sigma t \dots (36)$

c. Total water wave surface equation is $\eta = \eta_A + \eta_B$

VI. RESULT OF MODEL

6.1. The calculation of deep water depth Deep water depth was obtained using the criteria $tanh k_0 \left(h_0 + \frac{A_0}{2}\right) = 1$. For a wave amplitude that is much smaller than deep water depth h_0 , $k_0 h_0 \left(1 + \frac{A_0}{2h_0}\right) =$ $k_0 h_0 = constant$ applies. $tanh k_0 h_0 = 1$ can be obtained at $k_0 h_0 = \alpha_0 \pi$ where $tanh (\alpha_0 \pi) = 1$. Thus, $k_0 h_0 = \alpha_0 \pi$ and $h_0 = \frac{\pi}{k_0}$ (41)

 α_0 is a determined constant number, for example in CERC (1984) $\alpha_0 = 1$ was used, so that $\frac{h_0}{L_0} = 0.5$ was obtained. In this research, in addition to the criteria of $tanh(\alpha_0\pi) = 1$, the value α_0 was also determined based on other reviews.

Hutahaean (2019b) obtained that the larger the α_0 the larger the breaker depth and breaker height will be, so α_0 can be determined indiscriminately.

For a large wave amplitude, $tanhk\left(h + \frac{A_0}{2}\right) = 1$, where $k_0\left(h_0 + \frac{A_0}{2}\right) = \alpha \pi$, revision on α_0 was done against α_0 ,

$$\alpha_A = \frac{k_0 \left(h_0 + \frac{A_0}{2}\right)}{\pi}$$
(42)

Therefore the values of wave freuency σ and A_0 parameter were absorbed in the value of α_A . For the following calculation, $\alpha = \alpha_A$ was used. The value of α_0 cannot be used too large, e.g. 2.25, where $tanh(2.25\pi) = 1$, but it should take into consideration the characteristic of breaking that was produced, with the best value of $\alpha_0 = 1.6 - 1.9$. Hutahaean (2019b)) obtained that with $\alpha_0 = 1.65$, breaker depth that is in accordance with CERC (1984) was obtained.

	Table.1: Wave	characteristic	in several	wave	periods
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T	A _{max}	L ₀	h ₀	h ₀
(sec.)	(m)	(m)	(m)	L ₀
6	0,53	6,9	6,04	0,88
7	0,72	9,39	8,22	0,88
8	0,95	12,26	10,73	0,88
9	1,2	15,52	13,58	0,88
10	1,48	19,16	16,77	0,88
11	1,79	23,19	20,29	0,88
12	2,13	27,6	24,15	0,88
13	2,5	32,39	28,34	0,88
14	2,89	37,56	32,87	0,88
15	3,32	43,12	37,73	0,88

Table (1) shows the result of the calculation of wave characteristic for several wave periods which includes deep water wave amplitude maximum A_{max} , deep water wave length L_0 and deep water depth h_0 . The wave amplitude looks small but it will produce a large wave height, where the relation of wave height that is twice wave amplitude cannot be used. The calculation was done using the value of $\alpha_0 = 1.75$ the values of $\gamma = 2.05$, where this value was obtained with the procedure in Hutahaean (2019 c,d), whereas as wave amplitude maximum, (23) was used.

6.2. Water wave surface profile

The model was performed using wave period8 sec., wave amplitude 0.95 m, $\gamma = 2.05$ and $\alpha_0 = 1.75$. The result of the model can be seen in Fig.1.a., Fig.1.b. and Fig.1.c.

Fig.1.a. shows that $\eta_A \operatorname{and} \eta_B(\eta_A \operatorname{water} \operatorname{wave} \operatorname{profile} \operatorname{of} \Phi_A, \eta_B \operatorname{water} \operatorname{wave} \operatorname{profile} \operatorname{of} \Phi_B$) have cnoidal profile, and both have similar profile size, i.e. wave crest elevation $\eta_{max} = 1.62$ m, whereas wave trough elevation $\eta_{min} = -0.66$ m, therefore wave profile is asymmetric where η_{max} is not the same as $|\eta_{min}|$. Wave height H = 1.62 + 0.66 = 2.28 m, Wilson parameter value (1963), $\frac{\eta_{max}}{H} = 0.711$, with this parameter value the wave profile belongs to cnoidal wave profile (Table (2)).

Table.2: Wave type according to Wilson criteria (1963)

Wave Type	η_{max}
	Н
Airy waves	< 0.505
Stoke's waves	< 635
Cnoidal waves	$0.635 < \frac{\eta_{max}}{H} < 1$
Solitary waves	= 1



Fig.1.a. Wave profile η_A and η_B in the wave period of 8 sec., A = 0.95 m

The resultant wave, $\eta = \eta_A + \eta_B$, (Fig.1.b.dan Fig. 1.c.), obtained $\eta_{max} = 1.25$ m, $\eta_{min} = -1.31$ m, can be stated as symmetrical. Wave height H = 2.561 m, Wilson parameter $\frac{\eta_{max}}{H} = 0.487$, show that the wave has Airy's wave profile type. The condition is very different from the ones previously known, i.e. Airy's wave type can only be formed in a wave with a very small wave amplitude. One thing that should be noticed is that there is a concavity in in the wave crest. A wave with a sharp wave crest can hardly be seen in a wave in the deep water, it always looks flat. Wave crest in Fig. 1.b can be stated as flat, which is quite in accordance with the one in the nature.



Fig.1.b. Wave profile $\eta = \eta_A + \eta_B in a$ wave period of 8 sec., A = 0.95 m



Fig.1.c. Wave profile in a wave period of 8 sec., A = 0.95m

Furthermore, the calculation of water wave surface characteristic was performed in several wave periods with wave amplitude maximum, i.e. in equation (37), $A_{max} = \frac{g}{4\gamma^2 \sigma^2}$. The result of the calculation is presented in Table (3) and Table (4).

Table.3: Water wave surface characteristics at wave

amplitude maximum

<i>P</i>							
Т	η_{min}	η_{max}	Н	η_{max}			
(sec.)	(m)	(m)	(m)	Н			
8	-1,31	1,25	2,561	0,487			

9	-1,66	1,58	3,242	0,487
10	-2,05	1,95	4,002	0,487
11	-2,48	2,36	4,843	0,487
12	-2,95	2,81	5,763	0,487
13	-3,47	3,3	6,764	0,487
14	-4,02	3,82	7,844	0,487
15	-4,62	4,39	9,005	0,487

In the maximum wave amplitude, the Wilson parameter value $\frac{\eta_{max}}{H} = 0.487$ for all wave period shows that the wave belongs to to Airy wave, where η_{max} is quite close with $|\eta_{min}|$. Furthermore in Table (4), the value of $\frac{H}{A} = 2.71$ shows that an approach that the value of wave height *H* is twice the value of wave amplitude *A* cannot be determined or performed. Wave steepness $\frac{H}{L} = 0.209$, this condition exceeds the criteria of critical wave steepness from Michell (1893) with the value of $\frac{H}{L} = 0.142$

Table.4: The value of $\frac{H}{A}$ and wave steepness $\frac{H}{L}$ in wave amplitude maximum.

<i>P</i>							
Т	Α	L	Н	Н			
(sec.)	(m)	(m)	\overline{A}	L			
8	0,945	12,265	2,71	0,209			
9	1,196	15,522	2,71	0,209			
10	1,477	19,163	2,71	0,209			
11	1,787	23,188	2,71	0,209			
12	2,127	27,595	2,71	0,209			
13	2,496	32,386	2,71	0,209			
14	2,894	37,56	2,71	0,209			
15	3,323	43,118	2,71	0,209			

Note: wave height can be seen in Table (3)

6.5. Water wave surface profile at breaker point

To obtain water wave surface profile at breaker point, the values of *G*, *k* and *A* are needed at breaker point. To obtain the value of the three wave parameters, shoaling and breaking analysis was performed. The shoaling and breaking model used in this research looks similar to the one in Hutahaean (2019 b), the model that was not discussed here. Bearing in mind that the two wave potentials have similar equations for wave amplitude, wave constant and wave number, then the shoaling and breaking model will also be similar to the model in Hutahaean (2019 b) that was formulated using Φ_A .

Water wave surface profile

a.

As an example of water wave surface profile at breaker point, a wave with wave period T = 8 sec., wave amplitude A = 0.95 m and bottom slope $\frac{dh}{dx} = -0.005$ was used. Water wave surface profile at the breaker point is presented in Fig. 2 a. and Fig.2b.



Fig. 2a. Water wave surface profile at breaker point, η, η_A and η_B



Fig. 2b. Water wave surface profile at breaker point $\eta = \eta_A + \eta_B$.

At the breaker point, wave profile is asymmetrical, where $\eta_{max} = 1.90$ m, $\eta_{min} = -1.059$ m, where wave height H = 2.958 m, whereas Wilson parameter $\frac{\eta_{max}}{H} = 0.642$. With this parameter value, the type of the wave is cnoidal wave type. There are two phenomena that should be paid attention to, first, the occurrence of wave setup where in the deep water the wave profile is symmetrical, whereas in the shallow water the wave trough part is lifted. The next phenomenon is the separation of a wave from the two velocity potentials that were used, where there are two wave

crest. The presence of two adjacent waves also found in the coastal water. A more vivid example is tsunami wave on the coast or land, consist of two large main wave crests.

In the profile of the breaking wave, it is also visible that there is a wave trough in fornt of wave crest. This also occurs in tsunami, where prior to the coming of the peak of the tsunami, the coastal water recedes first.

b. Adjustment with breaker height index equation

The result of breaker height model was calibrated against the average value of 5 (five) breaker height indexes. The adjustment was performed by multiplying wave constant *G* with 0.336. Whereas breaker depth h_b was adjusted with breaker depth from SPM (1984), by changing the values of α_0 , where $\alpha_0 = 1.76$ resulted in a breaker height that fit with breaker depth from SPM (1984). The breaker height index equations used as comparators are breaker height index (BHI) equations from Komar and Gaughan (1972), Larson, M. and Kraus, N.C. (1989), Smith and Kraus (1990), Gourlay (1992) and Rattana Pitikonand Shibayama (2000), with the comparison result is presented in Table (5).

Table.5: Comparison of breaker height model with BHI

		H_b	H_b	h_b	h_b
Т	H_0	(m)	(m)	(m)	(m)
(sec.)	(m)	(model)	(BHI)	(model)	(SPM)
8	2,602	2,958	2,955	3,673	3,697
9	3,293	3,741	3,74	4,65	4,678
10	4,065	4,617	4,617	5,741	5,776
11	4,919	5,584	5,586	6,948	6,989
12	5,854	6,644	6,648	8,269	8,317
13	6,87	7,797	7,803	9,705	9,761
14	7,968	9,041	9,049	11,256	11,321
15	9,146	10,378	10,388	12,921	12,996



As has been stated that the adjustment of breaker height was performed by multiplying wave constant *G* at breaker pointwith a coefficient of 0.477.

VII. CONCLUSION

Both components of velocity potential equation as the solution of Laplace equation have similar wave number and wave constant, so that both can be performed as a unity to model water wave mechanics Water wave surface equation from each velocity potential component has different form, where the total of water wave surface equation is the sum of the two water wave surface equations. However, as has been stated that both have similar wave amplitude value and equation, wave number and wave constant G. Both produced similar wave profile. Therefore, both water wave surface equation are actually identical. Wave separation in the shallow water, also occurs in the nature, shows that the two velocity potentials should have been used. In addition, water wave surface resultant have different wave height with each component of water wave surface. This also strengthens that the two velocity potential components of Laplace equation should have been used all simultaneously.

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Environmental Compliance: Search for Effectiveness in the Application of Environmental Standards

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Abstract— Since the advent of the Lava Jato operation, the term compliance has acquired a hitherto unknown popularity. Although it has been related to criminal guardianship, it takes care of a perfectly possible strategic management in the most diverse branches of law. In this study, the compliance is approached within the environmental sphere, as an instrument of feasibility and effectiveness of legal norms and practices in favor of environmental protection. Much is questioned whether the practice of compliance is mandatory or to what extent would be of great value for the development and business performance. In the environmental aspect, the research demonstrates that the preventive nature of this governance technique can bring current and future benefits. In addition, there is, implicitly, the approach to the concept of sustainability within the objectives described by the United Nations. To carry on this study, a bibliographic research was developed, based on selected scientific articles, as well as Brazilian doctrine and legislation pertinent to the theme. The achieved results of the research demonstrated that applicability of compliance practice in the environmental matters can be adopted in view of its preventive nature.

Keywords—effectiveness of legal norms and practices, environmental compliance, sustainability.

I. INTRODUCTION

When addressing the compliance theme, it is necessary to bring a concept to enter its applicability. Compliance is an expression of the English language that comes from the to comply, that is, to conform. This definition draws on the need to adapt to the current legal norms and legislation¹. In the year 2019, the concern with the environment reached the most diverse spheres. This is a world issue where respect for environmental standards, principles and treaties have begun to take precedence over the debates. This demand for preservation and environmental recovery solutions has brought real challenges to governmental and private sectors, mainly on accountability. In this sense, we seek ways to achieve development without the occurrence of environmental damage: The objective is sustainable development as a way to drive both government and private sectors.

Considered compliance as part of strategic management, the technique was brought to the environmental area as a

¹ BREUS, Thiago Lima; GUIMARÃES, Fernando Vernalha; PETIAN, Angélica; MARCHESI, Bruna. Soluções Jurídicas em Compliance e Anticorrupção. Available in: https://www.vgplaw.com.br/compliance. Access: 02 july 2019.

way to make better adequacy and effectiveness of the then prevailing norms.²

It is also noteworthy that this is a multidisciplinary technique. It is imperative that the most diverse areas work together so that the program achieves a good result. Through the so-called "anticorruption Law" – Law No. 12.846/2013 – The compliance Institute is brought to the legal Brazilian planning for application in business management. It seeks to prevent corruption in public and private businesses. It is important to emphasize that corruption is a broad term that encompasses any situation capable of generating an imbalance capable of damaging both the public and private sector.³

The principled and normative application became the basis of compliance to achieve the best result. Constitutional principles – implicit and expressed – and those brought by international treaties are used at all times.

Also, regarding the implementation of the Institute of Compliance, those inherent to the public administration described in article 37, *caput*, of the Constitution of the Brazilian Republic of 1988, are fully applicable: legality, Impersonality, morality, publicity and efficiency. In addition to these, those laid down in article 225 of the constitutional text – which deals with environmental protection – are also applicable here. The principles of prevention, polluter pays, precaution and sustainable development stand out.

Based on these principles described and in the main norms related to environmental protection, this study was developed. The methodology used was the bibliography, through consultation with current Brazilian legislation, doctrine and scientific papers.

II. EFFECTIVENESS OF THE APPLICATION OF ENVIRONMENTAL STANDARDS

Since the National Environment Policy (1981), there has been not only an awakening in the environmental awareness of the Brazilian population but also a significant increase, perceptible over the years. After the promulgation of the Republic Constitution in 1988 and other legislations indispensable to environmental protection, an active participation of Brazil begins as a signatory of international treaties on the environment, in addition to hosting events of great repercussion.

The applicability of norms regarding protection and environmental preservation is seen as a priority, since it is directly related to the principle of the dignity of the human person, one of the pillars of the Brazilian constitutional order (art. 1. III of 1988 CRFB). The great concern involves the effective application of the norms and the way of exercising control in economic activities with potential polluter.

According to Attanasio *et al.*⁴, when present the results of environmental damage such as the effects of soil degradation, water pollution, among others, implicitly affect the increase of consciousness in the population about dependence on the environment. The relationship between man and natural resources is related to quality of life, which has caused, in recent decades, the revision, creation and expansion of specific legislation on the use of the environment.

For Attanasio *et al.*⁵, there was a concern of the legislator in seeking mechanisms for the State to meet the aspirations of the population, highlighting the rational, sustainable and permanent use of the environment in the most diverse sectors: rural, agricultural, trade, industry, services, Public administration and the common citizen himself.

Regarding the practice of compliance, it is important to highlight the relevance of the adoption of integrity programs⁶. In these programs, the following requirements

⁵Id. 6

² In the USA, for example, the creation of effective compliance programs has been intensified since the decade of 1990, due to the strengthening of the penal application of American environmental statutes and the consequences of violations Potentially more serious. SILECCHIA, Lucia Ann. Ounces of Prevention and Pounds of Cure: Developing Sound Policies for Environmental Compliance Programs. Fordham Environmental Law Journal, v. 7, n. 3, 1996, p. 583-590. Also mention the importance of the Clean Air Act Amendments of 1990 ("CAAA") that established criteria and rules for compliance certification. MAJUMDAR, Somendu B. Voluntary Environmental Compliance Auditing: A Primer. Fordham Environmental Law Journal, v. 7, n. 3, 1996, p. 817.

³ As we affirm in another opportunity, the expression "corruption" is a phenomenon whereby a state agent acts outside the normative standards of the system, favoring particular interests in exchange for reward. Corruption is the enemy of the Republic, since it means the private use of the public thing, when the basic characteristic of Republicanism is the search for the "common good", with the distinction between public and private spaces. NEVES, Daniel Amorim Assumpção; OLIVEIRA, Rafael Carvalho Rezende. *Manual de Improbidade administrativa*, 7. ed. São Paulo: Método, 2019, p. 3-4.

⁴ATTANASIO, C.; RODRIGUES, R.; GANDOLFI, S.; NAVE, A. Environmental adequacy of rural properties recovery of degraded areas restoration of ciliary forests. USP. Higher School of Agriculture "Luiz de Queiroz"-Department of Biological Sciences-Laboratory of Ecology and forest restoration. 2006. Available in

<http://www.esalq.usp.br/gerd/Recuperacao/ApostilaTecnicoLE RFFinal1.pdf. > Access on 20 Jul 2019.

⁶ We have already had the opportunity to affirm that the creation of a corporate compliance policy goes beyond, however, the mere compliance with legal norms, notably involving the

must be observed: control environment, risk mapping, procedure policy, communication or information and monitoring. This governance technique aims to ensure that measures implemented in the company and in the control system are not part of a new department, but, rather, be integrated into the company⁷.

The role of compliance, as corporate governance, is in its preventive nature. For Credidido, respect for ethics, integrity, administrative accountability and corporate morality are achieved through the effective application of the technique.⁸

It is important to emphasize that the regulatory laws of the corporate management programs – Law n $^{\circ}$ 12.846/2013 (Anti-Corruption law) and Law No. 13.303/2016 (state law) – have sanctioning norms and encouragement to Institution of compliance programs. The objective is to curb or discourage the practices of corruption not only in the public sector, but also in the private one. There is also an incentive for the implementation of management practices. That's why it's a corporate governance practice.

The search for effectiveness in applying standards and preventing abusive practices has caused the new legislation to impose sanctions on companies. According to the Law No. 12.846/2013,a parameter for the application of the penalties typified in that legal diploma, with the attenuation of the amount of the fine eventually applied, is the existence of internal mechanisms and procedures for integrity, auditing and encouraging the denounce of irregularities and the effective application of codes of ethics and conduct within the scope of the legal entity (article 7, PARAGRAPH VIII, of Law No. 12.846/2013 and articles 18, item V, 41 and 42 of Decree no . 8.420/2015).

Law No. 13.303/2016, in turn , required the implementation of codes of conduct and integrity within the scope of the state companies and their Subsidiaries, providers of economic activities or public services (articles 9, 12, item II, 14, item I, 18, item II, 24, item IV, 32, paragraph V, of Law no. 13.303/2016, in turn , required the implementation of codes of conduct and integrity within the scope of the state companies and their subsidiaries, providers of economic activities or public services (articles 9, 12, item II, 14, item I, 18, item II, 24, item IV, 31, 303/2016, in turn , required the implementation of codes of conduct and integrity within the scope of the state companies and their subsidiaries, providers of economic activities or public services (articles 9, 12, item II, 14, item I, 18, item II, 24, item IV, 32, paragraph V, of Law no . 13.303/2016)⁹.

It is important to demonstrate that there are three basic principles to the practice of *compliance*. First of all, the principle of morality, enshrined in article 37 of the 1988 CRFB, requires ethical, loyal and serious administrative action. It is not for another reason that article 2, paragraph one, IV, of Law no. 9.784/1999 imposes on the public administrator "Acting according to ethical standards of probity, decorum and good faith". As a consequence, the concern with the internal control of public management is natural, especially through the establishment of programs of compliance.

Secondly, the principle of publicity, also enshrined in article 37 of the CRFB of 1988, is fundamental for the *compliance* system. The said principle imposes the dissemination and externalization of acts of the public power.

Otherwise, the visibility (transparency) of the state Acts is closely related to the democratic principle (article 1 of the CRFB of 1988), enabling the exercise of social control on public acts. The obscure and secretive state action is typical of the authoritarian states. In the democratic State of law, the rule is the publicity of State acts; secrecy is the exception.¹⁰

Public transparency depends on the implementation of the fundamental right to the information provided for in art. 5, xxxiii, OF 1988 CRFB, in law n ° 12.527/2011 (Access to Information Law – LAI) and Law No. 13.709/2018 (General Law on personal data protection – LGPD).

implementation of an organizational culture that it emphasizes ethics and commitment to the norms, whether legal or the internal policies of a company, based on established standards of conduct.OLIVEIRA, Rafael Carvalho; ACOCELLA, Jéassic. The requirement of compliance and integrity programs in public hiring: the pioneering of the state of Rio de Janeiro and the Distrito Federal. *Revista Brasileira de Direito Público*, v. 17, n. 64, jan./mar., p. 9-30, 2019.

⁷ VASCONCELOS, Priscila E.A., LOPES, Ingrid F., FERNANDES, Sanny B.O. Analysis of compliance in the public administration under the aegis of the Constitutional principles (cap.). Democracy and fundamental rights. Studies in tribute to Professor Leonardo Rabelo. Rio de Janeiro: ed. Processo. 2019.

⁸ CREDIDIO, Guilherme S. Business Compliance as a tool for reducing corruption. Revista CEJ, Brasília, Ano XXII, N. 74, p. 85-90, Jan./abr. 2018. Available in < http://www.mpsp.mp.br/portal/page/portal/documentacao_e_div ulgacao/doc_biblioteca/bibli_servicos_produtos/bibli_boletim/bi bli_bol_2006/Rev-CEJ_n.74.09.pdf> Access on 25 Jul 2019.

⁹ OLIVEIRA, Rafael Carvalho Rezende. Organização administrativa, 4. ed. São Paulo: Método, 2018. p. 159 e segs.; GABARDO, Emerson; CASTELLA, Gabriel Morettini e. A nova lei anticorrupção e a importância do compliance para as empresas que se relacionam com a administração pública. Belo Horizonte: Revista de Direito Administrativo & Constitucional, ano 15, n. 60, p. 129-147, abr./jun., 2015.

¹⁰ OLIVEIRA, Rafael Carvalho Rezende. Curso de Direito Administrativo, 7. ed. São Paulo: Método, 2019. p. 41-43.

It is no difficult to understand that the advertising principle allows access to information and values spent in each public body. Transparency, therefore, is used to check for possible indications of corruption, since it allows for visibility of data and information related to the integrity of Public administration.

Finally, the principle of efficiency, inserted in the art. 37 of the CRFB of 1988, by the constitutional Amendment No. 19/1998, also plays a fundamental role in the institutionalization of *compliance* programs. The insertion of the principle of efficiency in the constitutional text aimed, in the normative field, to replace the "bureaucratic public administration" by the "Public Administration Management" (or "Results Management").¹¹

In the context of "results management", the interpretation and application of the law cannot depart from the consequences (legal and extra-legal) generated by the choices effected by the State authorities. Without leaving aside the importance of certain formalities, strictly necessary for the legitimate formation of the state will, the law starts to worry in a preponderant manner with the effectiveness of fundamental rights (final legality).

The achievement of the results, as far as possible, should be accomplished through a political-participatory process¹²: a) Planning: action plans, budget and priorities, highlighting the participation of the population through hearings and public consultations; b) Implementation: concrete measures to satisfy the previously delimited results; and c) Control: the controlling organs should not be restricted to formal legality in the analysis of the legality of administrative action, and should take into account the other principles and the achievement of the expected results.

For this reason, the institutionalization of compliance mechanisms, with the establishment of codes of ethics and internal control systems, functions as an important tool in the effectiveness of the principle of efficiency.

As highlighted by Breus *et al*¹³ the compliance Programs entail several benefits, such as: a) it is possible to recognize the agents that this is a company that seeks to

be in accordance with the predefined dictates; b) There is a valuation on the part of the government when the participation of these companies in hiring processes along to the public bodies, leaving clear that it is a company with solid and healthy business values; c) There is a profissionalization of business risk management; d) the preservation and optimization of the company's values also appear as positive factors; e) Facilitating access to financial resources of Credit institutions or even if necessary to the opening of capital; f) The management of conflicts of interest in a more effective way; and g) the permission in the constant evaluation of the company's purposes in order to better adapt them to the directions that the market comes to develop.

Furthermore, it is possible to verify that compliance rules for companies make better adequacy to existing standards, besides respecting the principles inherent in environmental management and business management.

III. ENVIRONMENTAL RESPONSIBILITY

It is essential to analyze compliance, from the perspective of compliance with environmental standards.

At this point, the history of the Brazilian legislation on environmental protection allows a better understanding of the civil, penal and administrative aspects of environmental responsibility.

The environmental awareness of Brazilian society is based on the years 80, with the publication of the National Environment Policy (Law no . 6830/1981), followed by the promulgation of the Constitution of the Republic in 1988. A greater concern about environmental preservation is initiated at this time.

Vasconcelos and Vasconcelos¹⁴ explain that, in the constitutional text, the environment acquires *a status* of diffuse law and goes on to have a chapter of its own: the Chapter VI of title VIII. This means that, by the new Brazilian constitutional order, environmental issues become a concern of the whole society and not just the public sector.

Art. 225 of the CRFB consecrates the right to the ecological balanced environment, well of common use of the people, which must be defended by the public authorities and the collectivity. All the members of the Federation (Union, States, Federal District and municipalities) must adopt the necessary measures to

¹¹ PEREIRA, Luiz Carlos Bresser. Gestão do setor público: estratégia e estrutura para um novo Estado. *Reforma do Estado e Administração Pública gerencial.* 7. Ed. Rio de Janeiro: FGV, 2008. p. 29. On the principle of efficiency, see for example: MODESTO, Paulo. Notas para um debate sobre o princípio constitucional da eficiência. Revista do Serviço Público, v. 51, n. 2, p. 105-119, abr./jun., 2000.

¹²OLIVEIRA, Rafael Carvalho Rezende. Curso de Direito Administrativo, 7. ed. São Paulo: Method, 2019. P. 45.

¹³BREUS, Thiago Lima; GUIMARÃES, Fernando Vernalha; , Angelica; MARCHESI, Bruna. Soluções jurídicas em Compliance e Anticorrupção. Available at: https://www.vgplaw.com.br/compliance. Access on 20 Jul 2019.

¹⁴VASCONCELOS, Priscila E.A. and VASCONCELOS, Paulo S. Environmental responsibility and sustainability of bioenergy plants. In: X CBPE Brazilian Congress of Energy Planning, 2016, Gramado, RS. Energy supply and demand: the role of information technology in resource integration, 2016.
protect the environment (art. 23, VI and VII, of the CRFB).

The conducts, commissive or omissive, and activities harmful to the environment subject the offenders, individuals or corporations, to civil, criminal and administrative sanctions, in the form of art. 225, § 3, of the CRFB. Similarly, art. 14, § 1, of the Law 6.938/1981, which provides on the national environment policy, establishes that the polluter is "obliged, regardless of the existence of guilt, to indemnify or repair the damage caused to the environment and to third parties, affected by its activity".

The growing concern about preserving and complying with environmental standards has been growing over the years. For Vasconcelos and Vasconcelos¹⁵, Brazil, as well as other developing countries, is influenced by the great global concern. There are many international treaties that Brazil is a signatory, including some large events, such as Rio-92 and Rio + 20, both occurring in the city of Rio de Janeiro, in 1992 and 2012, respectively.

As regards environmental accountability, it is necessary to point out that the principle of sustainable development, brought by the Brundtland report¹⁶ (1987), it is clear to demonstrate that only the concept of sustainability is attained when there is respect for economic, environmental and social orders.

The Ministry of the Environment 17 -MMA- indicates that the actions that respect the environment and policies that have as one of the main objectives the sustainability, will also have socio-environmental responsibility. All are responsible for environmental preservation: governments, companies and each citizen.

In addition to environmental accountability, it is necessary to produce and sustainable consumption on the part of society. According to MMA¹⁸, sustainable production is an incorporation that occurs throughout the entire life cycle of goods and services, aiming at the use of better alternatives to minimize environmental and social costs.

ocioambiental.html> Accessed on 20 jul 2019.

The definition brought by the United Nations Environment Program¹⁹ (PNUMA) on sustainable consumption. It is the use of goods and services that meet basic needs, providing a better quality of life. There is a direct relationship with the minimization of the use of natural resources and toxic materials, the generation of waste and the emission of pollutants throughout the life cycle of the product or service, so that it does not jeopardize the needs of future generations.

SUSTAINABILITY CERTIFICATIONS: IV. "GREEN" CERTIFICATES

It is important to emphasize the objective of corporate governance mainly in the environmental aspect. Sustainability certifications are the fruit of internal and external policies undertaken by legal entities, including the impact on negotiations with public authorities and other institutions in the market that act.

Based on the Brazilian energy sector, where there is a concern with the production of clean and renewable energies as a way to reduce environmental liabilities, it is possible to verify the existence of certifications at national and international level.

Sugar-energy mills – capable of cogenerating energy through sugarcane biomass - to be considered as selfsustainable plants, need to possess certain "green" certifications. For Vasconcelos²⁰, the UsinaVerde certificate (MCT, 2006) comes to those mills that have managed to transform an activity previously regarded as pollutant by the emission of GHG (greenhouse gases) in sustainable, mainly because it promotes the reduction in the production of residues like sugarcane bagasse.

The sustainability certifications of the sugar-alcohol or sugar-energy sector are not new. The Green Energy Seal²¹ was created in the year 2015. The Sugar Cane Industry Association (UNICA) and the Electric Energy Commercialization Chamber (CCEE) created this seal with the objective of certifying those companies that were not only producers but also consumers of clean and renewable energy. That is, it was a certification of energy self-sustainability.

The Green Energy Seal is granted on those companies that acquire and consume at least 20% of the total energy produced by the sugar-energy plants. However, there is

¹⁵Id. 5

¹⁶Bruntland report. Our common future. Available in <https://www.un.org/documents/ga/res/42/ares42-187.htm> Access on 20 Jul 2019.

¹⁷Ministry of the Environment. Responsabilidade Socioambiental. Available in <https://www.mma.gov.br/responsabilidade-

¹⁸Ministry of the Environment. Produção e consumo sustentável. Available in <https://www.mma.gov.br/responsabilidadesocioambiental/producao-e-consumo-sustentavel.html> Access on 20 Jul 2019.

¹⁹United Nations Environment Program. 1972. Disponível em < https://nacoesunidas.org/agencia/pnuma/>. Access 20 july 2019. ²⁰Valdes, Patricia; The legal-environmental responsibility of sugarcane mills and the recovery of degraded areas. Rio de Janeiro: ed. process. 2019.

²¹Sugar cane Industry Union. Only. Green energy seal. Available in < http://unica.com.br/selo-energia-verde>.Access on 20 jul 2019.

still a requirement that plants using sugarcane biomass as raw material for cogeneration must meet pre-defined sustainability criteria in addition to energy efficiency requirements²².

In addition to the UsinaVerde certificate and the Green Energy seal at the national level, there is the Better Sugarcane Initiative international certification . Called by the acronym BONSUCRO²³, it is a sustainability protocol in the sugar cane production sector.

The role of mills in the pursuit of sustainability is so relevant that it was a Brazilian mill, located in the interior of São Paulo, the first in the world to receive the BONSUCRO Certification²⁴.

Other economic sectors also have sustainability certifications. Brazil also presents a prominent position in the other countries. There are Brazilian companies among the ranking of the most sustainable 100 in the world. According to the data published in January 2019 by the Corporate Knights²⁵, there are four Brazilian companies with outstanding sustainable practices: Banco do Brasil S.A. (8th place), Natura Cosméticos S.A. (15th place), CEMIG (19th place) and ENGIE Brasil Energia S.A. (72th place).

Among the 20 companies with the most sustainable practices in the world, there are three Brazilians, as can be seen in Table 1.

For the purpose of better clarification, the Bank of Brazil is in the 4th. position and has several sustainability certificates, including an eco-efficient company²⁶.

It is important to emphasize that companies that adhere to compliance have a higher probability of achieving these certifications. This occurs by the very nature of the corporate governance technique, which seeks respect for laws and norms, in addition to the preventive and advisory character internally.

²² Id. 14.

²³BONSUCRO. Better Sugarcane Initiative. Available in <<u>http://bonsucro.com/site/certification-process/certification-</u> system/?lang=pt>. Accessed on 27 July 2019.

²⁴ eCycle. Usina de cana de açúcar brasileira é a 1º a receber certificação ambiental. Disponível em < https://www.ecycle.com.br/component/content/article/8-

tecnologia-a-favor/530-usina-de-cana-de-acucar-brasileira-e-a-

<u>10-a-receber-certificacao-ambiental.html</u>> Acesso em 27 July 2019.

²⁵Corporate Knights. 2019 Global 100 results. Available in < <u>https://www.corporateknights.com/reports/2019-global-</u>

<u>100/2019-global-100-results-15481153/</u>> Access on 27 July 2019.

²⁶ Banco do Brasil. Reconhecimento das ações em responsabilidade socioambiental. Disponível em < https://www.bb.com.br/pbb/sustentabilidade/reconhecimento-

<u>das-acoes-em-responsabilidade-socioambiental#/</u>> Acesso em 20 July 2019.

Table 1 Corporate Sustainability Ranking. Companies with sustainable practices.	Global	analysis.
Source: Corporate Knights. 2019 Global 100 results. 2019.		

	Company y	Country	Indus try	Participation
1	Chr. Hansen	Denmark	Food or other chemical agents	82.99%
	Holding A/S			
2	Kering SA	France	Clothing and Accessories	81.55%
3	Neste Corporation	Finland	Oil refinery	80.92%
4	Ørsted	Denmark	Wholesale business	80.13%
5	GlaxoSmithKline plc	UK	Biofarmaceutical	79.41%
6	Prologis, Inc.	USA	Real estate Investment Funds	79.12%
7	Umicore	Belgium	Primary Metals Products	79.05%
8	Banco do Brasil S.A.	Brazil	Banks	78.15%
9	Shinhan Financial Group Co.	South Corea	Banks	77.75%
10	Taiwan Semiconductor	Thailand	Semiconductor equipment	77.71%
11	Pearson PLC	UK	Professional Personnel Services	76.91%
12	Outotec Oyj	Finland	Machinery manufacturing	76.53%
13	McCormick & Company	USA	Beverage and food production	76.20%
14	Cisco Systems, Inc.	USA	Communications equipment	76.12%
15	Natura Cosmeticos S.A.	Brazil	Cleaning and personal Care	75.55%
16	ERG S.p.A.	Italia	Wholesaling	75.39%
17	Analog Devices, Inc.	USA	Semiconductor manufacturing	75.31%
18	Novartis AG	Switzerland	Biopharmaceuticals	75.19%
19	CEMIG	Brazil	Electric power Companies	75.18%
20	Sanofi	France	Biopharmaceuticals	75.16%

V. CONCLUSION

After addressing the facts and legal foundations covered in the research, it is possible to verify that *compliance* is not restricted to a particular area of activity. Because it is a multidisciplinary corporate governance practice, it is perfectly applicable in several areas of activity, including when it concerns environmental protection by organizations.

The beginner and normative approach demonstrated that *compliance* has a preventive nature. Effective application of codes of ethics and integrity programs within the public administration and private companies is able to avoid abusive practices and bring benefits in the medium and long term. Since all legal sustainability dictates are respected, it is possible to obtain certificates that will positively impact the market.

In addition, the implementation of compliance programs is encouraged by economic incentives, including the removal or mitigation of corporate accountability, given that environmental performance will be within the limits of the constitutional order and the laws and treaties in force.

However, it is stressed that the implementation of the compliance program in Brazilian organizations goes far beyond the sanctioning aspect, serving as an instrument for preventing environmental violations by companies.

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2014/2013/lei/l12846.htm. Access 27 July 2019.

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 < https://www.corporateknights.com/reports/2019-global-100/2019-global-100-results-15481153/> Acesso em 27 jul 2019.
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Parental Alienation: Psychological and Legal Implications

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Abstract—Analyze parental alienation and their emotional and legal implications is of fundamental importance for understanding the family dynamics and a possible appearance of complications. This study is a qualitative type of research literature review. It can be said that one of the major consequences of parental alienation is the emergence of the syndrome, as occurred compromise the child's healthy development. One of the study objectives is to assist families that pass in some way by a separation process in an attempt to prevent the installation of parental alienation; Whereas once implemented, the distance and the breakdown of the relationship between the alienated parent and child, the reconstruction of these family ties will require a long time. At work we try to clarify some key points in the process as differences between the sale and the syndrome; its stages; consequences; his guard and modalities of the Brazilian Law. **Keywords—parental alienation, mental health, legal planning.**

I. INTRODUCTION

Parental alienation is one of the most sensitive issues dealt with by family law. Even before the possible separation in court, parental alienation process may be triggered. In this article we will deal with the legal separation of couples in which it is established child custody to one parent. Both have the right and duty, provided by law, to participate in the growth and lower education through the established business system in the separation agreement or by the judge himself. This is a way to promote "continuity of coexistence between the child and the parent no guardian, or the family relationship, thus minimizing the break imposed by the dissolution of marriage" Fonseca (2006, p.163). However, too often the parent / guardian, ultimately establish "barriers" that hinder the former spouse's encounters with the child. Thus, the parent holding custody are promoting parental alienation, a situation that can contribute to the emergence of Parental Alienation Syndrome (SAP). SAP, as suggested by Fonseca (2006, p.164), "appears as the result of a combination of technical and / or process which, consciously or unconsciously, are used by the parent who intends to sell the child, which combines little child will be in with the parent not hold the guard."

A child suffering this kind of action unaware of the parent/guardian flatly refuses to maintain contact with the other parent, without necessarily a plausible reason. Over time SAP can worsen and lead to complete and irreversible removal not only of the child and with the alienated parent, as well as the family and friends of this. The transfer can be effected for a long time, causing serious consequences, both in behavior as psychological context of the child, which is usually only overcome with the son of the independence of the parent / guardian.

Alienating parent is appointed to that which seeks to reduce the presence of the other parent in the child's life. But the alienated parent is the one who suffers the action alienating the other parent. This attempt to minimize the moments of coexistence between the alienated parent and the child is not always caused by the holder of the parent child custody, since the alienating attitudes can be caused by both parties.

The parental alienation can occur for many reasons, such as an attempt to revenge the parent / guardian to with the other parent who felt aggrieved by the separation, to have developed a sense of hatred, or be a mere desire for exclusive possession that former spouse intends to have on the children. In all cases the child is the main victim and is the one who suffers most in this process, since the parental alienation, whether induced by the father or mother and yet motivated by several factors produces the same symptoms in children and affects Similarly.

Days (2013, p.78) states:

"Children become instruments of revenge, being unable to live with those who moved away from home. They are taken to reject and hate who caused pain and suffering."

Thus, the one who felt passed over the separation, which is the selling or alienating, nourishing a sense of bitterness and a desire for revenge, begins to instill in his son's head, what the doctrine calls false memories, triggering a real campaign in order to demoralize the other, which is called alienated. Buosi (2012, p.57), confirms what has already been mentioned when highlights that:

[...] nonconformity of the spouse with the separation, depression, dissatisfaction economic conditions arising by the end of the relationship, the need for exclusive possession of the children, the loneliness that you see in this or the fact that the ex- spouse maintain the relationship with the extramarital relationship partner that stemmed separation are determinants to one spouse (usually the holder of the guard) is used-the only "weapon" you have left to achieve and to take revenge on another: the children of the former spouse.

Analyze parental alienation and its consequences for those involved, it is of fundamental importance for understanding the family dynamics that lead to the emergence of Parental Alienation Syndrome.

II. METHOD

The technical procedures of the research were based on literature. According to Gil (2008), the literature is developed based on materials already developed, consisting mainly of books and scientific articles. The literature came from the references of consultation on the topic discussed, such as articles, books, magazines, periodicals, dissertations, theses and query databases.

The survey was conducted bibliographic and documentary form, undertaken in the journals of Higher Education Personnel Improvement Coordination (Capes), academics Google, government sites, NGOs, in which use terms such as parental alienation, parental alienation syndrome, family dynamics, and legal effects of parental alienation, all linked to the proposed theme.

2.1. Parental Alienation Concept

Parental alienation is treated by Law No. 12,318?? 0. The law brings the concept of what is to be "parental alienation." Therefore appropriate to transcribe below:

"Art. 2nd. It is considered an act of parental alienation interference in the psychological training of the child or promoted adolescent or induced by one of the parents, the grandparents or those who have a child or adolescent under his authority, custody or vigilance to repudiate parent or causes Subject to the establishment or maintenance of ties with this."

Regarding parental alienation, obsessive control over every detail of the day. The handler generally plays an obsessive control over every detail of his victim's life, to the point that it loses all power to make decisions, even about the most insignificant aspects of everyday life, which are dictated by those who have control.

"Parental disposal nothing more than a" brain washing "made by the guardian, so compromising the image of the other parent maliciously telling facts that have not occurred or not occurred according to the description given by alienating. Thus, the infant passes gradually to convince the version that was implemented it, generating distinct feeling that these memories fact happened. This generates feelings of contradiction and destruction of the bond between parent and child. Ends up identifying with the pathological parent, going to accept as true everything that is told to him. "Days (2011, p. 463).

Thus, the alienating, takes advantage of the fragility of the minor and his lack of judgment, to program it to move away from the alienated parent.

2.2 Difference between Parental Alienation and Parental Alienation Syndrome

The term syndrome has been heavily criticized as days (2013, p.316), so that is not provided or the International Classification of Diseases and Related Health Problems

(ICD-10), or the Diagnostic and Statistical Manual of Mental Disorders (DSM IV), because this "syndrome" means disorder, triggered reactions as a result of practice, and "sale" means the acts that trigger these reactions. According to Souza (2014, p.115) syndrome would only be set when the child was developing the symptoms of alienation that has suffered, ie the alienating doing his campaign against one of the parents, but the child does not let affect even there to speak in syndrome, only if the child develops disgust when she refuses to see the alienated parent, this happens when false memories instilled by alienating become truths for that child. Note then that syndrome is the result of a severe disposal, refers to the behavior of child during or after the entire process of selling, as Gardner (cited Souza, 2014, p.104) reports:

SAP is characterized by a set of symptoms that usually appear in the child together, especially in moderate and severe types. These include:

- Denigritory a campaign against the alienated parent;
- weak rationalizations, absurd or frivolous for depreciation;
- Lack of ambivalence;
- The phenomenon of the "independent thinker";
- Automatic support for the alienating parent in the parental conflict;
- Absence of guilt over cruelty and / or exploitation of the alienated parent;
- The presence of scenarios "ordered"; and
- Spread of the animosity to the friends and / or extended family of the alienated parent.

The children come to believe in such a way that deny vehemently be fruit of the influence of alienating. They believe that anger and disgust they feel the alienated parent are from themselves, with time the child internalizes all the feelings and can no longer distinguish reality from fantasy created by alienating when already installed the syndrome, the child no longer need the alienating manipulation to tarnish the image of the other, consciously or unconsciously, the child and alienating no longer distinguish what is more truth than a lie, and false implanted memories become reality for both. If not enough alienation by one parent.

In addition to the disposition occurs in cases of separation, whether contested or not, there is a possibility that the acts take place during marriage, but it is difficult to identify because there is a very linear difference between parental alienation and what doctrine foreign calls Family Hostile Environment, hard to find that term in Brazilian doctrines. Barros (2012, p.38) makes this distinction for better understanding:

The Family Hostile Environment (known by foreign doctrine as Hostile Aggressive Parenting) is often considered synonymous with Parental Alienation, but should not be confused. Parental alienation is linked to situations involving child custody or analogous case of divorce or separation litigation process. It is more related to psychological factor.

2.3. Sale Stages

For Gardner (1985 cited RAFAELI, 2002) Parental Alienation Syndrome (SAP), comes in three stages: Light, Medium and Bass.

Stage I Take it in the mild stage the children have strong emotional ties to both parents. Children express their desire for problems to be solved avoiding them feel confused when they hear the comments of the alienating parent, where there is the reduction of the image and importance of the other parent. Even at this stage the alienating "forgets" to inform appointments, meetings, school parties, errands and mentions that the other parent forgot to attend to commitments claiming forgetfulness, creates situations and occasions for the minor does not want to visit him Gardner (cited RAFAELI 1985, 2002).

Middle Stage II - In the moderate stage, is the moment in which some more severe conflicts usually arise when taken delivery of the child to the parent who does not maintain custody of the child, in times of visits, and there may be the assaults, generating discussions. The alienating unites its different weapons to ward off the other parent and destroy the bond of affection in the child's life. During this stage the child begins to refuse to go out with the other parent, pretend situations and nonexistent arguments, and at the time of the visit the child shows an offensive behavior after some time this presented behavior becomes milder Gardner (1985 cited RAFAELI, 2002).

Stage III Grave - At this stage children already show feelings of anger, hatred and rejection before the alienating, at the time the other charge is protected, loved and completely irrational. They are in the most advanced stage of Parental Alienation Syndrome at the time that some cases arise sources of false allegations of sexual abuse. In this third stage is considered serious and the child points behaviors screaming, aggression, moments of violence, panic attacks, especially in the moment before the visit Gardner (1985 cited RAFAELI, 2002).

2.4. Guard and its modalities of Brazilian Law

Clarissa, CM (2015.p.21) in his dissertation presented in the Master of Legal Sciences of the Autonomous University of Lisbon, presented various comments about parental alienation in the Brazilian legal system, according to the author custody underwent major changes in Brazilian law, since extremely antiquated view elencada the Civil Code of 1916, the discrete changes to the Civil Code of 2002 evolved in the reform done by Law 11,698 of 13/06/2008, yet still not fully applied to joint custody in order to meet the best interest of the children in most cases.

With the introduction of Law 11,698 / 2008, saw up the very real possibility before the legal provision for the application of joint custody, but even so, it was little used. Over the years, there was an evolutionary history of the family to the point that, in modern society, is not surprised more with the occurrence of shared custody or even unilateral custody given to the parent.

With the enactment of Law 13,058 of 22/12/2014 [1], this introduces joint custody as a rule, in the case of the current legal model in Brazil, obviously persisting situations in which a unilateral custody is the solution of if concrete, stressing that exceptionally.

In review of the Law, it appeared that aims to parental equality, based on the responsibility of parents and seeking balance of coexistence between parents and children, enriching for both parties, as well as rejecting the mentality of the right to visits with their children every two weeks, also hindering the occurrence of parental alienation, as the most direct contact between parents and children and their participation in the life of small.

The Brazilian Law walked well with the aforementioned innovation that contributes greatly to the non-occurrence of parental alienation in the face of human dignity and development of his personality, it is extremely enriching frequent coexistence between parents and children and the supervision of both parents for their children.

In the current context, it appears that women's aspirations are different, it is no longer attached to household chores, or by the need to work to support the family, and by his own ambition to participate in the labor market. However, without departing from the desire to be a mother. However, currently, given the higher rate of marital separations, parents have participation in the lives of children in couple of equality with mothers, this has detached itself from one image provider, effectively participating in the lives of children, including taking on household chores, for example, putting to changing diapers, helping with tasks and often, taking kids account in daily routines.

2.5. Parental Alienation Syndrome legislation in Brazil In Brazil, the Law 12,318 / 2010 came as a proposal to inhibit and even suppress the conduct of alienating and in the best interests of the minor, on August 26, 2010, approved the Law of Parental Alienation. "This law provides for measures such as counseling and the application of sanctions and fines, reversing guard, and even the suspension and loss of parental authority. In this space, the counseling is essential when there is psychological interference. the judge may, together or separately, without prejudice to civil or criminal liability arising and according to the seriousness of the case, take the following actions: warn the alienating; extend the family living arrangements in favor of the alienated parent; stipulated fine to alienating; determine psychological and / or bio-psychosocial care; determine the change of the guard for joint custody or its reversal; determine the precautionary attachment of the domicile of the child or adolescent; order the suspension of parental authority. The goal is to preserve the fundamental right of healthy family life, preserving the affection due in relations between children and parents within the family group.

Some actions that set the parental alienation, under Brazilian law:

- Hinder the contact of the child or adolescent with the parent;
- Perform disqualification campaign conduct of the parent in the exercise of parenthood;
- Hinder the exercise of parental authority;
- Hinder the exercise of the regulated right to family life;
- Presenting false complaint against the parent, family against this or against the grandparents, to prevent or hinder them living with the child or adolescent;
- Deliberately omitting the parent relevant personal information about the child or adolescent, including educational, medical and address changes;
- Change domicile to distant location without justification, aiming to hinder the coexistence of the child or adolescent with the other parent, with this family or grandparents.

2.6. Consequential of parental alienation

One of the major consequences of parental alienation is the emergence of the syndrome, as this will compromise the healthy development of the child, causing distress to all parties involved.

Installed alienation and brought the gap and break the relationship between the alienated parent and child, the reconstruction of these family ties will require a long time, according to Fonseca (2006, p.164)

The syndrome, once installed in smaller, this entails that, as an adult, suffers from a serious guilt complex for having been an accomplice of a great injustice against the alienated parent. On the other hand, the alienating parent is replaced paper one and only model for the child in the future will tend to repeat the same behavior.

The best way to identify when there is parental alienation is watching the conduct of the alienating parent. Denigrate the image of the other parent, omit important facts of the child's life, make important decisions related to the child's life without consulting each other, are examples of alienating behaviors that aim to hinder the coexistence between the parent combines the children, in a mill self-defense, they deny the conflict and come to believe that anger and rejection they feel the alienated parent is not fruit of the influence of alienating, but from themselves.

According to Marco Pinho:

Fact is that eventually the child will internalize everything and lose the admiration and respect for his father, developing fear and even anger the parent. More: Over time, the child can not distinguish reality and fantasy and manipulation and eventually believing everything and, consciously or unconsciously, will collaborate for this purpose, highly destructive situation for her, and perhaps in this particular case of rejection, yet highest to father. In other cases, not even the mother distinguishes more truth from falsehood and your truth becomes 'reality' for his son, who lives with fanciful characters in a treacherous existence, implanting thus false memories, hence the nomenclature Theory of alternative implantation of false memories. **Pine** (2009, p. 3).

Some other common effects that may be caused in children may vary according to age, your personality and the kind of relationship she had with her parents. There is also the possibility of the spread of the animosity to the friends and / or extended family of the alienated parent and the child.

III. FINAL CONSIDERATIONS

Throughout study on the proposed topic, we conclude that the work of a multidisciplinary team during a custody dispute, sum up the presence of a professional psychology that can make a good research on the routine of the child that is in question and examine whether it is being influenced by any of its parents. If the SAP phenomenon is identified, the judge may intervene in the decision in order to warn the alienating; extend the family living arrangements in favor of the alienated parent; stipulated fine to alienating; determine psychological and / or biopsychosocial care; determine the change of the guard for joint custody or its reversal; determine the precautionary attachment of the child or adolescent's home and declare the suspension of parental authority. The transfer can be effected for a long time, causing serious consequences, both in behavior as psychological context of the child, which is usually only surpassed with the independence of the child toward the parent / guardian.

Therefore, it is quite evident mainly in Brazil, from the Law 12,318 / 2010 that there is a large portion of the judiciary responsibility, therefore it should be faster. This study has led us to different conclusions as: the time comes that (s) son (s) perceives abuse, and take change and in other cases, perceive and cannot change. It is also clear in the survey that the financial conditions of alienating is one of the strongest conditions for effective disposal and can last for a long time, even until adulthood. Another fact that we can see is that to realize the isolation caused by the seller for several years, alienated because of their suffering, you can start to walk away and avoid their children, because you are feeling neglected and above all wronged. Sometimes the children are led to believe that the consummation of the separation of their parents, it is also a denial of love of parents for them. They are led to believe that the alienated parent does not suffer from this situation. Also we noticed that by the spread of the animosity to the friends of the alienated parent may be extended to close family members.

In short, this perverse process both the seller, the alienated and son are affected in some way. Away from the alienated parent of conviviality and proximity of (the) son (as) is a typical of alienating cruelty action that cold and determined manner, tries his unbridled hatred tarnish the image of the former spouse, forgetting that will also be affected by this rancor caught, reaching only a "Pyrrhic victory". expression used to refer to a the high price achieved victory, potentially carrier of irreparable damage.

Time is an "accomplice" of parental alienation, the longer the process takes, farthest from the alienated parent the child will be. The law of parental alienation in its article 5, said that the deadline for investigation and submission of reports is 90 days, is that this period is hardly practiced and when it happens, it is usually practiced extemporaneously, as it gives a procedural stage very later, in the statement, when especially in cases of false accusation and abuse, depending on the child's age, the realization of expertise should occur early in the process, under penalty of losing the object to be perished because it is known that the child's memory It requires that the check is made as close as possible to the facts, Freitas (2015 p.33-34). They also verified cases of extreme situation in which the psychological pressure is such that the parent-victim ends up succumbing. Do not just exercise the role of father and mother anyway, this work should be based on love, affection, attention, education and love. Only with these criteria will be possible to elucidate the individual integrity. The concepts, prejudices and emotional individual training are made from the interpretation of each on the environment you live in, based on the family environment and education you receive. In an environment marked by hatred and rancor is not capable to infer the necessary requirements for a healthy individual's psychic structure.

The children especially are the biggest losers, and that these are the result, that relationship that one day conceived them, and no doubt that those who alienates the children certainly do not know the true meaning of the word resilience, dignity and love.

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Analysis of Machining Parameters on CNC Milling of Aluminium 2219

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Abstract—This paper mainly focuses on the impact of input parameters like feed, spindle speed, axial depth of cut, and radial depth of cut on the output characteristics of CNC milling process of aluminium 2219. Material removal rate, surface roughness, and flatness are taken as the performance measures. The optimum process parameters and corresponding output responses are found out using Taguchi analysis. The multi-objective optimization based on grey relational analysis is used to attain maximum material removal rate simultaneously with minimum flatness and surface roughness. ANN models were developed using back propagation algorithms to predict the performance characteristics.

Keywords — Aluminium 2219, milling, optimization, grey relational grade, ANN.

I. INTRODUCTION

Milling is one of most commonly used processes for machining parts to get precise tolerances. With the increasing demand for quality product as well as for higher productivity, milling process need to be performed more efficiently.

Kuram and Ozcelik (2013) studied the effect of spindle speed, feed per tooth and depth of cut on tool wear, force components and surface roughness during micro milling of aluminium. They utilized Taguchi signal to noise ratio to minimize all responses and responses were optimized simultaneously using grey relational analysis. Sukumar et. al (2014) identified the optimal combination of influential factors in the milling process on AL6061 using Taguchi analysis. The input parameters selected were speed, feed and depth of cut and the output response was surface roughness (Ra). An artificial neural network model has been developed and trained with full factorial design. Shetha and George (2016) investigated the effect of machining parameters spindle speed, feed and depth of cut during face milling of wrought cast steed grade B. The response parameters selected were surface roughness and flatness. Pleta et. al (2016) utilized Taguchi method to understand the influence of speed, feed, depth of cut and nutational rate. on cutting force and tool flank wear on milling process of INCONEL 718. It was found that the nutational rate and rotational rate have the largest interactions with both cutting forces and tool flank wear. Mohamed et. al (2016) investigated the use of the Taguchi design methodology for parametric study of CNC milling on EN19, EN24 with speed, feed, and depth

of cut as input parameters and surface roughness, material removal rate, machining time as the output responses. Ribeiro et. al (2017) studied the surface quality in a CNC end milling operation of a hardened steel block with feed per tooth, cutting speed and radial depth of cut as input parameters. The optimal cutting combination was found out with best surface roughness value using Taguchi analysis.

It is found that limited works were done in optimization of milling parameters in aluminium alloy. Aluminium 2219 is a copper based alloy which finds use in many industrial applications. Hence this paper aims to investigate the effect of various process parameters such as speed, feed, axial depth of cut and radial depth of cut of milling process on aluminium 2219 with material removal rate (MRR), surface roughness (SR), and flatness as output responses. It also aims to develop an artificial neural network model for performance prediction of milling process on aluminium 2219.

II. DESIGN OF EXPERIMENTS

Process parameters and the levels for each parameters are listed in the Table 1

Table 1: Machining Parameters and Levels

Paramatara		Levels	
Farameters	1	2	3
Feed (mm/min)	500	1000	1500

Spindle speed (rpm)	1000	1500	2000
Axial depth of cut (mm)	0.3	0.6	0.9
Radial depth of cut (mm)	5	7.5	15

The designed combinations of input parameters based on L9 orthogonal array are shown in Table 2.

Table 2: Combination of Input Parameters

Sl. No.	Feed (mm/min)	Speed (rpm)	Axial depth of cut (mm)	Radial depth of cut (mm)
1	500	1000	0.3	5
2	500	1500	0.6	7.5
3	500	2000	0.9	15
4	1000	1000	0.6	15
5	1000	1500	0.9	5
6	1000	2000	0.3	7.5
7	1500	1000	0.9	7.5
8	1500	1500	0.3	15
9	1500	2000	0.6	5

III. RESULTS AND ANALYSIS

Experiments are conducted based on the input parameter combination by L9 orthogonal array. Each experiment is repeated 3 times for getting accurate results. Total 27 experiments are done and the experiment results are shown in Table 3.

SI No	MRR	SR	Flatness
SI. 1NO.	(gm/min)	(µm)	(mm)
1	1.62	0.42	0.024
2	1.68	0.44	0.027
3	1.63	0.46	0.025
4	4.12	0.38	0.026
5	4.14	0.36	0.024
6	4.19	0.32	0.022
7	13.8	0.22	0.018
8	13.79	0.24	0.024
9	13.75	0.26	0.020
10	13.52	0.48	0.020
11	13.63	0.42	0.022
12	13.7	0.44	0.024
13	4.86	0.18	0.017
14	4.8	0.18	0.020
15	4.78	0.2	0.022
16	2.46	0.2	0.016

Table 3: Experimental Results

17	2.56	0.19	0.018
18	2.52	0.18	0.015
19	14.4	2.28	0.040
20	14.65	2.1	0.038
21	14.45	2.08	0.034
22	13.2	0.32	0.022
23	13.29	0.32	0.023
24	13.45	0.36	0.019
25	5.26	0.22	0.018
26	5.196	0.2	0.019
27	5.1	0.24	0.016

The optimum combinations of process parameters are obtained from the S/N ratios. The calculated S/N ratios for different output responses are given in Table 4.

Table 4: S/N Ratios for MRR, SR and Flatness

Sl. No.	S/N Ratio MRR	S/N Ratio SR	S/N Ratio Flatness
1	4.3112	7.1250	31.9156
2	12.3603	9.0147	32.3757
3	22.7850	12.3757	33.6318
4	22.6810	6.9868	33.1277
5	13.6483	14.5676	34.0782
6	8.0015	14.4169	35.7133
7	23.2266	-6.6698	28.5387
8	22.4850	9.5285	33.3913
9	14.2934	13.1277	35.0353

Since material removal rate is desired to be at maximum, larger the better characteristic is used, meanwhile for getting lower surface roughness & flatness, lower the better characteristic is used for calculating S/N ratio.

The mean values of S/N ratio of MRR (larger the better) are shown in Table 5.

			Axial	Radial
Level	Feed	Speed	depth of	depth of
			cut	cut
1	13.15	16.74	11.60	10.75
2	14.78	16.16	16.44	14.53
3	20.00	15.03	19.89	22.65
Delta	6.85	1.71	8.29	11.90
Rank	3	4	2	1



Fig. 1: Mean Effects Plot of S/N Ratios for MRR

The delta value is the variation of mean S/N ratio from first level to the third level, and thus shows how on each parameter affect the particular response. It can be seen that radial depth of cut has the highest delta value and hence it has the highest influence on MRR. From the main effects plot of MRR (Fig. 1) it is clear that the optimum process parameters are found to be speed 1000 rpm, feed 1500 mm/min, axial depth of cut 0.9mm and radial depth of cut 15mm.

The regression equation for MRR is found as follows; MRR=-6.04+ 0.004475 feed-0.002760 speed

			Axial	Radial	
Level	Feed	Speed	depth of	depth of	
			cut	cut	
1	9.505	2.481	10.357	11.607	
2	11.990	11.037	9.710	5.587	
3	5.329	13.307	6.758	9.630	
Delta	6.662	10.826	3.599	6.019	
Rank	2	1	4	3	

- 8.680 axial depth of cut +0.9458 radial depth of cut.	(1)
Table 6: Mean S/N Ratios for SR	



Fig. 2: Mean Effects Plot of S/N Ratios for SR

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The mean S/N ratio values for surface roughness are shown in Table 6 (smaller the better for SR). Here spindle speed has the highest delta value and hence influence the surface roughness the most. From the main effects plot of SR (Fig. 2), the optimum process parameters are found to be speed 2000 rpm, feed 1000 mm/min, axial depth of cut 0.3 mm and radial depth of cut 5 mm.

The regression equation for SR is found as follows; SR=0.722+ 0.000558 feed-0.000797 speed

+0.898 axial depth of cut-0.0128 radial depth of cut (2) *Table 7: Mean S/N Ratios for Flatness*

			4 * 1	D 1' 1
			Axial	Radial
Level	Feed	Speed	depth of	depth of
			cut	cut
1	32.64	31.19	33.67	33.68
2	34.31	33.28	33.51	32.21
3	32.32	34.79	32.08	33.38
Delta	1.98	3.60	1.59	1.47
Rank	2	1	3	4



Fig. 3: Mean Effects Plot of S/N Ratios for Flatness

The mean S/N ratio values for flatness are shown in Table 7 (smaller the better for flatness). Here spindle speed has the highest delta value and hence influence the flatness the mostly. From the main effects plot of flatness (Fig. 3) the optimum process parameters for flatness are found to be, speed 2000 rpm, feed 1000(mm/min), axial depth of cut 0.3 mm and radial depth of cut 5 mm.

The regression equation for flatness is found as follows; Flatness=0.03168+0.000002 feed-0.000010 speed

+0.00815 axial depth of cut-0.000106 radial depth of cut (3)

The optimum output responses are found using the regression analysis and the results obtained are MRR 19 g/min, surface roughness 0.1018 μ m and flatness 0.01559 mm. The confirmation experiments are also done with the optimum combinations for material removal rate, surface

roughness and flatness. The results obtained are MRR 17.9 g/min, surface roughness 0.128 μm and flatness 0.01758 mm.

IV. GREY RELATIONAL ANALYSIS

The optimization of parameters considering multiple performance characteristics of the milling process is done using gray relational analysis. The gray relational grades (GRG) are calculated by the normalized experimental results of the performance characteristics and the results are given in Table 8.

Exp. No.	Grey Relational Grade	Rank
1	0.576	22
2	0.549	26
3	0.560	25
4	0.585	21
5	0.606	20
6	0.636	19
7	0.885	1
8	0.804	4
9	0.841	2
10	0.781	6
11	0.773	8
12	0.752	12
13	0.754	11
14	0.704	17
15	0.673	18
16	0.752	13
17	0.716	15
18	0.783	5
19	0.543	27
20	0.569	24
21	0.574	23
22	0.780	7
23	0.773	9
24	0.819	3
25	0.726	14
26	0.716	16
27	0.759	10

Table 8: Grey Relational Grades

The mean S/N ratio values for GRG are shown in Table 9 (larger the better for GRG). It can be seen that radial depth of cut has the highest delta value and hence radial depth of cut has the highest influence on gray relational grade. It is clear that the optimum process parameters for getting the optimum cutting condition are feed 1000 mm/min, speed 2000 rpm, axial depth of cut 0.6 mm and radial depth of cut 15mm.

Table 9: .	Mean	S/N	ratios for	GRG
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Level	Feed	Speed	Axial depth of	Radial depth of
Lever	Teeu	speed	cut	cut
1	-3.613	-4.106	-3.192	-3.571
2	-2.600	-3.123	-3.103	-3.949
3	-3.253	-2.237	-3.171	-1.946
Delta	1.013	1.869	0.089	2.004
Rank	3	2	4	1



Fig. 4: Mean Effects Plot of S/N Ratio for GRG Regression equation of GRG is as follows; GRG=0.3188+0.000024 feed+0.000145 speed +0.0072 axial depth of cut+0.01512 radial depth of cut GRG obtained from the regression equation is 0.8639. An experiment is also done with optimum combinations of cutting parameters and the GRG obtained is 0.867.

V. ARTIFICIAL NEURAL NETWORK MODEL

An ANN model is designed using Matlab Neural Network Toolbox to predict MRR, SR and flatness. The parameters used for the ANN model are structure 4-20-3 (4 neurons in input layer, 20 neurons in hidden layer and 3 neuron in output layer), feed forward back propagation algorithm in MATLAB, 80:20 training & validation to testing ratio, Tanslm is the transfer function for hidden layer and the mean square error (MSE) is the performance function.



Fig. 5: Training Output vs. Target



Fig. 6: Validation Output vs. Target

The training output vs target and validation output vs target are shown in Fig. 5 and Fig. 6. It is noted that MSE of predicted training data is 0.000946 and correlation coefficient is 0.99997, MSE of predicted validation data is 0.004591 and correlation coefficient is 0.9999. It shows that the model performance is high and output target correlation is perfect.

Exp	MRR		SR		Flatness	
No.	Exp.	ANN	Exp.	ANN	Exp.	ANN
110.	data	data	data	data	data	data
2	1.68	1.626	0.44	0.459	0.027	0.025
7	13.8	13.74	0.22	0.260	0.018	0.020
13	4.86	4.799	0.18	0.18	0.017	0.020
15	4.78	4.799	0.20	0.18	0.022	0.020
21	14.45	14.60	2.08	2.100	0.034	0.038

Table 10 Comparison of Experimental Data and ANN	
Predicted Test Data	



Fig. 7: Test Output vs. Target

Table 10 shows the comparison of experimental data and ANN predicted data. The test output vs target is shown in Fig. 7. It is noted that MSE of predicted training data is 0.01336 and correlation coefficient is 0.99998. So the testing results validates that ANN as a prediction model has statistically satisfactory goodness of fit from the modeling point of view.

VI. CONCLUSION

The conclusions made based on the experimental investigations of milling parameters on CNC milling of Aluminium 2219 are as follows;

- Experiments were conducted on aluminium 2219 successfully. The optimum combination of process parameters for material removal rate, surface roughness and flatness were found. It was concluded that surface roughness is most affected by spindle speed, material removal rate is most affected by radial depth of cut and flatness is also most affected by spindle speed. The optimum output responses were found using regression analysis and confirmation experiment.
- Grey relational analysis is done for the multiobjective optimization of process parameters in the milling process of aluminium 2219.
- An artificial neural network model is used for the prediction and optimization of machining parameters. The predicted results are found to be close to the experimental values. The developed model has good accuracy in predicting the output parameters under consideration.

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Abuse of Psychoactive Substances by Women and Treatment Difficulties

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Abstract— Harmful drug use by women is a growing problem. The objective of this study was to identify and discuss the relationship between gender inequality and the factors that lead women to abuse psychoactive substances, as well as the difficulties encountered in the performing treatment. This is a qualitative study, in which a semi-structured interview was conducted with seven women undergoing treatment at the Psychosocial Care Center for Alcohol and Drugs - CAPS ad in Manaus, Brazil. The results indicated some issues related to gender inequality as influencing the maintenance of drug abuse by women, discussed in five categories: 1st Notions about gender inequality; 2nd use of drug abuse; 3rd lived social vulnerabilities, 4th Difficulties in treatment; 5th Perception of public policy for women with drug problems. Thus, it is concluded the importance of discussions and new research with a feminist context to address this problem, in order to think about better forms of prevention and treatment aimed at women and their particularities.

Keywords—Gender Inequality; Drugs, Treatment.

I. INTRODUCTION

Although female visibility in the context of psychoactive substance (PS) use has increased in recent decades, research and care are predominantly focused on the male public. As stated by Menezes Alves and dos Santos Rosa (2016), the meanings related to "being a woman" vary according to the socio-cultural and historical context, and these are neglected when it comes to investigating drug interventions or policies. It is noteworthy that the current Brazilian drug law, no. 11,343 / 2006, makes no distinction focusing on the perspective of gender and human rights, working without considering the reality of women regarding the historical, socioeconomic and cultural aspects.

In order to contextualize aspects about gender differences, it is important to mention that, according to Zanello e Silva (2012), the concept "gender" was introduced in the science debates through feminist movements, as a category of description and analysis of interactions. as opposed to biological determinism and the duality of the sexes. Scott (1991) explains that American feminists used the term "gender" to emphasize the fundamentally social character of gender distinctions, indicating a rejection of biological determinism implicit in the use of the terms "sex" or "sexual difference." According to Diniz (2017), gender refers to the construction of roles, social places and attributions for each sex, whether in marriage, family, insertion and / or social structuring. The development of the term brings the idea of a social concept, which can be used to understand social relations from the perspective of power relations established between men and women, according to the cultural elaborations of the assumptions about what it is to be each one of them. sexes. Gordon (2002) refers to a possible gender equality in drug use as a trend, which is justified by changes in women's lifestyles, which today are more active in the labor market and independent, having as consequence higher charges.

According to the United Nations Office on Drugs and Crime (UNODC) World Drug Report (2018), men are the majority in substance use, but women have specific patterns of use. According to the report, women use nonmedicated and tranquilizing opioids at a level comparable to or higher than men. It has been observed that the trend towards increased rates of alcohol, cocaine, cannabis and opioid use for women is faster than for men, as is the development of disorders as a consequence of the use of drugs.

Bastos and Bertoni (2014) state that women who use drugs can have a life history that is crossed by gender inequality more intensely and cruelly, becoming even more adverse when there is abuse as well as drug dependence. Nascimento and Paiva (2007) show that in some peripheral communities in Brazil, crack use has been surpassed by women, especially by sex workers. This picture facilitates the low value of the drug, as well as the acceptance of sexual relations or favors as a bargaining chip. According to Menezes Alves and dos Santos Rosa (2016), because of physiological issues, where female metabolism is less tolerant to the effects of psychoactive substances, female users are more vulnerable to personal injury and harm, in addition to sociocultural issues about femininity, which generally influence male-oriented decision-making power in heterosexual relationships with regard to condom use, for example, in cases where men do not want to use protection, leading to a higher risk of HIV infection.

According to the research by Andrade et al (2016), health services are predominantly sought by women, however, for the treatment of drug addiction or other problems related to drug use, women are still among the smallest. According to the authors, throughout the historical process, the female gender was characterized by pre-established behavioral patterns that linked the figure of women to maternal activities, resulting in the lack of care for themselves, since there is the idea of the obligation of taking care of the other.

In the research conducted in the State of Ceará (Brazil), by Lima et al (2011), the authors identified that the predominance in the search for treatment for drug dependence at the Psychosocial Care Center for Alcohol and Drugs - CAPS ad is male and that women, although also seek, remained in treatment for less time. Thus, this situation contributes to the vulnerability in the social, occupational, family, physical and legal fields, which are possible spaces of violence. Andrade et al. (2016) explains that women who use drugs are doubly stigmatized, both because, in a way, they escape the conventional role of women, and because they use drugs. According to Lima et al. (2011), some factors that interfere with accessibility to health services and quality care for women are related to the environment being predominantly male. In addition, prejudice and

discrimination are present, as well as the fact that there is a space that often does not guarantee the necessary reception, making it difficult for women to express themselves.

This study aims to contribute to research related to gender issues in the context of psychoactive substance use by women and also raise questions and concerns regarding the forms of care and attention to the female category and its particularities in mental health. Its main objective is to reach an understanding of the relationship between socially constructed gender differences and the reasons or circumstances that lead many women to practice drug abuse, in addition to the difficulties these women encounter in dealing with this problem in the city of Manaus, in the state of Amazonas, with patients undergoing treatment at the Psychosocial Care Center for Alcohol and Drugs - CAPS ad.

II. METHOD

This work followed all the ethical criteria proposed in Brazilian Resolutions Ethics 466/2012 and 510/2016, and can be consulted through the code approved by the Research Ethics Committee, number 006140/2019 (CAAE 06522919.6.0000.5016).

This is a qualitative, exploratory study, defended by Markoni and Lakatos (2008). From the Consent Form for submission to the research ethics committee, provided by the Municipal Health Secretariat - SEMSA, the contact with the direction of the Dr. Afrânio Soares Psychosocial Care Center III, Alcohol and Drugs (CAPS ad), was made. It is a 24-hour institution with the purpose of offering specialized services to users of alcohol and other drugs.

Survey participants were women who were being treated at CAPS ad. The proposal suggested by the CAPS ad team was to take advantage of the presence of patients on the days and times that were scheduled clinical appointments. The team provided a list of 10 patients undergoing treatment, containing dates and times of consultations to be held. There was no previous contact with them, so the invitation to participate in the research was made shortly before each consultation, so that after the consultations the patients could answer the interview.

It was possible to contact only 7 women and all agreed to participate in the survey. As an inclusion criterion, women who were already undergoing treatment at CAPS ad participated in the study, and those who would be attending appointments for the first time were excluded. A semi-structured interview was conducted, which had a script of questions, built on the research of Maragoni and Oliveira (2013).

The interview was recorded and duly discarded after transcription, with sociodemographic questions and eleven questions that addressed topics such as: perception of gender inequality, drug use and abuse, social vulnerabilities and treatment. Data were collected between March and April 2019, most of the time in the rooms that were available at CAPS ad, allowing a placeholder and individualized dialogue with each participant. After explaining the purpose of the research and signing the Informed Consent, lasting 10 to 15 minutes. The collected data were analyzed in the light of the content analysis foundation of Bardin (2011).

III. RESULTS AND DISCUSSION

Regarding the characterization of the participants, the age range ranged from 23 to 43 years. Out of the seven interviewed, six are single, two live with their respective partners and one is married. With the exception of one, all women have at least 1 child, ranging from 1 to 9 children, but only three have their children under their care.

Three have incomplete high school education level, three with incomplete elementary school and one with incomplete higher education. Regarding the economic aspects, only two reported exercising some kind of paid activity and two claimed to receive government assistance.

Regarding aspects related to drug use, the age of start varies between 11 and 34 years. The obtained results made possible the division of the approached themes in five categories, that will be discussed next: Notions about gender inequality; Drug use and abuse; Lived social vulnerabilities; Difficulties in treatment; Perception of public policies for women with drug problems.

Understanding Gender Inequality

The notions of gender inequality that the interviewees showed are related to the perception of prejudice that has with women in general. The first conversation about this theme is related to the lack of equality in the workplace, which, for one of the participants, the discrimination that occurs with women compared to men is evident, highlighting the social role attributed to women in housework.

- There are times when men still have some prejudice with women about working as a security guard in the banks, because they think that women were only made to work at home, they are always on the stove and like that [...] that we just have to be a housewife. "This work is not for you, but for men," so they have a kind of prejudice and we women have to stomp and say that we have a right like all of them. (Interviewee 1, 23 years old)

Another point about discrimination against women in the labor market is mentioned by another participant, referring to the weakened credibility regarding work ability and responsibility: "I think that men have more rights sometimes, in terms of work, in terms of responsibility, thinks the woman has no ability to have responsibility" (Interviewee 7, 38 years old).

The discrimination cited in the interview is justified by the perception of gender differences imposed by a Judeo-Christian society. According to Simões and Hashimoto (2012), this society establishes a traditional family system, where there is a configuration of division of labor with socially and culturally established roles. The man / father is seen as the sole provider and the woman / mother as solely responsible for household chores as well as the needs of the offspring.

Participants also associated gender inequality with the lack of respect and bad image associated with women who use drugs compared to men: "For women it is even harder, right. [...] If she falls today, tomorrow she can get up but continue ... the people will talk about her past. The man doesn't, gets drunk in the gutter, gets up and remains a man, right. "(Interviewee 3, 32 years old).

Medeiros et. al (2017) in their study showed that the representation of the image of female drug users is linked to a deteriorated and disqualified image, associated with the naturalized idea that women who use drugs are saneless, impulsive, unpredictable and being incompatible with what society expects according to the social role assigned to women. The discourse associated with the social roles assigned to women is also present in the interviewees' statements as something naturalized. They acknowledge that inequality exists, but hold women accountable for having to achieve gender equality. They talk about types of women, and that the way to look at inequality is backwards, as there are growing rights achievements.

For me it is already backwards, I see everything the same, during college everyone is the same, my friends are ... no matter the sex. It has an inequality, I recognize that it exists, but so I don't see it that way anymore, I think it is backward to look that way. I think the woman sees herself ... victimizes ... not that they are victimizing themselves, of course women still have certain inequalities a lot still right, salary, work at home, work outside, but anyway ... so growing (Interviewee 6, 24 years old)

According to Rocha-Coutinho (2004), due to the occurrence of changes in cultural representations spreading at a certain speed, there is the illusion of a unified identity, as a result of overestimating the depth of these changes, believing that gender inequalities are eradicated. Beyond this view, in the perception of some participants, women need to "respect themselves" to be respected.

There is the virtuous woman and there is the sensible woman, the virtuous woman builds her house, which is the woman who stays at home, does things, does not stay at a neighbor's door, does not keep taking and bringing, said he told me [...] What I think of women is that women need love, affection, to be treated well, not with humiliation, slander, defamation, every woman has to respect herself, has to love herself (Interviewee 4, 43 years old)

According to Rocha-coutinho (2004), although social discourse has incorporated the new role of professional and independent women and questioning the doctrine of motherhood as an essence, in practice the definition of being a woman has changed very little, as this discourse continues to attribute to women the obligations related to the home and family, characteristics considered essential to the feminine. It is then believed that female identity has only been expanded and this new role included. Thus, for many women, even if they have to sacrifice job satisfaction, for example, the family remains a priority. As a consequence, even without realizing it, the woman in this configuration ends up contributing to the preservation of the macho system that prevailed in the system of a traditional society. It is interesting to discuss and reflect on the machismo reproduced by women as a result of a conditioning of thoughts with internalized macho ideals from birth in a patriarchal society, which benefits men and brings no privilege to women. Some contradictions in the interviewees' statements demonstrate the lack of knowledge about gender inequality as a structural problem.

Drug use and abuse

According to Menezes Alves and dos Santos Rosa (2016), women can start their relationship with PSs in general as a result of traumatic experiences, in addition to the pressure of socially imposed determinations on women. In this category, regarding the type of drugs used by the participants, the interviewees reported having used various types of psychoactive substances: *"What I have already done is to use all types of drugs.* (Interviewee 1, 23 years old);

"I have tried powder (cocaine), cannabis and what I got addicted to was stone, you know?" (Interviewee 3, 32 years old);

"I used cocaine, [...] crack, 9 years using crack, used very strong (Interviewee 4, 43 years).

Some relate the beginning of drug use to their relationships with partners or former partners who already used the substances and, as women believe, influenced them to use them.

I started at 21 years old. It was because of my ex partner. He gave me the weed. Then we went to the street and started using all kinds of drugs. Yeah, it was because of him (ex partner) that I started using. (Interviewee 1, 23 years old)

He used. This ended our relationship, but when I broke up, the vibe is bigger, you go out with one, you go out with another one, so, find a friend there, go ... Do you understand? (...) So, like, I got separated, and all that mess and it was pushing me to use it. (Interviewee 3, 32 years old)

The statements corroborate the studies by Dias Cruz et al. (2014), which elucidate as one of the motivations for women to start and maintain illicit drug use is often related to having a romantic relationship with a partner who also makes use of substances. What may lead some women to monitor their partner's consumption is a possible affective dependency as well as the need to feel emotionally accepted.

As for abuse, according to Dias Cruz (2014), some women also become abusive users because they consume the substance in order to accompany partners, and because they become their main suppliers, which would prevent their exposure to trafficking places and the community itself.

One of the participants mentioned her partner as the cause of her addiction:

"[...] I've been with my husband for 9 years, 9 years using crack [...] I spent 4 days and 4 nights on the street, look how I am now. It was crack, all because of him (husband). "(Interviewee 4, 43 years old)

Drug use also started in adolescence, out of curiosity and influence from friends: "*I think at 16-17 years. Ah, it was curiosity. My first drug was weed.*"(Interviewee 2, 31 years old); "I was 11 years old [...] I was curious, I wanted to know what it felt like. I ran away from home, friendships influenced me. "(Interviewee 5, 27 years old)

According to Soccol et al. (2018), the use of psychoactive substances by women may be associated with the desire to be accepted and respected socially, as well as by pressure from a particular social group. Thus, friends can play an influential role in pursuing these new experiences, especially drug use.

I only tried marijuana once but I didn't like it, I prefer alcohol. I started at 15 years old. [...] I worked in the supermarket, in that same supermarket I bought it. Me and some friends, colleague, went out to drink and "oh, let's go, I'll go with you, I'll have this bottle of wine here". Curiosity, at first. Yes! (Interviewee 6, 24 years old)

Schenker and Minayo (2005) state that adolescents who have friends who show approval, tolerance, or use drugs are more vulnerable to being tried than those whose friends disagree with or refrain from using.

[...] All [drugs]. 12 years. Friends, I saw, as I stopped more on the street than at home and I ended up ... [First drug] The glue. Problem at home. I started to work in the street then you know how it is, one mingles with the other and so it goes, then you want to do what the other does, you think that there is trickster thing in the street, it's nothing like that, that's all stupidity. (Interviewee 7, 38 years old)

This result is similar to the study by Maragoni and Oliveira (2013), where they showed that women started drug use in adolescence, being more vulnerable to external influences, a fact that occurred, above all, in situations distant from the working models of the adult, as in the last report: in the street. Substance abuse is also associated with street life. Participants reported that they began to use drugs after living on the street or having a more active life outside the home:

"It was when I went to live on the street, and then when I started using 24 hours, It didn't stop. It was too much." (Interviewee 1, 23 years old)

The perception of abuse as the "time to seek help" came from the moment when women identified that they were using drugs beyond what they considered normal:

"Every time I used it I didn't want to but was using it, got it? Then just this one, and go go go, [...] "(Interviewee 3, 32 years old), after suicide attempts:" I didn't realize, I wanted to keep suicide, I said I had no way, the enemy would say in my head 'throw you in front of the car' "(Interviewee 4, 43 years). According to Junior et al. (2018), drug use may increase the chances of suicidal behavior and is considered a risk factor for this behavior, especially in the female context, and may be associated with the presence of chronic mental disorders, the most common being depression and depression. schizophrenia. The realization that she needed help was also due to her shaken relationship of respect with her children, for fear of setting a bad example for them:

My daughter is already going to be 13 and she is already a girl, and I don't want to ... what I did I don't want my daughters to do, understand? [...] Like, once I went to correct my daughter and she said "who are you to talk about me?", Understand? [...] because of my daughters that I stopped. (Interviewee 3, 32 years old)

In this case, having children means a protective factor against drug abuse, but it is determined by the fear and guilt about being a woman and mother with the problem of substance use. According to Medeiros et al. (2017), the female drug user is considered a major social threat to the model of mother, wife and sexuality. This argument is supported by the repetition of the discourses posed in the society of drug user incompatibility and inadequacy to these previously defined feminine roles and roles.

Regarding maternity and drug use / abuse, as already mentioned in the interviewees' characterization, of the seven participants, six have children, and of the three children are not under their guardianship. Corroborating with the study by Maragoni and Oliveira (2013), where some users reported having difficulties in performing maternal activities, leaving their children alone for long periods or else under the responsibility of other family members to go looking for the drug, facilitating the loss of guardianship. Substance abuse, for some interviewees, was associated with personal, affective and social problems.

Regarding this problem, the participants reported that they realized that drug use was being abused when they had serious mental and physical health problems:

"When I got sick right, when I started getting sick I thought I was already ... "(Interviewee 2, 31 years old);

"Because I had a seizure, I couldn't stop anymore and I got sick, it's about 3 months, so I went to see a doctor and the doctor said it was due to the drink, that I was drinking too much." (Interviewee 5, 27 years);

"I was already a certain age. Many things happen in my life that make me understand what the drug means in my life, what it does." (Interviewee 7, 38 years old) Maragoni and Oliveira (2013) explained that the triggering of drug use is not only linked to experimentation, but to the individual's need to maintain consciousness in an altered state, increasing the likelihood of dysfunctional continuity of use, resulting in abuse when combined. adverse individual, family and social factors in this process.

I started to get addicted from my 19 years. Social factors, I had to pay rent, I had to study, I had to work at the time, and loving, affective problems were cascading. [...] I had noticed a long time ago, but I didn't care, but then this year I decided to find a way because I changed my girlfriend, I changed my life, so she decided to help me. [...] I started doing the abuse to escape reality, you know, escape, then I started to stop, to get used to this new life, this new relationship [...] I talk a lot about my past, my horrible past I had in childhood, she was realizing this and why she paid a psychiatrist, took me and he recommended that I come to CAPS, why I'm here today. (Interviewee 6, 24 years old)

A literature review by Silva (2015) pointed out that alcohol use among women may influence some factors: childhood marked by alcoholism of family members; alcohol consumption since childhood; presence of physical or sexual violence in the life course. The last report quoted above is from an alcohol abuser interviewee and the next category to be discussed is about the social vulnerabilities experienced by these women throughout their lives. The following report by the same participant corroborates the notes of Silva (2015).

Social vulnerabilities experienced

When I was little I was abused, because as I grew up, I'm an older sister and my mother always had to take my two sisters, she ran away from my alcoholic father, so I always stayed behind, the older one turns around, "You know how to take care of yourself", since I was a little girl, 5 years old the first time she left me at a neighbor's house saying she was going to pick me up and I stayed there a few months, my aunt who came to rescue me, then I stayed at the house from another aunt that her husband was abusing me, that's how it was, I grew up from house to house (Interviewee 6, 24 years old)

Women reported being victims of various social vulnerabilities: drug-related crime, family conflicts before and during the relationship with psychoactive substances, and life-long violence without and with drugs, including childhood sexual violence such as case of the last report. According to Maragoni and Oliveira (2013), the family may represent a risk or protection factor for drug use.

One of the most relevant risk factors is parental conflict as it exposes children and adolescents to hostility, destructive criticism and anger. While setting up an environment that is conducive to drug use depends on many factors, the family is one of the most important. Family conflicts and domestic violence or drug-related violence are present in most of the interviewees' experiences:

"Everything. Violence mainly in the street. Family conflicts too." (Interviewee 7, 38 years old);

"I got involved with a boy and jumped out of the car because this boy was more drugged than me and he wanted to kill me, gave him a crisis [...] I only know that he wanted to kill me. Domestic violence has already suffered with my ex. "(Interviewee 5, 27 years old).

According to Maragoni and Oliveira (2013), the existence of physical and verbal abuse and / or sexual abuse in families is considered a factor that contributes to trigger the problem of drug use and that domestic violence and these family conflicts They are often experienced by people with a history of drug problems.

I lived in the lion's cave, the evil spirit he accompanies the person who uses drugs [...] I knocked [on the door] like this: So and so? 'what do you want here, you bastard, you bastard? [...] then his family would listen and say' stick your dick in it ', so that all influenced me to make me drugged, so I was just like that 'help, my God' looks at the third and he's on me, he's a big guy, he's violent and he's at home (Interviewee 4, 43 years old)

Deprivation of access to basic social systems (housing, family, health, work, etc.) is a dynamic resulting from social exclusion and, according to Maragoni and Oliveira (2013), is part of the process that influences the life of the subject who has harmful relationship with drugs. The research by Lopes et al. (2010) shows the association between drug use and crime, which can be exemplified by the speech of one of the participants, about her experience with crime while living on the street:

"I was already using drugs to steal, I was already stealing, I was already hurting people on the street, got it? "(Interviewee 1, 23 years old).

According to Roldán et al. (2005), poverty and oppression are factors that influence violent behavior and this violence is a consequence of the interaction of individual, social, environmental and economic conflicts.

Difficulties in treatment

The participants associated the difficulties in treatment with prejudice related to the image of women who use drugs before society:

"It is because, like this, society thinks that men can and women cannot. Most people think that way. "(Interviewee 5, 27 years old).

In addition, they cited the limited availability of exclusive treatment for women and their particularities.

"What is missing is more clinical, more police station of Maria da Penha (Brazilian law which protect women against male aggression). (...) More recovery clinic for women is lacking. "(Interviewee 4, 43 years old).

As well as lack of money to travel to the treatment site. The difficulty that I really have is just transportation to come here, understand? (...) We women have a lot of prejudice, right, the person like that looks right because she is a woman "credo, that woman drinking there, that woman drugged there", people talk a lot, understand? More so for that too, god forbid. Look, I'm standing today, but no one will see me as if I had a stop, it's always going to be that junkie, because I'm a woman, you know? Discrimination ... (Interviewee 3, 32 years old)

They also reported obstacles to work where there is doubt and distrust about the ability to change behavior and responsibilities:

"Work like this is one of the difficulties because there is so much discrimination. People's lack of trust with us because they don't believe us, they don't think we have a chance to change or have responsibility. "(Interviewee 7, 38 years old)

According to Medeiros et al. (2017), the fact that women engage in activities considered socially transgressive results in the collective thinking of estrangement, being seen as "social failure" in the face of the expected female public in society and, in this case, drug use is seen. as a "transgressive" activity. Some participants reported not experiencing difficulties in treatment, nor because of being a woman, associating the responsibility of not allowing this to happen, in order to show imposition and non-submission:

"Well, none, because everything is being well accompanied." (Interviewee 1, 23 years old)

No, I never let them do it, only of course when I was younger, but nowadays, so after we become aware of the world, of life, of reality ... you kind of impose yourself on men, on people in general. treat as a human being, as a woman ... because in college there is no such thing, boys really respect. (...) because I am never a woman ... after I became aware of life. (Interviewee 6, 24 years old)

Perception of Public policy for women with drug problems

The interviewees reported that they find good public policies aimed at treating women with drug problems, but also that there are few treatment options and that there should be more recovery clinics and more dissemination of specialized services, since not all people who have access to treatment availability information, as well as the precariousness of medication needed:

"So far, it's been nice to me, it's been a good experience. But a lot of medicines we need don't have, as I need a medicine and I had to buy it." (Interviewee 6, 27 years old).

I think there should be more, you know? Is there a clinic for women? I think it's only in Manacapuru. Are you here in Manaus? The Hope Farm ... meets women, but it's very difficult. For women it is very difficult. There should be more, you see, because there are so many drugged women. (...) There should be more, for sure. (Interviewee 3, 32 years old)

I think the President has to put in a thousand recovery houses, the more recovery houses the better, CAPS, health care. There is a lack of assistance for the woman. What is missing is more clinical, more police station Maria da Penha. (...) There is more recovery clinic for women. (Interviewee 4, 43 years old)

As in the research by Maragoni and Oliveira (2013), it is noted the difficulty of access to specialized services and the lack of knowledge of the care network of the Brazilian Health System - SUS, where users may have alternatives for social reintegration and treatment, as well as their families.

There are a lot of people addicted to these things, especially in college and they do not look, I think very few people know, few people know the role of caps, is not disclosed, is not disclosed on tv like 'oh if you realize you're using a lot' [...] the city should disclose more, use the media, the vehicles right, to disclose 'look you're ok, ask for help in caps and such' because it's kind of empty until sometimes, there are days that are crowded but it is because family members come together, but few people know it. (Interviewee 6, 24 years old) They talked about the importance of CAPS ad, how they feel welcomed and cared for, and that they see no difference in treatment between women and men:

"Well, they are very careful with the people who come here, they take care, they protect." (Interviewee 1, 23 years old);

"Man, I think it's a big help for those who want to treat themselves, really CAPS is good." (Interviewee 2, 31 years old);

"Look, here ... I can say that this is my second home, because here they treat me well, here they don't treat you indifferently, you are treated as a person, as you deserve, and you're helping me a lot, thanks to God. "(Interviewee 3, 32 years old);

"I love myself here, I like it here, it's wonderful, there's breakfast, I didn't come here to eat, but there's breakfast. CAPS is something that is very important, people treat us well [...] I'm satisfied. "(Interviewee 4, 43 years old)

Participants see the institution as a "way out" for drug problems, where they perceive the rescue of autonomy and dignity as a human being, because it is a place where they feel respected, receiving attention and care.

It's like an exit door, I understand it as an exit door, because that's what I saw from my attitude, I tried to know and that's what is helping me. (...) For me it's great, I get here, I make my appointment, I'm leaving, treated me so well so far. It makes me want to come, I feel so good. (Interviewee 5, 27 years old)

Okay, really great, a job very well done, which is working for many people, at least in my life. Before I got here I had no reason for what I could do, what I was going to do with my life and nowadays for me to do something stupid or something I already think 3 times, 4 times, understand? So it makes me think not, that it is not for my sake, that I will succeed, that I will fight and I will succeed, understand? Just be patient, I've been putting it inside of me, it's been helping me a lot. (Interviewee 7, 38 years old)

When asked about possible improvements of the institution, as in the study by Leal (2009), the participants stated that they did not think about it, or that they think everything is fine so far, that they have nothing to complain about, except abou the need for greater dissemination of the service, so that other people can have access to treatment.

I think it's ok ... but many people do not know this CAPS, do not know what the hell this is, I did not even know it existed until this year, until the psychiatrist spoke, the psychiatrist who indicated, said 'hey take her there CAPS I will refer here that there is very good. 'There are psychiatrist, psychologist, I thought it was good, I thought it was great. (Interviewee 6, 24 years old)

No issues or considerations were specifically cited regarding the gender issue to be addressed in public policy assistance for the treatment of female drug users, other than the problem of poor availability of specific services for the female public. The fact that the interviewees do not cite too much criticism does not necessarily mean that there are no problems related to gender inequalities. According to Leal (2009), this lack of criticism and other demands demonstrate and reinforce the illusion they may have about the understanding of their needs and rights, as a consequence of the absolute subordination to the norms and values of a society that ends up excluding women of fairer care.

IV. FINAL CONSIDERATIONS

The data collected and analyzed in this study made it possible to understand the issues related to drug use and abuse by women, especially the relationship established with gender inequality.

Regarding the first category analyzed, it is noted that the notion about gender inequality that women have is related to the prejudice against women in general, the lack of equality in the workplace, weak credibility about responsibilities, lack of respect and the lagged image that is associated with women who use drugs compared to men. Regarding drug use and abuse, it was found that women have already used various types of psychoactive substances and relate the beginning of drug use with their relationships with partners or former partners, with the curiosity to experience the sensations caused by the drugs. substances, influence from friends, and having a more active life outside the home, whether working in the street as a teenager or not having a family structure that would allow life away from the streets.

Possible reasons for drug abuse are also related to street living, as well as relationships with other people who abuse drugs, as well as personal, affective and social problems. The perception of abuse as the time to seek help came when women identified that they were using drugs beyond what they considered normal after suicide attempts, because of the relationship of shaken respect with their children and health problems related to their use. use of substances. Regarding social vulnerabilities, it was found that all participants suffered or suffer some kind of risk situation such as physical and / or verbal violence, drug-related crime, sexual violence, domestic violence and various family conflicts.

As far as the treatment and the possible difficulties, the obstacle of prejudice against women drug users in society, the lack of money to access the place of treatment, problems with the work environment, in the sense of poor credibility, were identified. on the ability to change behavior related to drug use and responsibilities, as well as the limited availability of exclusive treatment to address particularities related to women. Participants' perceptions of public policies for specific treatment for female drug users are basically associated with poor availability of specialized institutions, demonstrating some compliance regarding their rights, as all appear to be satisfied with the treatment setting.

The statements of the interviewees referring to CAPS ad demonstrated the need for this welcoming, the importance of a humanized look at the individual with drug problems, since the result is positive in the sense of valuing these people as beings worthy of good monitoring and attention. However, it is questioned the poor adherence of women in treatment facilities for drug addiction or drug abuse and the interaction regarding discussions from a gender perspective in general care.

Thus, more studies are needed, more perspectives with this perspective relating gender with the possible reasons for the low adherence of women, since in this research, for example, it was difficult to contact more women who were following in the institution, since The female audience is actually much lower than the male audience.

It is necessary to understand more and more how gender inequality can influence psychological problems, which is one of the main reasons for the inclusion of women to harmful drug use, emphasizing that the biggest problem is not the use of drugs themselves, but the relationship that is established with the substance, considering the need to maintain consciousness in an altered state, most likely not to have to deal with so many sufferings consciously. It is believed that discussions with a feminist context can positively influence questions related to ways of treatment for women facing drug problems, in order to think about the particularities, the reasons for the gender inequality that lead these women to do. the harmful use of psychoactive substances, generating possible ways to prevent or reduce the damage of psychological aspects that may be associated with the maintenance of this problem. It is important to highlight

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Application of the Porous water Receipt well to Reduce the Puddle in Passo Village, Ambon City

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Abstract— The impact of land use change in developing areas, especially at Passo Village, Ambon Bay, is a serious problem if continuously ignored, and then RT (neighborhood) number 21.22 and 23 will experience inundation throughout the rainy season. This is because sea levels are higher than residential areas. In order not to experience a long puddle, the solution is to make a water catchment well by considering the condition of the existing drainage system that is no longer able to be burdened. From the results of the hydrological analysis in a residential area of 12.71 Ha, an average runoff coefficient of 0.85 was found with a rainfall intensity of 72.83 mm / hour. From the results of the discharge analysis for the return period of 2 years is 2.17 m3 / sec. Permeability for infiltration wells on site is 0.847 m / day, the calculation of the need for infiltration wells installed at the study site is based on the analysis of the width of the building roofs for types 36, 45, 50, 60.70 and 120. Construction of water infiltration wells made using two types of aggregates rough for non-sand concrete (non-structural concrete) with a mixture of 1 cement and 6 rocks or broken stone. Water infiltration wells installed from the calculation results for material from coral are 663 pieces and from 670 broken stones, individual infiltration wells are made in a circle with a sinking diameter of 1.25 meters and a depth of 2 meters, thus found reduced surface flow efficiency that can be reduced type 36 is 12.69% type 45 is 9.9%, type 50 is 8.82%, type 60 is 7.25%, type 70 is 6.15% and type 120 is 3.50% of infiltration wells made of rock. Keyword—Water catchment wells, concrete without sand, Passo Village.

I. INTRODUCTION

Changes in land use due to the growth of house buildings in a residential area, can indirectly damage the water catchment area. This results in the reduction of the rainwater catchment area which causes rain water to collect in the existing drainage channels.

These conditions will cause an increase in the volume of surface water which entering the drainage channel and overflow of water in the channel which can cause inundation or even flooding. Infiltration well is a means to collect rainwater and absorb it into the ground.

Infiltration wells function to provide artificial water recharge by injecting rainwater into the ground. The target location is the water infiltration area in the village of Passo, RT number 21.22 and 23 covering an area of 12.71 Ha. Water Infiltration Well Construction (SRA) can be used as an alternative in dealing with floods are Non-Sand Concrete, a mixture of 1 cement: 6 rocks of diameter 20 mm and Non-Sand Concrete mixed of 1 cement: 6 broken stones 20 mm in diameter. The purpose of this study is to reduce puddles by using non-sand concrete.

II. REVIEW OF LITERATURE

2.1 The benefits of recharge wells are

- 1) Reducing surface runoff so that it can prevent / reduce the occurrence of floods and puddles.
- 2) Maintaining and increasing groundwater level
- 3) Reducing erosion and sedimentation
- 4) Reducing / resisting sea water intrusion for areas adjacent to coastal areas
- 5) Prevents land subsidence
- 6) Reducing the concentration of groundwater pollution.

2.2 Procedures of Infiltration Wells

The procedure of infiltration wells is to deliver and store rainwater into holes or wells so that water can have time to stay on the surface of the ground, so that the water can seep slowly into the ground. From the procedure it can be seen that the main purpose of infiltration wells is to enlarge the entry of water into soil aquifers as infiltration water. Thus, more water will enter the ground and less flow as surface (runoff).



Fig.1: Process of delivering water into the free aquifer

n	$\underline{ \pi.K(hw^2-ho^2)}$	(og 1)
Q	- ln(ro/rw)	(eq.1)

The procedure for planning rainwater catchment wells refers to SNI 03-2453-2002. Calculation of flood share volume and number of wells needed is done using the equation

Vab = 0.85 * C * A * R	(eq.2)
Notes :	
Vab = flood share volume (m3)	
C = Runoff coefficient	
A = Area of drainage area (m2)	

R = Average daily rainfall height (mm / day)

2.3 Rain Intensity (I)

Calculation of rainfall intensity is usually required as part of the formulation in the calculation of plan discharge using the Rational Method. The use and determination of the intensity formula must be considered several things, among others:

a. Available data

- b. The simplicity and practicality of the formula used
- c. Trust in the results to be achieved and the results can be justified. The amount of rainfall intensity can be calculated with the empirical formula of rainfall

$$I = \left(\frac{R_{24}}{24}\right) \left(\frac{24}{T_c}\right)^{\frac{1}{3}}$$
(eq.3)

Notes :

I = rainfall intensity (mm / hour)

R24 = Maximum rainfall that is occur for 24 hours (mm) Tc= concentration time (hours)

2.4 Soil Permeability

Permeability is the speed at which water seeps into the soil both through macro pores and micro pores both horizontally and vertically. The permeability value is taken from the average value of impregnation factor

$$K = \frac{1}{absorption factor} (eq.4)$$

Table.1: P	Permeability	Coefficients	of Several	Types of Soil
------------	--------------	--------------	------------	---------------

Land Texture	Infiltraton speed (mm/hr)	Criteria
Sandy Clay	25 - 50	Very Fast
Clay	12.5 - 15	Fast
Dusty loam	7.5 - 15	Moderate
Clay clay	0.5 - 2.5	Slow
Loamy	< 0.5	Very Slow

2.5 Porous Concrete

Porous concrete is an application of civil construction that is important for sustainable development to overcome one of the many impacts of standing water and flooding. With the development technique used, the application of pour concrete can also protect water quality in the soil which then becomes a guaranteed source of water due to good circulation. To replace infiltration space due to changes in land use, porous concrete is used.

Another advantage regarding porous concrete reduces the level of pollution of ground water, because the concrete mixture does not use a mixture of hazardous chemicals, then the potential for groundwater pollution becomes smaller, by using porous concrete pavement that can reduce the need for rainwater preparation ponds, drainage channels, and management facilities other rain water.



Fig.2: Research Flow Diagram

IV. RESULTS AND DISCUSSION

4.1 Hydrological Analysis

Rain analysis uses maximum daily rainfall data for 10 years from 2009 to 2018,

- From the results of the calculation of the Distribution of Rainfall with Pearson Log III shows that the highest maximum daily rainfall each year ranges from 97.3 mm to 360.40 mm. The highest maximum daily rainfall occurred in January 2013 amounted to 360.40 mm.
- 2) The time of concentration (Tc) of runoff water into the channel is 0.775 hours or 46.50 minutes.
- 3) The value of rainfall intensity (I) for the 2-year return period is 72.83 mm / hour.
- 4) Calculation of flood peak discharge using the rational method. Peak Discharge (Q peak) is assumed to be a debit value rainfall that goes directly into the drainage channel. In the structural planning analysis, the infiltration well is used at a 2-year return period with peak discharge values occurring during the first 1 (one) hour 2.18 m³/s
- 5) Large infiltration of porous wells made of broken stone is 0.755 m / day (31.46 mm/hr) and coral material is 0.847 m / day (35.29 mm/hr)
- 6) Calculation of dimensions and infiltration well models as shown in the table below.

4.2 Calculation of Infiltration Wells

With theoretical analysis using the formula of Sunjoto (1988) for the dimensions of infiltration wells, the following calculations are carried out

$$H = \frac{Q}{FK} \left[1 - e^{\frac{-FKT}{\pi R^2}} \right]$$
 (eq.5)

The design plan dimensions of the infiltration well are designed based on technical data, namely:

- 1) Maximum infiltration well size will be used \emptyset 0,8 m and maximum 1,4 m with cylindrical section;
- 2) Size of well depth (H), which is 2 m;
- 3) Walls made of concrete without sand (a mixture of 1 cement: 6 rocks or broken stones 20 mm in diameter) with (D) 1.25 m and the rest is the face of the ground;
- 4) Inlet pipe size Ø 110 mm.
- 5) The bottom of the well is filled with sand, palm fiber and broken stone;
- 6) The well cover is made of a concrete plate with a thickness of 10 cm (a mixture of 1 cement: 2 sand: 3 broken stones).

Analysis of infiltration well needs is based on various parameters, namely the value of soil permeability, area size, groundwater level during the rainy season, rainfall intensity of an area, and so forth. The need for infiltration wells in RT number 21.22 and 23 at Passo villages is adjusted to the slope of the roof and the design of the cross section of the well. The calculation of infiltration well needs that should be installed in RT number 21.22 and 23 at Passo villages is based on the analysis of the width of the roof of a building type 36, 45, 50, 60.70 and 120 can be seen in table 2 and table 3

Table.2: Tot	al Infiltration	Wells	with	Porous	Rock
	Cond	rete			

Roof Area	Total	C	K	Dwell		
(m2)	(pc)	C	(m/hari)	(m)		
1	2	3	4	5		
36	181	0.85	0.847	1.25		
45	147	0.85	0.847	1.25		
50	104	0.85	0.847	1.25		
60	84	0.85	0.847	1.25		
70	59	0.85	0.847	1.25		
120	12	0.85	0.847	1.25		
Hdesign	Tr2	Awell	Vab	te		
(m)	(mm)	(m2)	(m3)	(Jam)		
6	7	8	9	10		
2	72.83	9.077	2.205	0.775		
2	72.83	9.077	2.757	0.775		
2	72.83	9.077	3.063	0.775		
2	72.83	9.077	3.676	0.775		
2	72.83	9.077	4.288	0.775		
2	72.83	9.077	7.352	0.775		
Vinfil	Vstr	Htotal	n	Total n		
(m3)	(m3)	(m)	(buah)	(buah)		
11	12	13	14	15		
0.248	1.957	1.596	0.80	144		
0.248	2.508	2.045	1.02	150		
0.248	2.815	2.295	1.15	119		
0.248	3.427	2.794	1.40	117		
0.248	4.040	3.294	1.65	97		
0.248	7.103	5.791	2.90	35		
	Total Wells					

Table.3: Total Infiltration Well	s with Broken Stone
----------------------------------	---------------------

Porous Concrete				
Ro of Area	total	c	K	Dwel1
(m2)	(pc)	U	(m/hari)	(m)
1	2	3	4	5
36	181	0.85	0.755	1.25
45	147	0.85	0.755	1.25
50	104	0.85	0.755	1.25
60	84	0.85	0.755	1.25
70	59	0.85	0.755	1.25
120	12	0.85	0.755	1.25
Hdesign	Tr2	Awell	Vab	te
(m)	(mm)	(m2)	(m3)	(Jam)
6	7	8.000	9	10
2	72.833	9.077	2.205	0.775
2	72.833	9.077	2.757	0.775
2	72.833	9.077	3.063	0.775
2	72.833	9.077	3.676	0.775
2	72.833	9.077	4.288	0.775
2	72.833	9.077	7.352	0.775
Vinfil	Vstr	Htotal	n	Total n
(m3)	(m3)	(m)	(buah)	(buah)
11	12	13.000	14	15
0.221	1.984	1.618	0.809	146
0.221	2.536	2.067	1.034	152
0.221	2.842	2.317	1.158	120
0.221	3.455	2.816	1.408	118
0.221	4.067	3.316	1.658	98
0.221	7.130	5.813	2.907	35
Total Wells			670	

From the analysis of infiltration wells on two nonstructural concrete used, the number of infiltration wells made with coral is less when compared to non-structural concrete of broken stone. Thus, the infiltration well with coral material is selected by taking into account the cost aspects and using material in the form of local wisdom by taking into account the requirements or standards of the installation of infiltration wells based on SNI.



Fig.3: Viewing dimensions of infiltration wells



Fig.4: Dimensional view of infiltration well dimensions



Fig.5: Non-sand infiltration well model

4.2 Characteristics

The compressive strength of porous concrete from the test results of the two test objects, the compressive strength of concrete in 28 days is obtained:

- a) For broken porous rock concrete is 10MPa
- b) For porous concrete rock is 4 MPa Strength of porous concrete will continue to increase

after the age of 28 days to be able to match the normal concrete.

Selection of concrete quality according to material specifications is important so that it does not experience wasteful costs and safe to use. Referring to the results of the concrete quality characteristics test, the non-rock concrete structure is sufficient to be used as an individual filtration well at the research sites RT. number 21.22 and 23 at Passo Village..

V. CONCLUSION

- With an area of 12.71 Ha in 3 RTs in Passo Village, the individual infiltration well made in a circle with a diameter of 1.25 meters and a depth of 2 meters, thus found a reduced surface flow efficiency for type 36 is 12.69% type 45 is 9, 9%, type 50 is 8.82%, type 60 is 7.25%, type 70 is 6.15% and type 120 is 3.50% of infiltration wells made of rock
- 2) The compressive strength of porous concrete from the test results of the two specimens, the concrete compressive characteristics of 28 days for broken stone porous concrete are 10 MPa and porous rock concrete is 4 MPa (selected) in order to save costs because of the non-concrete concrete considered sufficient to be used as an individual recharge well.

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Qualitative Aspects of the Cycle of Municipal Public Policy to Promote Cooperativism

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Abstract—This article aims to analyze the institutional dynamics of the municipal public policy to promote cooperativism, between 2013 and 2017, in the municipality of Gurupi-TO, to qualitatively evaluate the dynamics of the institutional cycle of municipal public policy for cooperativism in Gurupi-TO based on the perception of public managers, managers and beneficiaries in relation to the qualitative performance of the municipal public policy and to identify the challenges and propose guidelines for the consolidation of the management of the public policy to foment the cooperativism in the municipality of Gurupi-TO. This is qualitative research, with data collection through bibliographical and documentary research and semi-structured interviews with exmanagers and managers who participated in and participated in the conduct of this policy and with the beneficiaries (small producers of family agriculture). Therefore, he envisaged the convergence of public management interests with local cooperativism in Gurupi-TO by means of the political evaluation considering the aspects of the legitimacy of the process of elaboration of the actions, the perception of the beneficiaries of the public policy with the indication of the benefits and impacts in the conduct of the public policy of foment to the cooperativism.

Keywords—Cooperativism, Public Policy Management, Analysis of Municipal Public Policy.

I. INTRODUCTION

The present work has a local scope since the nuance of research aims to address the dynamics of public policy to promote the cooperativism of the municipality of Gurupi-TO. The municipality is located to the south of the State on the margins of the BR-153, is the third-largest in the population contingent of the state of Tocantins, with an estimated population in July 2017 of 85,523 habitants (IBGE, 2018).

In Brazil, there are public policies that are born as the theory predicts, that is, starting with a broad process of diagnosing the situation to be treated, going through a planning phase, by establishing guidelines, by defining the model of Implementation, by conducting tests, by the implementation of the policy itself and, finally, by its evaluation and monitoring, among other phases (DIAS, 2012; FREY, 2000). However, the emergence of public policies, which do not consider several of these important steps is something that happens frequently.

What is observed, in summary, is that the descriptors of the public policy cycle rarely reflect the real dynamics of public policy (SECCHI, 2010). Generally speaking, the process of public policy is uncertain, and the boundaries between its various phases are unclear, and these are overlapping, and some steps anticipate others.

In many cases, public policies may arise to address existing problems identified, without considering the underlying causes of these problems. The government does not always have the time to make an appropriate planning process for its policies.

Thus, the appropriate study on the implementation process of a policy is not sufficiently accomplished, putting in check the quality of expenditure and public investment in general, which relates to the context and the way in which public policies are formulated, implemented and evaluated.

In view of these observations, it is necessary to clarify that this study is aimed at the management of public policies in the construction/conduction of public policies for the promotion of cooperativism.

For this reason, it proposes to qualitatively evaluate the municipal public policy dynamics of fostering cooperativism, in the municipality of Gurupi-TO in order to guide the actions of governance, with a view to contributing to the formation of a safer environment and Favorable for the public policy of local and regional cooperativism to present effectively transformative results, at the height of society's expectations and in the realization of social rights, provided for in the Magna Carta-Federal constitution of 1988.

The research is part of the following problems: How does an institutional dynamic of the municipal public policy of cooperativism contribute to the consolidation of cooperativism in the municipality of Gurupi-TO? What are the challenges and possibilities of the management of public policies and cooperativism in the municipality of Gurupi-TO? To this end, it seeks to demonstrate the convergence of the interests between the management of public policies and the cooperativism for the effective consolidation of the municipal policy of fostering cooperative activism in the municipality of Gurupi-TO.

As cooperativas vão além dos padrões de políticas de responsabilidade social adotadas pelas empresas mercantis, uma vez que "a participação democrática e a educação cooperativista pretendem construir novas relações entre as pessoas, o que também repercutiria na comunidade, contribuindo, assim, para o desenvolvimento e a promoção da cidadania" (MILAGRES; AMODEO e SOUZA, 2011, p.72).

Thus, it aims to analyze the institutional dynamics of the municipal public policy of fostering cooperative activism, between the years 2013 and 2017, in the municipality of Gurupi-TO, specifically to qualitatively evaluate the dynamics of the institutional cycle of municipal public policy for cooperativism in Gurupi-TO based on the perception of public managers, leaders and beneficiaries in relation to the qualitative performance of municipal public policy and to identify the challenges and propose guidelines for the consolidation of public policy management to promote Cooperativism in the municipality of Gurupi-TO.

The research is justified by the low density of scientific papers on public policy management at the municipal level, especially in the municipalities of the state of Tocantins, intending to contribute in the theoretical aspect to the political and social actors Involved with cooperativism and public policy management.

The methodological part brings a qualitative approach, with data collection via bibliographic and documentary research and conducting semi-structured interviews with former managers and leaders who participated and participate in the conduction of the aforementioned policy and with beneficiaries (small producers of family farming). The collected data were categorized and submitted to content analysis.

The work is structured in sections being the first such introduction. The second section deals with the conceptual definition of public policies, addressing the importance of this area of knowledge its conceptual delimitations and the evaluation of public policies.

The third section deals with cooperativism, establishing historical evolution and the current state of cooperative principles, cooperativism in Brazil, in the state of Tocantins and in the municipality of Gurupi-TO.

The fourth section describes the methodology used in the research and form of data collection and analysis. In the fifth section brings the analysis, discussion of the results and finally are presented the final considerations of the study.

1.1. **DEFINITION OF PUBLIC POLICIES**

Brazil is a country historically marked by its natural and cultural diversity. similarly, the existence of social and economic inequalities is evident, as demonstrated by official requirements (PEREIRA, 2011).

Despite the different phenomena, poverty, inequality, and social exclusion are intimately interrelated, since poverty in Brazil is not determined by the scarcity of resources, but by inequality in the distribution of income and opportunities for economic and social inclusion, as shown by Barros (2004).

Neste sentido, importante frisar as definições e fundamentos das políticas públicas, bem como as formas de consecução de seus objetivos.

According to Secchi (2015), the policy, based on the term American policy, refers to the positioning and orientations for decision and action, a fact that gives it a more practical dimension and thus facilitates understanding its function in the social context.

The author also mentions that in the political decisions instituted at the State level, there is the participation of several actors, among which stand out the political parties, government agents and various other social actors, such as representatives of social movements, non-governmental organizations (NGOs) and private enterprise.

One can understand public policies based on two currents of thought: the North American focused on the action of analyzing public policies within a utilitarian logic, from the point of view of costs and results. And there is the other aspect, the European one that analyzes public policies as a political and collective process. Thus, there is a need for discourse between government action and the theory of the state, especially the one that values the collective since public policies aim to meet the welfare of society.

Public policies are directed at solving collective demands, which may affect the private life of citizens, and private entities may participate in their formulation or share their implementation, and the possibility of doing so is supported by public decisions, in decisions taken by government agents, emanating from the imperative power of the state. And, for academic purposes, a conceptual theoretical synthesis is presented in **Table 1 below.**

Author	Definition
Laswell (1950)	"public policies were, in fact, the realization of the Government in action, almost an act of governing,
	conjugated with the verbal time in the Gerundian), its studies should also assume the intentionality of such
	actions adopting a prescriptive perspective, so that Public policy decisions and analyses converge to
	answer the following questions: Who gains what, why and what difference does it make."
Dye (1972)	Public policy emerges as "everything a government decides to do or not to do".
Jenkins (1978)	"set of interrelated decisions made by an individual actor or set of actors regarding the selection of
	objectives and the means to achieve them in a situation where actors are able to achieve those objectives."
Souza (2006)	"Field of knowledge that seeks, at the same time, to "put the government into action" and/or to analyze
	this action (independent variable) and, when necessary, to propose changes in the course or course of these
	actions (dependent variable)".
Souza (2007)	"There is no single better definition of what public policy is. Mead (1995) defines it as a field within the
	policy study that analyzes government in light of major public issues and Lynn (1980) as a set of
	government actions that will produce specific effects. Peters (1986) follows the same vein: public policy is
	the sum of the activities of governments, acting directly or through delegation, and influencing the lives of
	citizens. Dye (1984) epitomizes the definition of public policy as 'what the government chooses to do or
	not to do'. The best-known definition remains Laswell, that is, public policy decisions and analysis imply
	answering the following questions: who gets what, why, and what difference it makes".
Rua (2013)	() Public policies (policy) are one of the resulting political activity (politics): they comprise the set of
	decisions and actions related to the mandatory allocation of values involving public goods. "It is important
	to develop the understanding that public policies are the result of political activity and that this consists in
	the peaceful resolution of conflicts, a process essential to the preservation of life in society."
Amabile (2012)	"Are decisions that involve issues of public order with broad scope and aimed at satisfying the interest of a
	collectivity. They can also be understood as strategies of public action, structured through a decision -
	making process composed of complex variables that impact in reality. They are the responsibility of the
	formal authority legally constituted to promote them, but this burden has been increasingly shared with
	civil society through the development of various mechanisms of participation in the decision-making
	process."
Howlett et al.	"The <i>policy-making</i> deals fundamentally with actors surrounded by constraints that have to reconcile
(2013)	<i>(policy goals)</i> with <i>(political means)</i> in a process that can be characterized as "applied problem resolution"
	in Decision making process".
Secchi (2015)	"An elaborate guideline to tackle a public problem [], a policy is a guideline for someone's activity or
	passivity; The activities or passivities deriving from this guideline are also part of the public policy".

 Table1. Theoretical and Conceptual Structure of "Public Policy"

Source: Elaborated by the author (2018).

From the definitions of 'public policy 'outlined elsewhere it is perceived that, until then, the government acts as the main actor to achieve the purposes of a fair and egalitarian society and for both public policy plays a central role in life of people, because it is a key factor in contributing to the welfare of society.

Therefore, it is assumed that public policies are formulated to provide better welfare conditions for the population, and society, as an end to public policy, has a substantial role in its process of definition, elaboration, implementation, and evaluation.

In this respect, Brazil stands out as a country that has benefited, in the last decade, by adopting policies to promote growth with equity, even if it still needs to advance to improve the reach of these policies (DEDECCA; THUNDER SOUZA, 2014), as shown in **Figure 1 below.**



EVOLUTION OF GROSS DOMESTIC PRODUCT AND PER CAPITA FAMILY INCOME (%) BRAZIL, 1999-2001 *

Thus, in order for society to meet its needs, the Government needs to be effective in the production of public policies, fulfilling them satisfactorily, because good public policies are built consciously, that is, governments need to efficient processes to allocate and balance demands in order to solve the core of problems.

Given this complex relationship between government and society, the political process is fraught with irrationalities, inconsistencies, and reasons for lack of coordination. These short comings often derive from poorly resilient sources of policy, since if both those who participate and those who do not participate in governments are no longer familiar with the nature and functioning of the political process, they are unlikely to imagine strategies for success in influencing their course and ensuring that they produce effective results (HOWLETT; RAMESH; PERL, 2013).

Although public policies are indispensable to society, they occupy a central place in the world of public management, as managers need resources to perform their tasks at high levels of intelligence, sophistication, and competence. A disjointed political process influences the functioning of policies and in the meantime, managers are unable to devise effective strategies to positively influence the direction of the process to ensure an integrated set of outcomes (WU et al., 2014).

Thus, the disarticulation of the public policy process has caused, over the decades, problems caused by the existence of a range of fragmented policies, as will be explained in the next section.

Rather, it should be noted that, as seen, the concept of public policy is transversal to several areas or sectors of public intervention, adjusting according to the identified public problem, establishing a causal relationship. In other words, depending on the type of public policy at stake, the structuring of conflicts, coalitions and the balance of power change, determining the political dynamics and perhaps the political process.

Therefore, for the desired purposes of this study, the concept of Secchi (2015) is the most appropriate, because

Fig.1: Evolution of gross domestic product and per capita family income (%) **Source:** IBGE, Directorate of Research, Coordination of work and income, a national survey by continuous household sample, 2014.
it understands that public policies should be developed to face a public problem in order to guide activities to solve the problem or even in cases of omission or passivity, public policies are also able to meet these needs.

1.2. THE DYNAMICS OF THE PUBLIC POLICY CYCLE

Public policy (policies) occurs in a tense and high-density political environment (politics), marked by power relations, extremely problematic, among actors of the state and society, among intersectoral agencies, among the powers of the State, between the national level and subnational levels, between political community and bureaucracy.

The process of drafting public policies (policymaking) is also known as the Public policy cycle (policy cycle). Such a cycle is a visualization and interpretation scheme, which organizes the life of public policy in sequential and interdependent phases.

It can also be said that the cycle is an approach to the

study of public policies, which identifies sequential and interactive- iterative phases in the production process of a policy, and the model of the "cycle of public policies" is an abstract conception of Political process, which although it does not exactly correspond to what happens in practice, acts as a resource for the analysis of public policies. This is why it is called the "Heuristic Model" (RUA, 2014).

Saravia and Ferrarezi (2006) distinguish the following stages: formation of the agenda, elaboration of alternatives, formulation, implementation, execution, monitoring, and evaluation.

However, Secchi (2010, p. 44) understands that the "visualization of the public policy cycle is restricted to seven main phases: 1) Identification of the problem, 2) Agenda formation, 3) Formulation of alternatives, 4) Decision making, 5) Implementation, 6) Evaluation, 7) Extinction ", proposing the scheme shown in **Figure 2**, **below:**



Fig.2: Public Policy Cycle **Source:** Adapted from Secchi (2015, p.43).

In general terms, the main phases of public policy are as shown in table 6 below:

STAGES	DESCRIPTION
Agenda formation	recognition and definition of a given situation as a relevant collective political problem
	and may take the form of a government program and/or budget planning;
Alternatives	From the definition of the problem on the agenda, efforts to build and combine solutions
formation and	to the problems are essential, and the objectives, strategies and the study of the potential
decision making	consequences of each solution alternative need to be established. This is the time when
	methods, programs, strategies or actions that can achieve the established objectives are
	elaborated. Decision making is seen as the next step in formulating solution alternatives,
	where decision makers have problems at hand and chase after solutions.

Table.2: Main stages of a public policy

Implementation	and	This phase follows decision-making and precedes the first evaluative efforts, where the
monitoring		concrete results of public policy are produced, the rules, routines, and social processes are
		converted from intentions into actions, analyzing performance against the objectives set;
Evaluation		At this stage of the public policy cycle, the implementation and monitoring process is
		examined in order to better understand the state of the policy and the level of reduction of
		the problem that generated it, that is, a crucial moment for producing feedback on the
		previous phases.

As for Rua (2013, p.36) "one way to deal with this complexity, without disregarding the systemic dynamics, is to associate the systemic model with the policy cycle model, which addresses public policies through its split into sequential steps "as shown in **Figure 3**:



Fig.3: Public Policy Cycle associated with the systemic model **Source:** RUA (2009, p.36).

Secchi (2010) differs from Rua (2013) in considering that the steps are not understood as a linear process since the starting point is not clearly defined and the activities of different stages may occur simultaneously or the stages themselves may present themselves partially overlapping.

However, the correct way to understand the public policy cycle is of paramount importance to the manager, because understanding this process can contribute to clear reflections on how and which policy instruments can be employed and refined. In addition, it helps to organize ideas, makes the complexity of public policy simplified, and helps actors create a comparative framework for heterogeneous cases (SECCHI, 2010).

With respect to the objectives outlined in this paper, especially in the intermittent/cyclical dynamics of the public policy of fostering existing cooperativism, the development of the research is related to municipal management and the government platform.

Notably in Gurupi-TO, within the administrative structure of municipal public management, there is the secretariat of government directed to cooperativism, despite being linked to other structures (Municipal Secretariat of Production, Cooperativism, and Environment).

Thus, considering that the importance of the conception of the "public policy cycle" stems from the fact that its stages correspond to a sequence of elements of the political-administrative process and can be investigated with regard to the actors, their relations, their resources of power, political and social networks, and the practices or actions that are typically at each stage, let us address how an existing public policy can be measured and analyzed, what affects society or group has on public policy, especially what it concerns the achievements achieved and the expected and unintended consequences (SARAVIA; FERRAREZI, 2006).

Given this, the objectives and actions implemented in the area of cooperativism by the local government secretariat as well as the national and state guidelines are indispensable for the evaluation of the existing policy, in order to identify the challenges that guide it and its qualitative assessment. Therefore, to understand the context of the implementation of municipal public policy to foster cooperativism, we begin to explain about local cooperativism.

1.3. COOPERATIVISM ON THE LOCAL ASPECT

Cooperatives are vehicles for mobilizing resources in the communities where they are located, given the commitment to promote actions that promote the production of goods and services, and consequently benefits the circulation of resources within the community, as well as social and economic development.

And among the aspects of local development, the cooperative activity also promotes job and income generation, because through the cooperative system citizens are able to engage in the purchase, sale, use, and supply of goods and services, benefiting from better working conditions and income, generating opportunities and quality of life in the environment.

According to data from SESCOOP on the cooperative landscape in the state of Tocantins, 2015 closed with a total of 45 cooperatives distributed in the branches listed in **Table 3, as follows:**

Table.3: Branches of cooperatives in the Tocantins

COOPERATIVE BRANCHES	ANO DE 2015
Farming	14
Consumption	0
Credit	03
Educational	04
Special	0
Housing	0
Infrastructure	0

Mineral	03
Production	01
Health	07
Work	06
Transport	07
Tourism and Leisure	0
TOTAL	45

Source: SESCOOP (2018, s/p).

In the municipality of Gurupi-TO, to which this work is addressed, Cooperativism is conceived as a pillar in public management, such as the edition of Municipal Law

 N^{o} . 1.188 of June 30, 1997, which brought the need for strengthening cooperativism, as Articulation of measures to improve the population of the rural environment. From then on, cooperativism is the basis of support for the implementation of the municipal developmentalist public policy.

In the municipality, local potentialities can be evaluated in order to diagnose the conditions for the economic, social and cultural development of the community involved. In this way, cooperativism can contribute to the improvement of the quality of life of those who are in vulnerable economic and social conditions.

In the case of Gurupi-TO, The local potential is linked to agricultural activities, due to the promising potential of the region and its consolidation in the market, as a regional pole of the South Tocantinense.

According to data from the OCB/Sescoop system in Gurupi there are 08 (eight) active cooperatives, as listed in Table 4.

Table.4: Active cooperatives in Gurupi - TO.

N.	COOPERATIVES
1	UNIMED GURUPI MEDICAL WORK COOPERATIVE (Continued)
2	COOPERATIVE MEAT PRODUCERS AND GURUPI DERIVATIVES - COOPERFRIGU
3	SOUTH TOCANTINS AGRICULTURAL PRODUCERS COOPERATIVE - COOPERSUL
4	COOPERATIVE OF HEALTHCARE USERS - USIMED GURUPI
5	REGIONAL CO-OPERATION OF AGRICULTURE PRODUCERS FAMILY - COORPAF
6	COOPERATIVE BRAZILIAN CENTER FOR ECONOMY AND MUTUAL CREDIT OF HEALTH
	PROFESSIONALS LTDA
7	SICOOB CREDIPAR - COOPERATIVA DE CRÉDITO E LIVRE ADMISSÃO DO PARAÍSO DO
	TOCANTINS E REGIÃO - LTDA
8	SICREDI - RURAL CREDIT COOPERATIVE AND TOCANTINS STATE PUBLIC SERVANTS

Source: OCB/Sescoop (2018, s/p).

be presented.

During this work was realized the degree of relevance of the performance of these cooperatives for local development, considering their social and economic impact.

II. MATERIALS AND METHODS

impact. This is a research of qualitative approach, through the deductive method, comprehensive, explanatory, thinking

in the evaluation with the political connotation of the municipal public policy to foster cooperativism in the municipality of Gurupi-TO.

The research was divided into three basic stages: in the first, documentary and bibliographic researches were developed; In the second, the data collection technique was used (in this study we adopted the semi-structured interview using the techniques, snowball, and theoretical saturation); and in the third and last step, it consisted of data analysis, using as support Bardin (2016) content analysis technique. Both evidenced the evaluation categories in the construction of the research result.

Having defined the problem, the objectives of the original research and the methodology to be employed, it started, therefore, to collect the research data.

The collection of documentary data consisted of bibliographic research and documentation, in, search for laws and models of public policies of coping existing in the country, in its governmental and institutional databases. Searches were performed using the following main search indexers: Public Policies; Public Policy Cycle; Public Policy Evaluation; Cooperativism. Therefore, the sources of information are official and public and are basically immediate documentary (Legislation, Projects, Articles and Scientific Journals).

From the models of public policies aimed at cooperativism, existing in Brazil, if the public policy in the municipality of Gurupi-TO is similar and specifically aimed at fostering cooperativism. Once identified the municipal public policy with this design it was selected as the object of the proposed study, as well as the actors involved in its conduction and those benefited by its actions, who participated after the necessary approval of the project by the Research Ethics Committee. UnirG University (CAAE: 83357518.7.1001.5518), upon acceptance and signature of the TCLE, to conduct semistructured individual interviews. The sample quantity for individual interviews followed the theoretical saturation technique of Fontanella et al., (2008, p.17) which implies the "theoretical saturation closure is operationally defined as the suspension of inclusion of new participants when the data obtained now present, in the researcher's evaluation, some redundancy or repetition, and it is not considered relevant to persist in data collection ".

The perception of the theoretical saturation point is "when the obtained data start to present, in the researcher's evaluation, a certain redundancy or repetition, and it is not considered relevant to persist in the data collection" (FONTANELLA; RICAS; TURATO, 2008, p.17). Thus, there being repetition and no innovation in the theoretical reflection in the interview is a sign that saturation has been achieved.

For example, the table showing the theoretical saturation regarding the category of actions developed by the municipal policy of fostering cooperativism in family farming in Gurupi-TO was formulated, as shown in **Table 5 below.**

	Inte	rviews	5		-								-	Total of
Actions	B1	B2	B3	B4	B5	B6	В7	B8	В9	B10	B11	B12	B13	Recurrences
Soil Preparation (machinery)	X	X		X		X		X	X	X	X	X	X	10
Inputs (seed/limestone)		X												1
Technical assistance by professionals	X													1
Small Farmers Fairs Infrastructure		X	X	X	X									4
Purchase school Lunch	Χ	Χ				Χ	Χ	X					X	6
Transport	X	X		X		X			X		X	X		7
Total new categories of utterances for each interview.	4	2	0	0	0	0	0	0	0	0	0	0	0	

 Table.5: Actions of the municipal policy of fostering cooperativism in family farming

Source: Based on data from interviews with beneficiary actors based on Fontanella et al. (2008).

Table 5 shows the theoretical saturation of the "Developed Actions" category since the new statements

appeared only in the first two interviews and in the others there were repetitions of the statements and no innovation to this category of the applied semi-structured interview.

The data collection effort was also carried out through semi-structured individual interviews with the municipal managers (secretaries and managers), for which authorization was required from both the municipal manager and the person responsible at the time by the Municipal Secretariat of Production, Environment, and Cooperatives from the municipality of Gurupi-TO. Once the authorizations were obtained, it was time to contact by telephone or in-person (considering the availability of the participant) with the former managers who directed the municipal public policy between 2013 - 2017, explaining the research objectives, and the who agreed to participate, a date was scheduled for TCLE collection and semistructured interview, which were conducted with 03 (three) former managers and 01 (one) director, with an average duration of 35 minutes, being identified by G1, G2, G3 and G4 to preserve the confidentiality of identities and information. The interviews were recorded and later transcribed for analysis.

From the data collection, these were analyzed through Content Analysis, with the formulation of categories which explain the findings of the specific objectives set and found together with the description of public policy evaluated and the final conclusions of the research through the interpretation that required in this methodological technique.

It is important to emphasize that for the purpose of this research, the sequence of steps was adopted to perform the content analysis recommended by Bardin (2016), in view of its wide use and popularity in qualitative research analysis, as they came to the researcher, that is, the analysis grid was open type.

The results were obtained from the content analysis of the documental and bibliographic research and the interviews with the social actors in the total of 17 actors, being 04 former managers and 13 beneficiaries associated with the associative/cooperative organizations in the municipality of Gurupi-TO.

Now the results of the work are presented.

III. RESULTS AND DISCUSSION

Based on the methodology employed, the institutional dynamics of the municipal public policy cycle of fostering cooperativism between 2013 and 2017 were qualitatively analyzed and evaluated in order to identify the challenges and propose guidelines for the consolidation of municipal management of the public policy of fostering cooperativism existing in Gurupi-TO.

Evaluation is the phase of the public policy cycle where the implementation process and public policy

performance are examined to better understand the state of the policy and the level of reduction of the problem that generated it.

The present work privileged an evaluation with political connotation, according to (SECCHI, 2015), considering the aspects such as: the legitimacy of the elaboration process of the actions, the perception of the beneficiaries of the public policy with the indication of the benefits and impacts, and the participation of the actors in the conduct of public policy to foster cooperativism.

With regard to the legitimacy of the process of elaborating the actions, G3 and G4 pointed to the existence and relevance of the Sustainable Rural Development Council in which the existing problems faced by the management as well as the producers/beneficiaries of the existing policy are discussed and confirmed by the beneficiary. B2, note: The Sustainable Rural Development Council, which was also created already in this administration, we, for example, analyzes the actions developed and those that did not work very well this year what we may be doing to improve (...); Listening to them, the Associations are represented on the Board and have participated in the meetings, we make a planning with their participation, it is not a planning that comes only from the Board (G4). It has the relevant entities that participate in the actions developed as the Rural Development Council (G3).

(...) We have a Sustainable Rural Development Council that I think is the one that takes care of these actions the most, determines (B2).

The statements demonstrate the existence of a legitimate and evenly organized channel for deliberations concerning existing public policy, allowing the influence of citizens in the decisions taken.

Regarding the perception of the benefits and impacts generated by the existing public policy to foster cooperativism, the mentioned benefits are: improvement of work and income through governmental product purchase programs, improvement in productivity through technical assistance and support with infrastructure with the improvement of the roads, the offer of transportation of products for sale and of the inputs. Such benefits and impacts are thus reported by the beneficiaries.

We had a lot of encouragement from the city in both beekeeping and agriculture (...); the city gave beekeeping courses, gave some material, gave the boxes, overalls, was 4 boxes for each producer, that's where the production of honey began in the Gurupi region

(...); Look they [the management] always give us

technical assistance, the technician goes there to help in the planting, in the preparation of the land (B1).

Has the rural development program through family farming to assist us in the case of tillage. We have the driving [trans- portation] to pick up our products here because we sell it to City Hall for school lunches (B2).

We have to benefit the fair of the producer that is very good to sell (B3).

The benefits we have is that with the fair increased the producer's income, improved a lot (B4). We have courses to improve production and this fair is too good (B5).

She [the management] tidying up the roads when she has to, sending the machines to the railings, throwing limestone, that's very good for us (B6).

The fairs came at the right time, so we could sell the products from the farm (B7). Increase income because we start selling more at fairs and for school meals (B8).

They bring tractors to help prepare the land and the roads, send cars to dispatch the goods to schools and fairs (B9). She [management] and the tractors to harrow the land, gives us a lot of support and benefit (B10).

They [management] give the tractor, the bus to pick up and take us, bridge and tidy up the roads (B11). We have a tractor and bus to help us (B12).

Direct purchase greatly improved our income, tractors at the time of planting is very good to help with planting (B13).

Former managers also report on the benefits of existing policy

(...) Today the result we have here is an organized fair that happens 3 times a week (G1).

(...) public policies, for example, of direct (purchase), with a simultaneous donation, of government purchases by the education department itself, were at least 30% of the school meals it has to come from family farming origin then these public policies they exist here (...) (G2).

(...) mechanized patrol was an important acquisition to promote local production, management offers the operator of the machine, fuel all to make life easier for the small producer (G3).

(...) producers today they receive support from soil preparation, guidance, courses, beekeeping, organic farming, and various other costs even of NCR (right rural business), learn how to plan their production, until the time to market, they have logistical support, three fairs were created for them [beneficiary] (G4).

The statements above show that the existing policy generates benefits and consequently positively impacts the lives of these beneficiaries, or better, provides a better quality of life. Therefore, it is noticeable the progress in relation to the effects of public policy analyzed as an alternative in solving the social problem related to labor supply and income of this portion of the population, namely family farming.

Regarding the participation of actors in the conduct of politics, most expressed their freedom to exercise their participation, speaking, listening, giving suggestions in collective deliberations, following the testimonials.

Many times they [managers] already get the project ready, present and guide us to participate because it is good for us. They often set up meetings, the association invites staff and often they [beneficiaries] do not go (...); Management whenever they have something to do they invite and participate and most producers only listen (B1). Whenever you are meeting with us, I always participate (...) (B2).

I always talk and sometimes they ignore me because I don't come to meetings to be quiet because if I don't talk they won't know what we are feeling or needing (B3).

Sometimes we have a meeting, yes, we participate (...) (B4).

I have attended some meetings, but I am not talking much, just listening (B5). Whenever you have a meeting, it is very good and helpful (B6).

The city hall has frequent meetings, had one (last) month and I have participated (B7). They always have meetings with us, there are some that I went to and some not (B8).

For this criterion, according to Tenório (2010, p.6) is defined as: "endowed with information and with free access to channels of deliberation, any individual (citizen) or organization is able to influence decisions taken through the deliberative process".

Therefore, the above statements show the importance of people's participation in the pursuit of their rights, the more people participate, the more they seek knowledge of their rights and duties, but without acting, it is difficult to improve the quality of life in all sectors. , whether at work, in education or in health.

In the semi-structured interviews conducted with both actors, they were asked: "On a scale of 1 to 5, being: 1- bad; 2- regular; 3-good; 4- Very good and 5-Excellent, what would be your assessment of the existing policy.

The result of the evaluation concludes that the interviewed audience was divided in the result, and 52.93% considered Gurupi-TO's policy of fostering cooperativism satisfactory and 41.18% considered it fair (poor to fair).), except for aspects of the policy to be refined.

I think it should improve communication between managers and producers because many meetings are scheduled and city hall staff do not go (B1). We have to have a better commitment to implement CEASA for us, it would be an incentive to produce and sell more (B3). Management could follow associations more closely and see how they work and need help improving (B5).

Improve the roads (B6 / B7 / B8 / B12 and B13). In the perception of former managers

The policy needs to have continuity if with each management you have an interruption you have a return to the past, then the motivation, everything you do has to have a sequence, persistence, you have to persevere because if you suffer interruption you have a setback (G1).

(...)the culture of cooperation it has to be excellent for Gurupi and region, now today it is not excellent so we have an opportunity to advocate a different culture and then I believe the secretariat itself, the work done will make it possible for us to become excellent that today I see as insipient that people do not talk, is shy, people, in fact, when you talk about a culture of cooperativism people, they tarnish that old image of cooperative that did not work in our region, we need to have an instrumentalizing public policy, now this is a big challenge because not everyone wants the organized and structured production system (G2)

(...)managers have no affinity for working with the cooperative side. There is no director of cooperativism here. So how do you promote this if you don't have people in a position to work. This is how putting people in the right place will develop the right things. Then you will put the wrong people they will not develop. The secretaries here are politicians, which is the most ridiculous thing I've ever seen, this should be a technical position (G3).

We still have much to improve on this issue of cooperativism and make the population and the productive classes understand the importance of cooperativism for the social and economic development of the region. Our advantage at the moment is that we have a manager with this vision aimed at encouraging cooperativism (G4).

Among the aspects mentioned by the interviewees for the improvement of existing public policy are: communication between management and beneficiaries, infrastructure, monitoring of beneficiary associations, continuity of actions in succession between managements, education and culture for the improvement of local cooperativism and appointment of managers and technical servants trained to develop local **cooperativism**.

Criterion	Description
The legitimacy of the process	The functioning of the Municipal Council for Rural Development, its equal
of elaboration of actions	formation with society, has an impact on the legitimation of the deliberative
	process of the existing public policy.
Perception of benefits and	Some of the benefits mentioned by the interviewees were: investment in road
impacts generated	infrastructure, technical assistance for producers, mechanized patrol for tillage,
	provision of free public transport by producers and production; direct purchase
	and for school meals of the production, generating impact in the improvement of
	the work and increase in the income of the producers.
Ctalashaldan nantisination in	There are a desire for dame to proticize to an alive listening and sining
Stakeholder participation in	They expressed their freedom to participate, speaking, listening and giving
policymaking	suggestions in collective deliberations, with the possibility of compliance with
	management.

Table.6: Summary of Public Policy Assessment from the actors' point of view

Source: Research data, 2018.

The existing policy is directed to the development of local production from family farming the beneficiary public is concentrated in the formation of local associations that have representatives before the Municipal Council of Rural development as well as promotes the intermediation of municipal public management actions for members, providing positive impacts on job generation and increased family income.

Therefore, the municipal public policy for cooperativism in Gurupi-TO based on the perception of

public managers, leaders and beneficiaries can be assessed as partially satisfactory since their idealization and conduction are guided in Legitimacy of the actions developed which are decided by collective deliberation in Council formed for this purpose, being this sphere constituted in a joint form between public actors, beneficiaries and organised civil society and the Participation of beneficiaries.

On the conduct of public policy was mentioned by the beneficiaries that participation took place freely and

without coercion, despite the caveat that not all manifestations and requests are not accepted by the municipal management, since it is up to this Decide, based on discretion, which actions are really necessary at the lowest cost.

As for the benefits and impacts promoted by the policy analyzed, they consist of most of the beneficiaries ' opinions, in infrastructure actions that enable local production from family farming to generate positive impacts and Relevant in working and income conditions and consequently in improving the quality of life of the beneficiaries, as shown in the recurrent literature.

Tem- Whether as challenges to be faced by the management of public policy: the consolidation of the effectiveness of the public policy of fostering cooperativism through continuous actions of cooperative education and culture, maintenance of a public management directed by Skilled actors and governmental and institutional commitment to the consolidation of rural cooperatives, in particular covering activities of family farming.

Regarding the improvement of communication channels between management and beneficiaries, the dissemination of actions and deliberations as well as the effective participation of beneficiaries in the management of public policy are issues of collective deliberation and that in the sessions both Actors can manifest and in collective consensus analyze what best meets the needs.

Therefore, it is understood that the consolidation of public policy management to promote cooperativism through the analyzed indicators can be effected through the editing of municipal law that regulates cooperativism and the actions developed by Municipal management as a strategic tool in promoting the economic, social and political strengthening of the beneficiaries of the municipal policy of fostering cooperative activism.

IV. CONCLUSION

The main objective of this paper is to analyze the institutional dynamics of the municipal public policy of fostering cooperativism, between 2013 and 2017, in the municipality of Gurupi-TO, specifically to qualitatively evaluate the institutional dynamics of the municipal public policy for cooperativism based on perception of public managers, managers and beneficiaries regarding the qualitative performance of municipal public policy and identify the challenges and propose guidelines for the consolidation of public policy management to foster cooperativism in the municipality of Gurupi-TO.

With the interpretation and inference from the semistructured interviews, it was possible to evaluate the qualitative performance of municipal public policy through political connotation indicators (SECCHI, 2015) that the existing policy of fostering indicating cooperativism is satisfactory, however, it needs to improve the channels of cooperation communication between the management and the beneficiaries, and monitoring of the beneficiary infrastructure associations / cooperatives, which can happen through the consolidation of a legal instrument that can guarantee the continuity of the actions in the succession of the municipal administrations, to effect the education and culture for the improvement of the local cooperativism and enable the appointment of managers and technical servants trained to develop local cooperativism.

Regarding the challenges and possible guidelines for the consolidation of public policy management to foster cooperativism in the municipality of Gurupi-TO, the following challenges can be seen: the effectiveness of public policy for fostering cooperativism through continuous actions of cooperative education and culture, maintenance from a public management directed by trained actors and governmental and institutional commitment to the consolidation of rural cooperatives, especially covering family farming activities.

With regard to the objective that was outlined this was achieved by offering subsidies for the resolution of the initial problem (how the institutional dynamics of the municipal public policy of cooperativism contributes to the consolidation of cooperativism In the municipality of Gurupi-TO? What are the challenges and possibilities of managing public policies and cooperativism at the local level?)

It is important to emphasize that public policy for the promotion of cooperativism in Gurupi-To promotes important actions to improve the quality of life in rural areas, especially for small producers who develop their agricultural activities In the collective (settlements) and family scope, and as members of local associations declared in most of the speeches that know the cooperativism. However, the form of organization and realization of production is exercised in a manual way with the help of public management in the increase of production and the intellectual work is guided by the organization to which they belong, characterizing selfmanagement and equalling to popular cooperatives (CANÇADO, 2005).

In the course of the research, it was possible to classify the organizations of the beneficiaries of the public policy of fostering cooperativism as popular classes less favored in situations of unemployment and social exclusion, which adds them even more to the class of popular cooperatives.

Public actions, developed in favor of beneficiaries with the supply of means of production, also constitute another element that is present in the organizations of family farmers.

The public policy analyzed rescues the role of the State, in this case, the municipality of Gurupi-TO, as an inducer of the economic process, boosting the economic and social responses to the claims of the beneficiaries, namely, the family farmers.

The management of public policy analyzed emphasizes the direct creation of work opportunities for organized workers, providing social emancipation, guaranteeing citizenship and social inclusion.

With these woven considerations, it was possible to highlight elements that can contribute to the consolidation of public policy to promote cooperativism in Gurupi-TO through the elaboration of guidelines, objectives and instruments capable of developing Management strategies in conducting the existing public policy with the purpose of implementing skilled human resources aimed at improving the rural population living in family farming.

Thus, it can be affirmed that despite the challenges listed, the promotion of cooperativism promotes relevant influence and possibility in the process of social inclusion not only in the pursuit of economic growth but also as the social and political strengthening of Beneficiaries of the municipal policy of fostering cooperativism.

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Industrial Urea Process – Simulation and Validation

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Abstract— Due to a variety of applications, there is an ever-increasing demand for urea and subsequently its production process remains a popular research topic. In the current climate however, studies for solving industrial challenges and the search for a more sustainable process design are required. Previous works concerning simulation of industrial scale production have been developed, however almost none of them are reproducible nor consider urea quality parameters. The severe process operating conditions and the lack of biuret information are the main challenges in modeling and simulating such complex process. This paper proposes a systematic approach for simulation and validation of the current urea production process. Industrial data from the largest operational urea facility in Latin America are used. Simulation is validated against more than 30 industrial parameters. Deviation of less than 6% is obtained for mass composition and less than 8% for other variables considered. This work is a key point for retrofit studies and design of new processes models.

Keywords—industrial data validation, industrial process simulation, urea process.

I. INTRODUCTION

Demand for urea is constantly increasing. Widely used as nitrogen-based fertilizer, additive in animal feed and in cosmetic industries, urea has recently taken a leading role reducing NO_X emissions for diesel engines [1].

There are a number of reported studies ([2]; [3]; [4]; [5]; [6]; [7]; [8]; [9]; [10]; [11] and [12]) on mathematical modeling and/or simulation synthesis section - the reaction section. Nevertheless, there is still a range of restrictions for simulating such a complex process.

A mathematical model for synthesis section was developed by [6]. The thermodynamic framework was based on Wilson and ideal gas equations. Inlet and outlet temperatures and mass fractions in the reactor and Scrubber outlet were compared to industrial data and varied from -6.9% to 2.6%. Zhang et al. (2005) simulated also the high synthesis loop. Extended electrolytic UNIQUAC equation and perturbed-hard-sphere were employed for thermodynamic modeling. Reactor and stripper outlet mass fractions varied from 2.7% to 9.7% when compared to industrial data. Rasheed (2011) simulated the urea reactor applying SR-POLAR equation for thermodynamic modelling and proposed a power law kinetic for ammonium carbamate and urea formation. Deviations from industrial data were reported as less than 5.0% for liquid composition in the reactor outlet. Zendehboudi et al. (2014) proposed a mathematical model for urea reactor based in a UNIQUAC approach. When compared to industrial data, deviation less than 2.3% for the liquid outlet stream is obtained. Edrisi et al. (2016) simulated the entire urea plant using SR-POLAR for thermodynamic modeling. Industrial data deviation and biuret reaction weer not reported. Chinda et al. (2017) simulated the synthesis loop through SR-POLAR basis and proposed a power law kinetic model for ammonium carbamate, urea and biuret formation. Deviations from industrial data were less than 6%. Jeenchay et al. (2018) simulated urea process using NRTL for thermodynamic approach and no validation was presented.

The main difficulty in simulating urea process is still the availability of physical-chemical data in the range of conditions observed along the entire process. An important quality parameter for urea as final product, the biuret content, is lacking in available data at relevant process conditions. Just Hamidipour et al. (2005), Zendehboudi et al. (2014) and Chinda et al. (2017) had considered biuret reaction in synthesis section. Besides this, further studies using the developed simulation as basis are only presented in [12], as an economic analysis of the process. A validated simulation is a reliable way to identify industrial bottlenecks in the current urea process and a key point for studies aiming in promoting innovation and technology breakthroughs for industries.

This paper proposes a systematic approach for simulating and validating urea process. For this, industrial data from the largest operational urea facility in Latin America and biuret reaction are considered. Employed methodology is presented in three steps: *Step 1 - Industrial data collection; Step 2 – Process Simulation, Step 3 – Process validation.*

In order to guarantee reproducibility for other urea industrial cases, all steps are performed using commercial software and the main simulation parameters are presented.

II. METHODOLOGY

The methodology presented here is hierarchical and is composed of three steps. Each step can be used independently given that information from previous step is available.

Step 1.1. Industrial Data Collection

At this step, all industrial data (flows, compositions, temperatures and pressures) are collected. The intention of this step is to obtain enough information to model the process and validate the simulation. Industries usually have their own agenda for collecting data concerning stream compositions depending on the analytical equipment used and the laboratory procedures and schedules.

It is important to collect data from all available composition analyzers and flowmeters in the plant in order to validate the mass balance of the simulation. In order to validate the energy balance, it is necessary to collect data from pressure and temperature indicators. It is convenient to have these data from points as close as possible to the composition analyzers, such that flow rates can be estimated where necessary.

Step 2. Process Simulation

The steady state simulation proposed for urea process is built in AspenPlus[®]. Ammonium carbamate, urea and biuret reactions are considered, given that urea is formed only in liquid phase. Industrial data do not consider the ammonium carbamate mass fraction. Therefore, it was assumed that 99.0% of CO_2 reacts to form ammonium carbamate, according to [8] and [13].

Thermodynamic modeling is based on SR-POLAR equation, recommended for highly non-ideal systems at high temperatures and pressures and for both non-polar and high polar components, according to [14], [15] and [16]. Kinetic equations are taken from [10].

Pure component data and binary interaction parameters of NH₃, CO₂, H₂O, urea, ammonium carbamate, N₂, O₂ and H₂ are taken from the AspenPlus database. Biuret pure component data is obtained from NIST (National Institute of Standards and Technology) and DECHEMA (Gesellschaft für Chemische Technik und Biotechnologie) database. In terms of vapor pressure and binary interaction parameters, biuret is assigned the same parameters are urea. This step results in detailed mass and energy balance data and the properties of all streams in the flowsheet.

Step 3. Process Validation

The main objective of this step is to perform the validation of the simulation using the data collected in Step 1. Thus, it is necessary to process all the industrial data in order to evaluate which data can be used to validate the simulation, since industrial data may present some fluctuation during operation. All the plant data collection, performed in Step 1, should be taken at the same time or, at least, on the same day. This is a point to be highlighted, given that inter-connected industrial plants do not operated at steady-state and it is important to ensure stable operating points are used in the data treatment. In a urea production complex, it is possible for example that the ammonia unit is shut-down before the urea plant experiences deviations due to upstream process e.g. natural gas/residue asphaltic processing. It is less important to understand the nature of the up-streams deviations, as long as it is possible to identify deviations in the given process data in order to rule them out of validation process. For this, an analysis with the variation coefficient is performed with the capacity data taken each 4 hours. Coefficient of variation with values less than 1.5% are considered to represent data that are not varying significantly [10] and, therefore, indicate a steady-state condition in the process. These two procedures can guarantee that data used for validation correspond to a stable and continuous operation. Finally, the validation process can be performed calculating the deviation between industrial experimental data and data obtained from the simulation. Thus, this step can be described as: (a) from the processed data from Step 1, select only those

ones that were taken on the same day. (b) collect production capacity data. (c) calculate arithmetic means, sample standard deviation and coefficient of variation using the production capacity data. (d) eliminate data with variation coefficient greater than 1.5%. (e) evaluate the deviation between industrial experimental data and data obtained from the simulation.

III. RESULTS AND DISCUSSION

The process unit analyzed produces 2000 ton/day of urea through Stamicarbon technology and can be divided into five blocks: synthesis, evaporation, prilling, desorption & hydrolysis and recirculation. A simple block diagram of the process can be seen in *Fig. 1*.



Fig.1 - Simplified block diagram for industrial urea production.

The main equipment in the synthesis section are: pool condenser, reactor, scrubber and stripper. This section is for ammonium carbamate and urea responsible production. After leaving the synthesis section, the liquid product from the stripper is sent to recirculation. This section is responsible for removing the ammonium carbamate present in the solution through its decomposition in NH3 and CO2, besides condensing NH3 and CO₂ into ammonium carbamate and recycle them back to the synthesis section. The recirculation section consists in: rectifying column and its respective heaters, condensers and an atmospheric flash tank. The production from the recirculation section is fed to the evaporation section in order to concentrate up the urea solution before it is prilled. This section operates under vacuum, which means a big part of water, ammonia and carbon dioxide are removed from the solution. The evaporation section consists mainly of three evaporators and its respective heaters. The last section is called desorption and hydrolysis and consists in an adsorber and two desorber units. The main function of this section is to recovery NH₃, CO₂ and urea present in the water that comes from the Evaporation section.

Step 1. Industrial data collection

Industrial data collection was performed as described at Step 1. Thus, mass composition analyzers and flowmeters were identified in the industrial flowsheet. Further, pressure and temperature indicators closest to mass composition analyzers were also identified. Process flowsheet and data point collection can be seen in *Fig. 2* and *Fig. 3*. Mass composition analyzers are indicated in blue, flowmeters in green, pressure indicators in yellow and temperature indicators in red. In order to facilitate the sequence of processing units, TAG order is based on section unit (S-Synthesis; E- Evaporation; P-Prilling; D&H-Desorption & Hydrolysis; R-Recirculation) and flow streams (numerical sequence).

Step 2. Process simulation

Process simulation was performed as described in Step 2. From AspenPlus model library: urea reactor was modeled as a sequence of CSTRs in series; pool condenser using R-Stoic; stripper, scrubber, rectifying column, absorber, desorbers and hydrolyzers as RadFrac columns; main heat exchangers, condenser and evaporator T-5 were modeled as Heat-X; evaporators T-6 and T-7 were modeled as Vdrum. List of the main equipment and the correspondent AspenPlus model library used for simulation can be seen in *Table 1*.

Table 1 - Model library from AspenPlus.

TAG	Unit	Model	TAG	Unit	Model
S-2	Stripper	RadFrac	R-7	Rectifying	RadFrac
S-4	Pool	R-Stoic	R-8	Condenser	Heat-X
S-5	Reactor	RCST R	R-12	Absorber	RadFrac
S-6	Scrubber	RadFrac	Н& D-17	Desorber1	RadFrac
E-24	Condenser	Heat-X	H& D-18	Hydrolyzer	RadFrac
E-25	Evaporator	V-drum	H& D-19	Desorber2	RadFrac
E-26	Absorber	RadFrac			

Step 3. Process Validation

Data from a total of 270 operational days were provided by an industrial urea plant for validating the simulation. As described at Step 3(a), in order to guarantee consistency to the analysis, all the experimental points should be taken in the same operational condition. Only 32 operational data points (days) met this criterion. (b) Production capacity from this data was taken in intervals of 4 hours. (c) Arithmetic mean (AM), sample standard deviation (SSD) and variation coefficient (VC) were calculated. (d) Production capacity data with coefficient of variation with values lower than 1.5% were selected. Table 2 presents the data used and obtained at this step for points with VC lower than 1.5%. The production capacity range varied from 86.45% to 98.21%. (e) Validation of the simulation was performed calculating the difference between industrial and simulated data and dividing it per industrial data.



Fig.2 - Process flowsheet and data point collection for Synthesis, Recirculation and Hydrolysis & Desorption sections.

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Fig.3 - Process flowsheet and data point collection for Evaporation section.

Poin t	AM (%)	SS D	VC (%)	Poin t	AM (%)	SS D	VC (%)
A	86.4 5	0.39	0.45	G	95.6 6	0.14	0.1 5
В	86.7 0	0.39	0.45	Н	95.8 7	0.29	0.3 0
С	87.0 6	1.05	1.21	I	96.6 2	0.63	0.6 5
D	87.3 3	0.07	0.08	J	98.1 3	0.11	0.1 1
Е	87.3 7	0.52	0.60	К	98.2 1	0.49	0.4 2
F	87.4 1	0.10	0.11				

 Table 2 - Statistical Analyses with capacity planta data.

Equations used for process validation step, can be seen in *Table A* Appendix A. *Fig. 4* shows the comparison of mass fraction for each component in the outlet of the reactor (R) and the stripper (S). As it can be seen there is a great accordance between industrial (IND) and simulation (SIM) results.



Fig.4 - Comparison between mass fraction composition in the outlet of the reactor and the liquid outlet of stripper.

A total of 37 different process parameters were evaluated, among them stream temperature, steam generation, mass fraction for CO₂, NH₃, urea, H₂O and biuret, CO₂ conversion in the reactor and stripper efficiency. For all mass fractions evaluated, the deviation between the value predicted by the simulation and the real value obtained from industrial data were less than 6%, while for steam generation and stream temperatures the deviation was less than 8%. A selected list of variables and the comparative deviations with other similar works are given in *Table 3*. As it can be se seen for reactor and stripper results were very close to reported data from literature.

Table 3 - Absolute average deviation for evaluated point					
Equipment	Parameter	This work	Lite- rature	Ref.	
Pool Condenser	LP steam flow	7.56%	-	-	
	Urea MF	0.89%	-	-	
	$CO_2 MF$	5.95%	8.84%	[6]	
	NH ₃ MF	4.33%	9.76%	[24]	
	Urea MF	3.38%	2.65%	[5]	

Condenser	Urea MF	0.89%	-	-
	$CO_2 MF$	5.95%	8.84%	[6]
-	NH_3MF	4.33%	9.76%	[24]
	Urea MF	3.38%	2.65%	[5]
Deceter	H ₂ O MF	4.38%	2.71%	[24]
Reactor	Biuret content	4.96%	-	-
	CO ₂ conversion	2.41%	0.44%	[3]
	N/C ratio	4.83%	6.90%	[5]
	H ₂ O /urea ratio	6.18%	-	-
Scrubber	T of the liquid outlet	4.77%	-	-
	$CO_2 MF$	5.00%	5.10%	[24]
	NH ₃ MF	6.12%	4.14%	[24]
-	urea MF	2.93%	0.20%	[4]
-	H ₂ O MF	4.32%	4.96%	[24]
-	Biuret content 4.969		-	-
Stripper	Efficiency	2.53%	-	-
	N/C	2.42%	-	-
	H/urea	6.50%	-	-
	Steam flow	4.27%	-	-
	T of liq outlet	6.16%	-	-
	Urea production	3.56%	-	-
	Urea MF	1.52%	-	-
Rectfying column	H ₂ O MF	3.04%	-	-
	Biuret content	3.18%	-	-
	Urea MF	4.17%	-	-
Urea tank	H ₂ O MF	4.83%	-	-
vuilly	Biuret content	3.82%	-	-
Final	H ₂ O MF	6,91%	-	-
product	Biuret content	5,73%	-	-
Rofluy	$CO_2 MF$	4.34%	-	-
condensate	NH_3MF	4.89%	-	-
tank	urea MF	2.58%	-	-
	CO_2MF	4.31%	-	-
Ammonia	NH ₃ MF	4.55%	-	-
water tank				
water tunin	Urea MF	3.49%	-	-

IV. CONCLUSION

A simulation for all sections of urea production is developed and validated against more than 30 industrial parameters using a total of 32 processed daily operations data. Good consistency between simulation results and industrial data is presented, being that a deviation of less than 6% is obtained for mass composition and less than 8% for other variables considered. Reproducibility of other industrial urea plants is therefore possible and permits using it for reliable retrofit studies and design of new processes models

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APPENDIX A

Table A - Equations used in validation step.

Simple Arithmetic Average	$\overline{x} = \sum_{i=n}^{n} x_i$
Sample Standard Deviation	$s = \sqrt{\frac{1}{n-1}\sum_{i=n}^{n} (x_i - \overline{x})^2}$
Coefficient Of Variation	$Cv = \frac{s}{\overline{x}}$
Deviation between simulated and industrial data	$deviation(\%) = \frac{industrialdata - simulationdata}{industrialdata} \times 100$
CO ₂ conversion	$\chi_{CO2} = \frac{urea}{urea + 1,365 \times CO_2}$
N/C relation	$\frac{NH_3}{CO_2} = \frac{2 \times urea + 3.53 \times NH_3}{urea + 1.365 \times CO_2}$
H/U relation	$\frac{H_2O}{urea} = \frac{H_2O \times 3,33}{urea}$
Stripper efficiency	$\eta = \frac{urea}{urea + 1,765 \times NH_3}$
Biuret content	$biuretcontent = \frac{biuretmass}{biuretmass + ureamass[kg]}$

Bibliometric Analysis on "Quality in Health Care" Luciana Iglesias de CastroSilva¹, Denise Cristina de Oliveira Nascimento²

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Abstract— This study has the purpose of performing a systematic review of literature on quality in health care as a premise in quality management, oriented to patient satisfaction, favoring the service of the surgical room. The methodology adopted by this project relies on the model of text search on the web, proposed by Costa (2010), known as webibliomining. To this end, a search was made in the database of abstracts and citations of scientific literature, Scielo. The keywords applied were "peri-surgical care", "quality in nursing care", "presurgical visit", and "quality in surgical nursing care". The study period was from November 2018 to March 2019. Results indicated that the largest number of publications occurred in 2012, 2014, and 2016. A number of contributions and methods were found from the starting point, for example, important attributes regarding caring and the care referenced by the authors (quality in care, safety, and guarantee), biopsychosocial aspects with respect to the theoretical framework contributing as important management strategies for changes in patient care with quality. A significant aspect in the analyses collected was that scientific productions oriented to aspects of personal satisfaction of surgical patients, with regard to inherent aspects, are poorly referenced, which motivates the study so as to contribute to future researches by the scientific community.

Keywords—Quality in Care, Health Services, Satisfaction, Bibliometrics.

I. INTRODUCTION

Quality has been mentioned in all aspects of service provision as a very important and critical issue in organizations. Having an effective role in the articulation of hospital structures, which aim at assisting their clients in a holistic way, this attribute demands effective processes with management tools in a systematized way so as to improve their performance.

As such, Paranaguá and Moura (2016) state that service provision in the healthcare sphere faces adversities to meet the demands of patients and family members in the provision of quality care. To accomplish this quality, health professionals must present systems and work processes with a focus on continuous health care enhancement, identifying the factors involved and implementing mechanisms to evaluate and quantify the quality levels provided.

Hospitals play a major role in the social sector, where, in the view of society, they prove to be decisive. Among these relationships, care services aimed at managing processes and relationships. In this manner, a nursing diagnosis is a valuable tool to guide the selection of care, implementation, as well as planning, thereby favoring teaching, scientific research and, lastly, care plan (NOVAES; TORRES; OLIVA, 2015). The need to have satisfied patients in a hospital environment means that quality is an important condition for care. Hence, in the hospital field of service provision, regulatory bodies recognize satisfaction as an indicator of utmost importance (PENA 2012).

As stated by Sena, Nascimento, and Maia (2013), in presurgical patient care, the nursing staff is responsible for providing care to their emotional and physical needs, orientation to surgical procedures, and evaluation. Such conditions favor later phases, like post-surgery, reducing surgical risks, thereby preventing complications. Dissatisfaction is commonly related to the inadequate presurgical stage.

Molina (2016) points out that understanding patient profiles in hospitals in order to establish and set priorities and plan for quality management is of great relevance. In turn, Amorim et al. (2014) stress that, as regards the surgical patient, when the procedure is to be performed, the patient has feelings of uncertainty about the prognosis and fear about the procedure.

From this perspective, the goal of this study focuses on identifying the main attributes of health care from the perspective of scientific bases that deal with the theme "quality in health care", described in a number of articles that this work discusses with importance in the healthdisease process. For this reason, it was used the webibliomining method suggested by Costa (2010) for identifying the main attributes. The priority, within the hospital units, was to use the surgical room to compose this study, as it is a service of great amplitude and repercussion in the hospital field.

This method comprises a set of rules that allow composing the initial reference, adopting a way of analyzing different works and "different thinkers" related to the subject, in which, among others, the most relevant productions are refined. Jesus and Costa (2015) also report this type of search is generally linked to search engines, such as keywords, category, author, or title.

The adoption of the theme quality in health care determines a critical-reflexive and comprehensive instrument that considers some important variables, aspects, and factors to achieve a lasting path toward maintaining the health and well-being of a population in a practical and efficient manner.

Hence, the following questions arise for analysis along with the theme: is there an author who stands out with a larger number of publications? What is the most cited article? What are the peak production years? Is there a magazine in evidence on the subject? What is the origin of publication with the greatest impact factor? What is the language that emerges in a publication in searching for keywords? These questions are answered in the results of this article by means of the graphs and tables generated.

II. THEORETICAL FRAMEWORK

Considering health and privileging hospital services as being of great use in care, it is of utmost need that effective systems are linked to the care process so that more and more assistance provided can be seen as a management tool, with humanized and lasting enhancement. In this way, a care model called Systematization of Peri-Surgical Nursing Care (SPNC) contextualizes the participatory, comprehensive, individualized, documented, evaluated, and ongoing care (CASTELLANOS; JOUCLAS, 1990).

In the work of Pena (2012), it can be seen that, in the same line of the quality perspective, patient satisfaction is very important for this indicator to be effective in hospital care. Therefore, the reliability dimension is an important criterion in nursing care to represent satisfaction.

In an integrative way, the study by Rodrigues (2012) shows that the veracity regarding the understanding of how the patient feels and how he/she reports his/her satisfaction is important. In this connection, the premise function of the nursing staff is revealed as the most represented in the hospital staff. In this way, Guerreiro (2014) states that the Surgical Room is often considered a hostile and cold environment, which represents the separation and risk of imminent death. As the surgery approaches, it is common for patients to feel threatened not only by the unknown environment but also by all fears inherent to the surgery.

Santos (2016) points out that the United Nations, by means of the "Safe Surgery Saves Lives" program, aims, by this global mission, at increasing the standards of quality and safety of patients in the surgical room, as the number of deaths in surgical practices is significant.

This appraisal is significant for quality in health care, considering health is essential for survival and maintenance of life. The relevance of patient evaluation in health services should be valued since this enables to obtain a set of perceptions related to the assistance he/she receives. In this way, it is possible to acquire information that favors the organization of these services (PENA 2012).

Fonseca (2009) considers that, in hospital practices, the surgical block is perceived as being of great significance in the budget of organizations. In addition, the author mentions that, since the very beginning, nursing in the surgical center (SC) has had the premise of maintaining a safe, comfortable, and clean environment to perform surgeries.

III. METHODOLOGY

It was used the methodology recommended by Costa (2010), which describes a proposal for the definition of an initial starting group of bibliographic documents, which supports the performance of any scientific research based on the most expressive articles on a given theme, with the identification of authors who write on the subject, and the identification of the most relevant attributes found in such a study.

As such, it was adopted the webibliomining model proposed by Costa (2010) because of the type of search, exclusively online, which fits the proposal for the study. The method is called like that for representing a "refining" of texts on the Internet. This type of research is performed using a direct procedure of textual search by keyword, title or author.

Costa (2010) assumes the adoption of a set of rules to select the initial reference, in other words, older articles written by different authors, identifying the "different lines of thought" in the initial discussions; more recent articles by different authors, identifying the "different lines of thought" in the most recent discussions; articles with a higher degree of relevance in the database and articles with greater relevance for each of the more stressed production cycles, identifying which articles had greater significance during the peak moments of the theme under study.

Based on the results of this search, the 16 articles with relevance and pertinence to the theme were selected for the literature review. As there was a duplication of four articles in the refinement of interest, these were considered as a single finding; it was therefore considered a total of 16 articles because they were close to the theme of the study.

The research was conducted in the search system of articles indexed in the Scielo Database, accessed by means of the Capes Journal Portal, in order to identify and analyze what has been consolidated in the literature on the subject, from November 2018 to March 2019, with a view to selecting the initial reference of the bibliometric analysis.

The use of Scopus Elsevier database was not reported in the analysis because it resulted in some references very specific to surgical pathologies distant from the theme and the degree of satisfaction related to the results of surgical procedures, involving the final result of the intervention. *Scielo* research database showed more significant studies with strategic and relevant proximity to the theme.

In this study, the following keywords were selected: "perisurgical care", "quality in nursing care", "pre-surgical visit", and "quality in surgical nursing care". These words were searched in the *Scielo* and *Scielo Elsevier* databases by means of the *Portal de Periódicos da Capes* (Capes Journal Portal).

Therefore, bibliometrics was structured in the following way:

- Distribution of records by a basis of research;
- Survey of the production chronology from 2009 to 2019 (first trimester);
- Initial reference, with identification of journals (articles) with greater similarity, impact, significance with the theme;
- Surveys of the main attributes of quality of health care focused on nursing care in the surgical clinic.

All results of this analysis are presented in the next section.

IV. RESULTS AND DISCUSSION

At this stage, results of the search in the *Scielo* database are displayed, once the *Scielo* Elsevier database mentioned above did not help the search since it was not related to the theme of this study, which favored research focused on other diagnoses.

4.1 Distribution of Registers per Article

A total of 167 registers from the initial search were returned to the *Scielo* database, with the search restricted to the following filters: nursing, searching only for articles and the period between 2009 and 2019. From these 167, it was used 16 articles. The excluding criterion was the approach to the theme. Table 1 shows the quantification of the distribution of these articles by search terms, expressed in keywords.

THEME	FOUND	APPLIED
Quality in nursing care	115	3
Pre-surgical visit	5	4
Quality in surgical nursing care	12	6
Peri-surgical care	35	3
TOTAL	167	16

Table 1: Distribution of registers per keywords

Source: elaborated by the author (2019)

Given this quantification, the following can be seen in the keywords found: "Quality in nursing care", despite resulting in a large number of articles, only three were applied; on the other hand, in the search for "Pre-surgical visit", from five findings, three resulted; whereas "Quality in surgical nursing care" had a considerable use of half of 12 articles; lastly, "peri-surgical care" refined four articles from 35 found.

4.2 Survey of the Chronology of Production in a Time Frame between 2009 and 2019

In this section, as shown in Figure 1, it is approached the time frame with the number of articles equivalent to each year assigned in this research.



Fig.1: Number of articles published

Figure 1 shows the 16 articles with a time frame between 2009 and 2019. There were some more significant production cycles in the following base years: 2016, with four articles; 2014, with three articles; and 2012 and 2017, with two articles. In 2009, 2010, 2011, 2013, and 2018, only one article was found. In 2015 and 2019 (until the first trimester), there was no selection of articles.

4.3 Authors per Publication

Among the articles cited in this study, 51 authors were listed in alphabetical order in Table 2.

Table.2: Amount of publications per author

AUTHOR	N° OF
Action	PUBLICATIONS
Ana Paula Vilcinski Olivia	1
Anabela Maria Santos Coimbra Novo	1
Antonio Fernando Carneiro	51
Adnairdes Cabral de Sena	1
Airton Bagatini	11
Ana Elisa Bauer de Camargo e Silva	30
Ana Fátima Carvalho Fernandes	41
Ana Lúcia Queiroz Bezerra	29
Ana Maria Ribeiro Teixeira	45
Ana Paula Patola Guerrero	1
Ana Rosete Camargo Rodrigues Maia	1
Ana Vanessa Deffaccio Rodrigues	3
Anna Maria de Oliveira Salimena	44
Anna Paula Sousa Silva	5
Aparecida de Cássia Giani Peniche	25
Cristina Arreguy-Sena	76
Dagmar Williamowius Vituri	13
Eliane Regina Pereira do Nascimento	1
Elisiane Soares Novaes	4
Fabiane Cardia Salman	1
Gabriela Camargo Tobias	6
Getúlio de Oliveira Filho	44
Gisela Maria Schebella Souto de Moura	31

Source: Adapted from *Scielo* (2019)

Table.2: Amount of publications per author

AUTHOR	N° OF PUBLICATIONS
Isabela Fernanda Larios Fracarolli	4
João Henrique Silva	2
João Manoel Rodrigues de Melo	2

José Mariano de Moraes	6
Júlio Cezar Brandão	3
Karine Lorenzen Molina	1
Leonardo Secchin Canale	1
Lígia Fahl Fonseca	23
Luis Antonio dos Santos Diego	11
Marcelo da Silva Alves	79
Marcia Galan Perroca	33
Maria Conceição Lavinas Santos	6
Maria do Carmo Lourenço Haddad	46
Maricy Morbin Torres	4
Marisa Maria Rebelo Pereira Figueiredo	28
Marli Terezinha Oliveira Vannuchi	14
Marta Maria Melleiro	78
Mileide Morais Pena	12
Natália Assunção Branco	1
Patrícia Aron	7
Pricilla Cândido Alves	2
Priscila Fernandes Martins	14
Rosa Maria Pelegrini Fonseca	1
Selma Petra Chaves Sá	2
Thalita Gomes do Carmo	1
Thais Vasconcelos Amorim	6
Thatianny Tanferri de Brito Paranaguá	6
Willian Tiago de Oliveira	67

Source: Adapted from Scielo (2019)

Regarding the authors listed in Table 2, Marcelo da Silva Alves stands out for the highest number of publications, with 79 publications; his article mentioned in this study was "Systematized Care in Pre-Surgical Cardiac Surgery: Theory of Transpersonal Care from the Perspective of Nurses and Patients" (*Cuidado sistematizado no préoperatório cardíaco: teoria do cuidado transpessoal na perspectiva de enfermeiros e usuários*). Immediately after, there was Cristina Arreguy-Sena, with 78 papers, being the article of this author mentioned in this study the same of the author with the first prominence, both followed by the other authors listed.

4.4 Distribution per Language

In selected 16 articles on the basis of 167 articles found, it was verified that 13 articles are in Portuguese; two, in the Spanish language; and one, in English.

4.5 Origin of Publications

Table 3 shows the origins of the publications, indicating how many documents each one presents. The impact

factors of the Scientific Journal Rankings (SJR) are also displayed, as well as the citation impact per document.

From the Table, it can be analyzed the journals that published the articles used in this bibliometric analysis, which are eight in all. Among them, *Acta Paulista de Enfermagem*. stood out for the number of articles published and applied in this work, with four articles. The *Revista da Escola de Enfermagem da USP*, *Revista Gaúcha de* Enfermagem, Revista Brasileira de Enfermagem – REBEn, and Enfermería Global have each published two articles used in this work. Lastly, the Brazilian Journal of Anesthesiology and the Revista da Escola Anna Nery each presented one article used. In this research, one article belongs to a thesis published by the Escola Superior de Saúde, Instituto Politécnico de Setúbal, which is not part of the journals.

	IMPACT FA	CTOR	Nº OF ADTICLES	
ORIGIN OF PUBLICATIONS	SJR	Citation per doc.	N° OF ARTICLES	
Acta Paulista de. Enfermagem	0.432	0.809	4	
Revista da Escola de Enfermagem da USP	0.743	0.573	2	
Revista Gaúcha de Enfermagem	0.543	0.460	2	
Revista Brasileira de Enfermagem (REBEn)	0.634	0.850	2	
Enfermería Global	0.2516	0.167	2	
Millenium–Journal of Education, Technologies, and Health	0.948	1.499	1	
Brazilian Journal of Anesthesiology	0.320	0.735	1	
Revista da Escola de Enfermagem Anna Nery	0.999	0.500	1	
Escola Superior de Saúde Instituto Politécnico de Setúbal	-	-	1	

Table.3: Journals highlighted per publication

Source: Adapted from Scielo (2019)

Table 3 also shows that the journal that is most prominent per impact factor regarding the Scientific Journal Ranking (SJR) is the *Revista da Escola de Enfermagem Anna Nery*, with 0.999, followed by the Millenium – Journal of Education, Technologies, and Health, with 0.948, and the others. With regard to the citation impact per document, the Millenium – Journal of Education, Technologies, and Health is distinguished, with 1.499, being followed by the *Revista Brasileira de Enfermagem – REBEn*, with 0.850.

4.6 Articles Applied

Chart 1 illustrates the starting point for the bibliographic research, consisting of 16 articles on "Quality in health care".

TITLE	AUTHORS	CONTEXT	YEAR	CITATIO NS
		Quality in Nursing Care		
<i>Grau de satisfação de usuários de um hospital privado</i> (Degree of Satisfaction of Patients of a Private Hospital)	M ileide M orais Pena; M arta M aria M elleiro.	This article focuses on understanding the degree of satisfaction of patients in a private hospital and the factors involved in this satisfaction, based on the Parasuraman, Zeithaml, and Berry models, by means of the descriptive exploratory method of quantitative approach. As such, the study provided a multisectoral diagnosis, assisting the managers of the institution in reviewing care and management processes.	2012	15

A satisfação dos pacientes segundo a forma de internação em hospital universitário (Patient Satisfaction According to the Admission Process to a University Hospital)	Karine Lorenzen Molina; Gisela Maria Schebella Souto de Moura.	This study aimed at analyzing the patient satisfaction, based on the admission to a university hospital, applying the cross-sectional study method conducted in 366 patients over 18 years of age. The quality "assistance provided to patients" was evidenced in a high level of satisfaction, highlighting the nursing category among other groups.	2016	1
Necessidades de cuidados: o olhar do paciente e da equipe de enfermagem (Care Needs: Patient and Nursing Staff Perspective)	Priscila Fernandes Martins; Marcia Galan Perroca.	This article sought to compare care needs from the patient and nursing staff perspective and investigate sociodemographic factors associated with these perceptions by means of a comparative study of a hospital institution in the countryside of São Paulo State, Brazil. The authors were patients and nursing professionals. It was noticed an alignment in the care focused on holistic assistance to patients and nursing staff.	2017	0

Chart 1: Starting point

TITLE	AUTHORS	CONTEXT	YEAR	CITATIONS		
	Pre-surgical Visit					
Cuidado sistematizado em pré-operatório cardíaco: Teoria do Cuidado Transpessoal na perspectiva de enfermeiros e usuários (Sy stematized Care in Cardiac Pre-Surgery: Theory of Transpersonal Care from the Nurse and Patient Viewpoint)	Thais Vasconselos Amorim; Cristina Arreguy-Sena; Marcelo da Silva Alves; Anna Maria de Oliveira Salimena.	A case study focused on the implementation of transpersonal care theory, between the nurse and the patient, on the pre-surgical visit. Convenience sampling, consisting of nurses and patients, was applied to the methodology. With regard to the results, the importance of the pre-surgical visit by patients and nurses was identified as something of great value.	2014	0		
Por detrás da máscara, um olhar que se preocupa: visita pré-operatória de enfermagem (Behind the Mask, a Look that Cares: Pre-Surgical Nursing Visit)	Ana Paula Patola Guerrero.	The study was based on a project developed on the theme "pre-surgical visit", with a view to knowing the entire process and its implementation, and the development of competencies by nurses. A systematic review of the literature on the topic and statistical analysis of visits and patient satisfaction with them was conducted.	2014	0		

Análise da intensidade, aspectos sensoriais e afetivos da dor de pacientes em pós- operatório imediatis <i>ta de</i> <i>Enfermagem Pré-operatória</i> – <i>A opinião dos doentes</i> (Pre-Surgical Nursing Visit – Patient Feedback)	ão Manoel Rodrigues Melo; Ana Maria beiro Teixeira; nabela Maria Santos pimbra Novo; Marisa aria Rebelo Pereira gueiredo; Natália ssunção Branco.	This study describes the pre-surgical visit as a means of enhancing the performance and satisfaction of nurses and patients. The method was a simple descriptive quantitative study. A questionnaire with open and closed questions was applied; it was verified the opinion of patients, highlighting the following criteria: calmness, confidence, and security. Results show that the pre-surgical visit is a factor of continuous improvement in care quality.	2016	1
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Chart 1: Starting point

TITLE	AUTHORS	CONTEXT	YEAR	CITATIONS	
Quality in Surgical Nursing Care					
Avaliando o indicador de desempenho suspensão cirúrgica, como fator de qualidade na assistência ao paciente cirúrgico (Evaluating the Performance Indicator Surgical Suspension as a Quality Factor in the Care of Surgical Patients)	Selma Petra Chaves Sá, Thalita Gomes do Carmo e Leonardo Secchin Canale.	It is an exploratory descriptive study based on quantitative analysis, presenting the topic of suspension of surgeries and its reasons in a cardiology hospital located in a large metropolis. The authors concluded the identification of problems by means of findings are relevant indicators in both clinical and administrative terms.	2011	22	
Responsividade do serviço de enfermagem na visão do cliente (Responsiveness of the Nursing Service in the Client Perspective)	Ana Vanessa Deffaccio Rodrigues; Dagmar Williamowius Vituri; Maria do Carmo Lourenço Haddad; Marli Terezinha Oliveira Vannuchi; Willian Tiago de Oliveira.	The research consists of a quantitative study, which used interviews regarding admission to hospital and perception of care offered as important aspects to define the degree of satisfaction. A medical- surgical unit was used in a public university hospital. Findings indicated the nursing service is properly presented showing high satisfaction.	2012	4	
Diagnósticos de enfermagem em clínica cirúrgica (Nursing Diagnoses in Surgical Clinics)	Elisiane Soares Novaes; Maricy Morbin Torres; Ana Paula Vilcinski Oliva.	Based on a cross-sectional, descriptive, and exploratory study of a qualitative approach, the research was conducted intending to identify the frequency of nursing diagnoses in patients of surgical clinics. Results showed comprehensive diagnosis and impact on care diversity; with this profile, they promote the implementation of care plans, contributing to the care quality.	2014	11	

Chart 1: Starting point

TITLE	AUTHORS	CONTEXT	YEAR	CITATIONS	
Quality in Surgical Nursing Care					
Indicadores de assistência em uma clínica cirúrgica (Assistance Indicators in a Surgical Clinic)	Thatianny Tanferri de Brito Paranaguá; Ana Lúcia Queiroz Bezerra; Gabriela Camargo Tobias; Ana Elisa Bauer de Camargo e Silva.	The present study approaches surgical admissions selectively by cross-sectional descriptive study and by analysis in medical records. It was found that surgical admissions remained in the highest proportion in patient outcomes. A need to reconsider actions with regard to care and for institutions to conduct work processes systematically with care indicators in order to improve the quality and safety of their patients were identified.	2016	4	
Construção de uma ferramenta para medida de percepções sobre o uso do checklist do Programa de Cirurgia Segura da Organização Mundial da Saúde (Development of a Tool to Measure Perceptions about the Use of the Checklist of the Safe Surgery Program of the World Health Organization)	Luis Antonio dos Santos Diego; Fabiane Cardia Salman; João Henrique Silva; Júlio Cezar Brandão; Getúlio de Oliveira Filho; Antonio Fernando Carneiro; Airton Bagatini e José Mariano de Moraes.	The work mentions the focus with respect to patient safety, as recommended by the World Health Organization (WHO), determining the relationship between adverse and avoidable conditions in surgery, and the implementation of the checklist as a verification tool before surgeries. The purpose was to develop a tool of actions of anesthesiologists and residents, which led to seven items of reliability and internal consistency.	2016	1	
Análise da intensidade, aspectos sensoriais e afetivos da dor de pacientes em pós-operatório imediato (Analysis of the Intensity, Sensory and Affective Aspects of Pain in Patients in the Immediate Post- Surgical Period)	Alcione Carla Meier; Fernanda Duarte Siqueira; Carolina Renz Pretto; Christiane de Fátima Colet; Joselia Sonego Gomes; Cátia Cristiane Matte Dezordi; Eniva Miladi Fernandes Stumm.	The study aims at evaluating the pain of patients in the immediate post-surgical period by sensorial and affective aspects. A cross-sectional analytical method was adopted involving 366 patients; it was found that pain in the immediate post-surgical period is an important factor for research and attention to health professionals.	2017	0	

Chart 1: Starting point

TITLE	AUTHORS	CONTEXT	YEAR	CITATI ONS	
Peri-surgical Care					
Enfermagem em centro cirúrgico: trinta anos após criação do Sistema de Assistência de Enfermagem Perioperatória (Nursing in a Surgical Center: Thirty Years after the Creation of the System of Peri-Surgical Nursing Assistance)	Rosa Maria Pelegrini Fonseca; Aparecida de Cássia Giani Peniche.	An integrative review study on nursing in the surgical center, in a time frame from 1978 to 2006, was conducted. The study resulted in the classification of six topics: "Pre-surgical visit", "Intersurgical care", "Post-anesthesia recovery room", "Post-surgical visit", "Instrument construction or validation", and "Patient perception". The articles discussed the adversities and easiness of the nursing staff in providing quality care. The need to humanize and individualize care was confirmed, contributing to the construction of knowledge and being a performance indicator for the professional nurse to develop collectively for patients and their families.	2009	43	

Conhecimento e expectativas de mulheres no pré-operatório da mastectomia (Understanding and Expectations of Women in the Pre-Surgical Period of Mastectomy)	Pricilla Cândido Alves; Anna Paula Sousa Silva; M íria Conceição Lavinas Santos e Ana Fátima Carvalho Fernandes.	As the main issue of the study, concerns and expectations of breast cancer patients about surgery are raised. The hermeneutic-dialectic method was used, limited to three categories: feelings and expectations related to mastectomy, removal of breasts, and information about the surgery. The authors concluded that the patient experiences a pre-surgical period of great anxiety, fears, different feelings, and stress. The importance of emotional support is highlighted, together with the educational role of the professional to minimize disturbing emotional situations.	2010	10
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Chart 1: Starting point

Source: Elaborated by the author (2019)

TITLE	AUTHORS	CONTEXT	YEAR	CITATIONS	
Peri-surgical Care					
Prática do enfermeiro no cuidado ao paciente no pré-operatório imediato de cirurgia eletiva (Nurse Practice in Patient Care in the Immediate Pre-Surgical Period of Elective Surgery)	Adnairdes Cabral de Sena; Eliane Regina Pereira do Nascimento; Ana Rosete Camargo Rodrigues Maia.	The goal of this study was to analyze the care provided to patients in elective surgeries in the pre-surgical stage. A descriptive study with a qualitative approach was conducted. Findings revealed that most of the care is in guiding these patients with regard to the psychological aspect in disagreement with the methodology adopted in the hospital.	2013	8	
Avaliação da intensidade e desconforto da sede perioperatória (Intensity and Discomfort Evaluation in Peri-Surgical Thirst)	Isabela Fernanda Larios Fracarolli; Lígia Fahl Fonseca; Patrícia Aron.	The purpose of this study was to evaluate the intensity and discomfort related to thirst and associated factors during anesthetic recovery, frequently reported by patients as a factor of dissatisfaction, generating anxiety in the peri-surgical stages.	2018	0	

Source: Elaborated by the author (2019)

Chart 1 highlights the context in which each one of the articles used in this bibliographic research is presented, together with the respective titles, authors, year of publication of each article, and how many citations each article has, all separated by the keywords sought.

The article *Enfermagem em centro cirúrgico: trinta anos após criação do Sistema de Assistência de Enfermagem Perioperatória* (Nursing in a Surgical Center: Thirty Years After the Creation of the Perioperative Nursing Assistance System) can also be highlighted as having the greatest impact on scientific citations (43 times), with a theme

closely linked to the biopsychosocial aspects of surgical patients, meeting the theoretical framework.

An important point that should be mentioned in the analyses is that scientific productions related to the personal satisfaction of surgical patients, with respect to the intrinsic aspects, are poorly referenced in the selected articles, which leads to orientating this study so as to contribute to the scientific community.

4.7 Words Highlighted in the Articles under Analysis

Jesus and Costa (2015) display an example of a "word cloud" made using the Wordle site. This created cloud

discloses the most repeated words in the articles examined herein. The model also works as an analysis of consistency of the text, as depicted in Figure 2.



Figure 2: Word cloud from the database

Source: Adapted by the Wordle (2019)

Words as in English:

- Abordagem approach
- Estudo study
- Hospital hospital
- Cirurgia surgery
- Visita visit
- Segurança safety
- Forma form
- Enfermeiros nurses
- Equipe staff
- Trabalho work
- Pacientes pacients
- Qualidade quality
- Quantitative quantitative
- Assistência care
- Método method
- Descritivo descriptive
- Enfermagem nursing
- Resultados results
- Assistenciais assistential

The words displayed in Figure 2 are those that most often are found in the text of the analysis of the 16 articles selected to be part of this study. The words that are most frequently used are repeated in a larger number; as such, it is clear they also cover the keywords employed to achieve the search for articles in *Scielo*.

4.7 Identification of the Main Quality Attributes to Health Care

This section emphasizes important attributes in the care/caring relationship identified by the authors after the bibliometric method, according to Chart 2.

AUTHORS	MAIN ITEMS
Mileide Morais Pena; Marta Maria Melleiro.	Quality in care; Nursing staff.
Karine Lorenzen Molina; Gisela Maria Schebella Souto de Moura.	Nursing staff.
Priscila Fernandes Martins; Marcia Galan Perroca.	Quality in care; Guidelines on surgery; Guarantee.
Thais Vasconselos Amorim; Cristina Arreguy-Sena; Marcelo da Silva Alves; Anna Maria de Oliveira Salimena.	Nursing staff; Quality in care; Guarantee.
Ana Paula Patola Guerrero.	Reduction of anxiety; Occasion to answer questions.
João Manoel Rodrigues de Melo; Ana Maria Ribeiro Teixeira; Anabela Maria Santos Coimbra Novo; Marisa Maria Rebelo Pereira Figueiredo; Natália Assunção Branco.	Safety; Quality in care; Confidence; Calmness.
Chaves Sá, SP; Gomes do Carmo, T; Secchin Canale, L.	Nursing staff; Quality in care.
Ana Vanessa Deffaccio Rodrigues; Dagmar Williamowius Vituri; Maria do Carmo Lourenço Haddad; Marli Terezinha Oliveira Vannuchi; Willian Tiago de Oliveira.	Nursing staff; Quality in care; Guarantee; Confidence.
Elisiane Soares Novaes; Maricy Morbin Torres; Ana Paula Vilcinski Olivia.	Quality in care.

Chart 2: Attributes per author

AUTHORS	MAIN ITEMS
Thatianny Tanferri de Brito Paranaguá; Ana Lúcia Queiroz Bezerra; Gabriela Camargo Tobias; Ana Elisa Bauer de Camargo e Silva.	Quality in care.
Luis Antonio dos Santos Diego; Fabiane Cardia Salman; João Henrique Silva; Júlio Cezar Brandão; Getúlio de Oliveira Filho; Antonio Fernando Carneiro; Airton Bagatini e José Mariano de Moraes.	Safety; Risks of anesthetic and surgical procedures.
Alcione Carla Meier; Fernanda Duarte Siqueira; Carolina Renz Pretto; Christiane de Fátima Colet; Joselia Sonego Gomes; Cátia Cristiane Matte Dezordi; Eniva Miladi Fernandes Stumm.	Quality in care; Individualized attention.
Rosa Maria Pelegrini Fonseca; Aparecida de Cássia Giani Peniche.	Calmness; Confidence; Safety; Continuous improvement; Quality in care.
Pricilla Cândido Alves; Anna Paula Sousa Silva; Maria Conceição Lavinas Santos; Ana Fátima Carvalho Fernandes.	Occasion to answer questions.
Adnairdes Cabral de Sena; Eliane Regina Pereira do Nascimento; Ana Rosete Camargo Rodrigues Maia.	Safety.
Isabela Fernanda Larios Fracarolli; Lígia Fahl Fonseca; Patrícia Aron.	Welcoming; Comfort.

Chart 2: Attributes per author

Source: Elaborated by the author (2019)

Based on the analysis of Chart 2, the following items were observed to be the most repeated among the articles examined: Quality in care, ten times; Nursing staff and safety, five times each; Occasion to answer questions, three times; Guarantee, confidence and calmness, two times each; the others were only seen once.

The research revealed a considerable number of quality attributes in health services in accordance with the studies and authors, which emphasizes the need to identify patient satisfaction in surgical procedures.

V. CONCLUSION

The bibliographic review enabled the association of characteristics and quality attributes of health services with the two fundamental elements in surgical procedures: quality and safety. Surgical safety issues are widely known. Hence, a global movement that embraces all systems for safer surgical care could save millions of lives.

Results indicate a set of inherent attributes to people and that, once they are achieved, they reach a level of personal satisfaction, given that they are essential to health-disease processes. It has become a challenge for hospital services. When it comes to the quality of surgical patients, safety is an item of priority.

The research made it possible to identify the most relevant criteria referenced in the literature about the quality in care of health services linked to the degree of surgical patient satisfaction in relation to nursing care, in addition to the aspects of a safe and comfortable condition.

By examining results, the following keywords were identified: "Quality in nursing care"; "Pre-surgical visit"; "Quality in surgical nursing care"; and "Peri-surgical care", the one with the highest number of articles found was "Quality in nursing care", with 115 articles, of which three were selected. In contrast, "Quality in surgical nursing care" sought 12 articles, of which six were utilized.

Given the result of the 16 articles verified from 2009 to 2019, in 2016, there was a focus on the largest number of articles, with four, followed by 2014, with three, 2012 and 2017, with two. In 2009, 2010, 2011, 2013, and 2018, only one article was found, and, in 2015 and 2019, no articles were found.

With regard to the authors mentioned in this study, it can be listed 51 among them. Among them, what stands out most in a number of publications is Marcelo da Silva Alves, with 79 publications, followed by Cristina Arreguy-Sena, with 78 publications. Portuguese was the language that distinguished itself, with 13 articles analyzed.

Regarding the origin of publications on the subject, eight journals and one thesis were selected. Among the eight, the *Acta Paulista de Enfermagem* was highlighted and brought four articles. At the same time, the most significant impact factor in citation documents was the Millenium-Journal of Education, Technologies, and Health, with1.499 in factor, while the Scientific Journal Ranking (SJR) was represented in the *Revista da Escola de Enfermagem Anna Nery*, with 0.999.

Among the 16 selected articles, the article *Enfermagem em centro cirúrgico: trinta anos após criação do sistema de assistência de enfermagem perioperatória* (Nursing in the Surgical Center: Thirty Years after the Creation of the Peri-Surgical Nursing Care System) has greater relevance, with 43 citations. For each of these articles, essential items for the quality of health care were found. In this way, the item that most appeared in the articles, "Quality in care", was found ten times.

For this reason, the webibliomining method is particularly significant in the enhancement of students and researchers who would like to expand their knowledge. This method has already been used in a number of works. The exchange in the literature collection, with autonomy in choosing the database, was accessed, in this study, by the *Portal de Periódicos da Capes*.

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Influence of pesticide use on gross domestic product in Santa Maria de Jetibá-ES

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Abstract— The increased use of pesticides due to the expansion of agricultural production and the lack of more comprehensive and rigorous legislation and enforcement has made Brazil a major consumer of pesticides, assuming in 2009 the position of largest consumer market of pesticides in the world. The state of Espirito Santo has a relevant influence on this prominence of the country, placing itself among the ten Brazilian states that have the largest sales in the country of this class of pesticides, being Santa Maria de Jetibá an important trader and consumer of pesticides due to its intense agricultural production. Given this intense commercialization of pesticides, and the problems caused by pesticides to environmental and human health, the objective was to make a situational diagnosis of the commercialization and use of pesticides in the municipality of Santa Maria de Jetibá were used, analyzing the influence on the Gross Domestic Product of the municipality. In the city of Santa Maria de Jetibá, there was intense agricultural production and intense use of pesticides, and the percentage share of GDP was much higher than those of neighboring cities that do not practice intensive agriculture.

Keywords—Commercialization of pesticides, Health impact, Pesticide, Pesticide Consumption.

I. INTRODUCTION

The expansion of agricultural production and the lack of more comprehensive and rigorous legislation and enforcement make Brazil stand out as a major consumer of pesticides and has, since 2009, assumed the position of the largest pesticide consumer in the world (PACHECO, 2009; IBGE, 2019).

According to Nascimento Neo et al. (2014) to increase productivity, maintain the production cycle and generate employment, the use of pesticides is an appropriate resource, given its basic control function such as crop pests. The use of pesticides was leveraged by agribusiness in order to boost consumer market purchases. In large part of agricultural practices, as the ones aimed at accomplishing their own economic benefits (KANCANS et al., 2014). The World Health Organization defines pesticides as any "substance capable of controlling a pest that may pose a risk to populations or the environment". In this sense, pesticides are used to control bacteria, fungi, weeds, arthropods, mollusks, rodents and any life forms harmful to the environment or human health and wellbeing (WHO, 2005).

The term pesticide began to be adopted in Brazil from Federal Law No. 7802/1989, regulated by Decree No. 4074/2002 of products and agents of physical, chemical or biological processes, intended for use in production sectors, storage and processing of agricultural products, pastures, protection of native or planted forests, other ecosystems and urban, water and industrial environments whose purpose is to alter the composition of flora or fauna in order to preserve them from the action of living beings considered harmful, as well as the substances and products used as defoliants, desiccants, stimulators and growth inhibitors (BRAZIL, 1989).

The mass use of pesticides in agriculture occurred in the 1950s in the United States, with the so-called 'Green Revolution', which was intended to modernize agriculture and increase its productivity. In Brazil, the Green Revolution took place in the 1960s and, with the implementation of the National Program for Agricultural Pesticides (PNDA), had a significant increase in the 1970s. PNDA linked the use of these substances to the granting of agricultural credits, being the States are the main driver of this practice (SIQUEIRA, 2013; SOUZA, 2011; JOBIM, 2010).

After World War II, the use of pesticides increased significantly due to the development of chemical synthesis industries. Today's agriculture is based on the Green Revolution created in the 1960s, structured in monoculture production using pesticides and other products and techniques that enhance productivity (CLEAVER JR, 1972; KOLAR et al., 2008).

Brazil has public policies that promote the use and trade of pesticides. Policies maintained by the influence of the ruralist bench in the National Congress. Examples are the costs of registering products with the National Health Surveillance Agency – Anvisa (from R\$ 180.00 to R\$ 1.800.00) and the exemption, in most states, of the Tax on the Commercialization of Goods and Services (ICMS) (SOARES et al., 2012).

Worldwide spending on pesticides has grown annually. According to Meyer (2003) and the World Health Organization (WHO, 2010), developing countries consume 20% of all pesticides produced in the world. The use of pesticides has continued to increase, where the turnover of pesticides worldwide accounted for about 28% of businesses (CAVALCANTE, 2014).

According to Embrapa (2014), the annual consumption of pesticides in the world is approximately 2.5 million tons.

In Brazil, the annual consumption was over 300 thousand tons of the marketed crude product, being approximately 130 thousand tons of active ingredient (ia), which represents the equivalent of a 700% growth in the use of pesticides, in parallel with the growth of 78% in agriculture by 2013 (EMBRAPA, 2013).

Brazil is the world's largest consumer of pesticides. This is due to the tax incentives derived from public policies to the pesticide product, applying the policy that allows tax benefits to the use, marketing, production and importation of pesticides (MELO, 2016) as public policies to encourage agricultural poisons that occur through extrafiscality, which in turn are tax rules used as a means of influencing human conduct in the purchase of such products (VEIGA; MELO, 2016). Extrafiscality is negative when incentives, tax exemptions and subsidies in the marketing of pesticides are provided (CAVALCANTE, 2014).

Most pesticides are registered for agricultural use and only a small number of pesticides can be used in Public Health (VEIGA; MELO, 2016). Any use of pesticides in Brazil must comply with current national legislation, regardless of its purpose (VEIGA; MELO, 2016).

The sale of active ingredients in Brazil exceeded 600 thousand tons in 2012. This is due to the public policies of incentives for agricultural poisons, considering the technical products - those obtained directly from raw materials by chemical, physical or biological process destined to the production of formulated or premix products - and Formulated Products (PF) - pesticide or the like obtained from technical or premix product (IBAMA, 2013). Received formulated product reports cover a total of 329 active ingredients. Of this amount, 88 have marketing values disclosed as corresponding to trademarks whose active ingredients have at least three companies holding registration. The 88 active ingredients totaled less than in 2012, corresponding to less than 500,000 tons domestically. However, in 2017, sales of active ingredients corresponded to 539,944.95 tons (IBAMA, 2017).

Some of the bestselling pesticide active ingredients in Brazil are glyphosate and its salts; 2,4-D; Atrazine; Acephate; Chlorpyrifos; Methomyl; Mancozeb; Imidacloprid, among others (IBAMA, 2013). Annual sales, from 2000 and 2012, grew by 194.09%. Herbicides are the most widely applied worldwide, such as glyphosate and 2,4-D, for example, used for weed control, followed by insecticides, fungicides and acaricides. In Espírito Santo, the most commercialized pesticides and related products in 2017 were: glyphosate and its salts; 2,4-D; flutriafol and mancozeb (IBAMA, 2017).

Brazil demonstrates itself as one of the countries with the largest developments in pesticide use in the world. The conditions of a tropical country require producers to use more pesticides; The country runs two harvests a year, which does not happen in cold countries (LIMA, 2016). In Table 1, we observe the ten most active ingredients sold in Brazil in 2017, representing 380,965.12 tons of active ingredient commercialized. Source: IBAMA / Consolidation of data provided by the registrants of technical, pesticide and related products, as

	Sales	
Active Ingredient	(ton. IA)	Ranking
Glyphosate and its		
salts	173.150,75	1st
2,4-D	57.389,35	2nd
Mancozebe	30.815,09	3rd
Acephate	27.057,66	4th
Mineral Oil	26.777,62	5th
Atrazine	24.730,90	6th
Vegetable Oil	13.479,17	7th
Dichloride de		
paraquat	11.756,39	8th
Imidacloprid	9.364,57	9th
Copper oxychloride	7.443,62	10th
Total	380.965,12	

per art. 41 of Decree No. 4,074 / 2002.

In the state of Espirito Santo, the most sold use class in relation to formulated products is the Herbicide class, with more than 2,500 tons of active ingredient sold. These numbers ranked the state, in 2013, in a position among the ten Brazilian states that have the largest sale in the country of this pesticide class (IBAMA, 2013). The use of these products has been increased due to the need for agricultural production associated with high consumption due to population growth (ANVISA, 2012). In 2017, the state of Espírito Santo totaled more than 3.7 thousand tons of pesticides traded (IBAMA, 2017).

Pesticides are widely applied during food production to control weed and fungal growth or to prevent damage by insects, mites, rodents and others. Often used postharvest to extend plant life and improve quality. The presence of chemicals resulting from the use of pesticides already guide international standards of production, exportation and, consequently, worldwide consumption (KOESUKWIWAT et al., 2010).

The problem of the research is to know if the use of pesticides, commercialized and used, in family farming in the municipality of Santa Maria de Jetibá - ES is high in relation to the state and neighboring municipalities and if these data influence the Gross Domestic Product – GDP of the county in a positive or negative way.

According to a report in Gl (2017), Santa Maria de Jetibá has olericulture as one of the strongest activities in

the municipality's trade, being Santa Maria de Jetibá an important marketer and consumer of pesticides. The vegetables grown in the municipality are sold to more than half of the Brazilian states, with 95% of the 5,200 local properties growing vegetables; approximately eight thousand families involved. Due to the high use of pesticides in the daily lives of many farmers, associated with the large commercialization of pesticides in the municipality, it was decided to perform a situational diagnosis of the use of pesticides in the municipality of Santa Maria de Jetibá as well as associate their influence on municipal GDP. Thus, the objective of this work is to make a situational diagnosis of the commercialization and use of pesticides in family farming in the municipality of Santa Maria de Jetibá-ES, through studies on existing public data, presenting the panorama of marketing and use of pesticides in the municipality, analyzing the influence on the GDP of the municipality of Santa Maria de Jetibá through the existing public data.

II. MATERIALS AND METHODS

In order to achieve the objective of this study, the research adopted was qualitative through the case study strategy. Performed through a triangulation of data from: institutional data, internet data and interviews. Thus, the research uses the following research instruments: exploratory interviews, data analysis and semi-structured interviews by agenda.

2.1 Study Area

The data observed are from the city of Santa Maria de Jetibá, mountain region of Espírito Santo, located 80 kilometers from the capital city of Vitória. It is a city with colonization of immigrants, with approximately 39 thousand inhabitants, mostly Pomeranians and Germans who carry the traces of cultural tradition, especially the Pomeranian language. The municipality has as economic foundation the agricultural production, maintained by family farmers in small rural properties (IBGE, 2013).

The municipality has the agricultural activity with the greatest influence on the city's economy, as it has considerable agricultural potential in its economy. (SANTA MARIA DE JETIBÁ, 2015).

2.2 Sociodemographic, Economic and Environmental Characterization

Demographic data allowed quantifying population groups to perform calculations and analyzes. These data consist of number of inhabitants, births and deaths, separated and distributed by sex, age, education and occupation (MINISTRY OF HEALTH, 2013). These data were obtained from the free access website of the Brazilian Institute of Geography and Statistics (IBGE). The city's economy data were obtained by consulting the IBGE through an online survey on the institute's website.

2.3 Data Collect

They were acquired through consultation with the Brazilian Institute of Geography (IBGE), Institute for Agricultural and Forestry Defense (IDAF), Brazilian Institute of Environment (IBAMA), and the application of questionnaires to family farmers and doctors.

To promote communication, to establish the speeches and to obtain the complementary data of the research, it was necessary to apply the semi-structured interview, with closed and open questions. The questionnaire was answered by family farmers in the municipality.

2.3.1 Use Of Agrotoxics

A case study of a company in the municipality of Santa Maria de Jetibá was prepared, separating only data available from the company by IDAF, from 2015, differentiating the herbicide, insecticide and fungicide classes and their quantities of pesticides sold in liters and in kilograms, to assess the most traded and most-at-risk group for the population as well as their possible health effects. This analysis is corroborated by the interview conducted by family farmers conducted in a master's work, where respondents had the opportunity to report on their experiences in rural life using the pesticide.

2.3.2 Interview

The interview was comprised in a master's work with the application of a semi-structured questionnaire, in faceto-face research methodology, with simple and welldirected questions. However, in this study we used only the extra interview reports, reports about the influence of pesticides on their lives spontaneously from the interviewee. The interviews were conducted in the homes and appropriate places of the interviewees themselves duly authorized by them.

The inclusion criteria for choosing the families and persons interviewed was at least three years of work and farming with the use of pesticides; be a farmer; have no impediment of religious nature or any other belief that precludes participation in the study; be at least 18 years old; voluntarily agree to participate in the study by signing the informed consent form (Annex).

The number of respondents was 56 farmers, according to the criterion of information redundancy, but 39 extra spontaneous reports of the interviewees were used. Redundancy is understood as the moment when information is sufficiently confirmed and the emergence of new data is increasingly rare (ALVES-MASSAOTTI; GEWANDSZNAJDER, 1998).

Farmers were asked some questions, as well as others such as: (a) Use or not of pesticides; (b) frequency of use; (c) The classes they use (herbicide, insecticide, fungicide, etc. and the most commonly used; (d) Visits by professionals for instruction of use; (e) Frequency of rural technical assistance by INCAPER.

The research project was submitted to Plataforma Brasil, for analysis and approval by the Research Ethics Committee (CEP), Health Sciences Center, Goiabeiras Campus of the Federal University of Espírito Santo, as it involves research with human beings, with the opinion number: 3228832 and status of the Opinion: approved on March 28, 2019. Research project approved in accordance with the CEP Consubstantiated Opinion (Annex 2).

The interviewees were properly informed about the research interests and the study objective and, agreeing to participate, signed an Informed Consent Form, according to the Resolution 466/12 of the National Health Council / Ministry of Health.

III. RESULTS AND DISCUSSION

3.1 Agricultural production

The interviewees were properly informed about the research interests and the study objective and, agreeing to participate, signed an Informed Consent Form, according to the Resolution 466/12 of the National Health Council / Ministry of Health.

It was possible to evidence that the agricultural production of the municipality of Santa Maria de Jetibá includes more than one hundred different types of crops, characterizing the agricultural diversity of the municipality that reaches different agricultural markets. Santa Maria de Jetibá occupies the position of largest producer of fruit and vegetables among the cities of Espírito Santo (PMSMJ, 2016).

The interviewees stated that crops vary with the planting period and because of crop rotation performed in the planting area as a way to prevent disease and increase yield. They also reported that the crop is diverse and that pesticides vary according to the type of crop.

For each type of agricultural crop, there are several active ingredients that can be used as a pest control (ANDREI, 2017). The use is determined by the types of pests that travel the crop (ANDREI, 2017). Thus, knowledge of the classes that are sold in the municipality of Santa Maria de Jetibá made it possible to highlight the main groups commercialized in the municipality, as well as some products that are not related to crops, but were somehow sold to be used.

Table 2 consolidates the products with their active ingredients, chemical groups and intoxication medium. These pathways were selected considering as the main reported by the interviewees compared to those of the label.

Table 2 - List of ten pesticides with significant		
representativeness in retail trade in Santa Maria de		
Jetibá		

Pesticide	Active principle	Chemical group	Pathways of Intoxicatio n
Gramaxon e 200	Paraquat	Bipyridylum	Contact / inhalation
Danimen 300 CE	Fenpropathrin 300g/L	Pyrethroid	Contact / inhalation
Score 250	Diphenoconazol e	Triazol	Contact / inhalation
Furadan 50 ou 350	Carbofuran	Benzofuranyl methylcarbamate	Contact / inhalation
Polytrin 400/40	Cypermethrin 40g/L; Profenofós 400g/L	Organophosphat e; Pyrethroid	Contact / inhalation
Decis 25 CE	Deltamethrin	Pyrethroid	Contact / inhalation
Pirate 240 SC	Chlorfenapyr	Pyrazole Analog	Contact / inhalation
Verdadeir o 600 WG	Cyproconazol e; Thiamethoxa m	Triazole; Neonicotinoid	Contact / inhalation
Amistar Top	Azoxy strobin; Diphenoconazol e	Strobilurin and Triazol	Contact / inhalation
Roundup	Glyphosate acid; Isopropylamin e salt	Substituted Glycine	Contact / inhalation

Source: Adaptation from IDAF (2019).

Farmers reported nausea, vomiting, dizziness, skin irritation and others. Ingestion cases are not very common, but were frequent in suicide cases.

Cases of intoxication resulting from the inappropriate use of pesticides have been described, where symptoms of intoxication associated with moderate exposure are subjective and vague, such as headache, malaise, stomach pain, weakness and drowsiness, among others (CASTRO, 2011). The slow intoxication, resulting from the exposure of rural workers to pesticides, deserves attention, as they are the most worrying, as the symptoms are not exclusive to poisoning, and may be confused with other pathologies including parasitic diseases (ROUQUAYROL; ALMEIDA-FILHO, 2013). Such intoxications are termed acute, but often are limited to just headaches among other annoyances. Official data are limited to hospital reports related to acute poisoning. This picture, accommodated by underreporting, is given as a "silent tragedy" (ROUQUAYROL; ALMEIDA-FILHO, 2013).

Pignati (2017) surveyed 23 active ingredients proving the diversity of specific active ingredients in only four crops in ten municipalities. It is noted that in Santa Maria de Jetibá, the focus is different in relation to crops; however, a much larger variety of crops is planted. Thus, the variety of pesticides present in the municipality is even greater when compared to the work of Pignati (2017), resulting in greater attention in relation to application, requiring from the farmer greater knowledge of the preparation and application, since each pesticide It has its peculiarities and distinct pathways of intoxication.

3.2 Agrotoxic Sales In The City Of Santa Maria De Jetibá

The most commercialized pesticide classes in the municipality of Santa Maria de Jetibá were herbicides, fungicides and insecticides (Table 5).

Table 5 – most commercialized pesticide classes in the municipality of Santa Maria de Jetibá-ES

Classes	KG	LT	
Fungicides	28.772,88	17.097,67	
Insecticides	5.684,63	18.843,22	
Herbicides	2.984	41.013,27	
TOTAL	34.460,5	76.954,16	
Sourcee: Adaptation from IDAF (2015).			

Data on the quantity of pesticides sold by the Company studied were provided by IDAF, as established by State Law No. 5,760 of December 2, 1998, as amended by Law No. 6,469 of December 11, 2000, which establishes, among other things, that all company that commercialize the pesticide must send this institute a semi-annual report of its sales.

The agricultural activity associated with the commercialization of pesticides in the municipality promotes a significant contribution to the economy of the municipality explained by the Gross Domestic Product (GDP). The analysis of GDP allowed highlighting Santa Maria de Jetibá to the highest level in relation to gross domestic product compared to the neighboring municipalities that make up the highland region of the state of Espírito Santo (Figure 1) and (Table 6).



Source: (IBGE, 2016)

The results obtained in the GDP data at current prices; there is a significant difference between the GDPs of the municipalities of the highland region of Espírito Santo, more expressively Santa Maria de Jetibá (IBGE, 2016).

Producing food and proving a strong agriculture, the municipality showed the highest value added of Espírito Santo agriculture, being superior to the related municipalities compared in figures 1 and 6 (IBGE, 2016).

Table 6 - Gross Domestic Product per capita (R\$ 1,00) among municipalities of the highlands of Espírito Santo - 2010 to 2013 and 2016

Microregions				
and	2010	2012	2013	2016
Municipalities				
Central	12.061.67	16 200 00	16 9 40 77	19 001 16
Serrana	12,001.07	16,299.99	10,842,77	18,921.10
Itaguaçu	9,158.62	14,692.45	12,667.32	16,575,42
Itarana	10,711.42	13,592.74	14,724.25	18,192.73
Santa	8 810 55	10 605 56	11 760 66	15 562 70
Leopoldina	0,019.55	10,005.50	11,700.00	15,502.70
Santa Maria	15 211 26	20 726 56	22 325 00	26 220 00
de Jetibá	15,211.20	20,730.30	22,325.00	20,239.09
Santa Teresa	11,502.85	14,761.10	14,482.61	18,035.85
Ca	LICN.	(2015) . ID	CE(2016)	

Source: IJSN (2015) e IBGE (2016).

GDP at current prices means all wealth without inflation produced in the locality analyzed and, in table 3, we can see the behavior of federations over the years 2010 to 2013 and 2016 (IBGE, 2016). It was observed that Santa Maria de Jetibá had a growth of 161.98%, above the Central Serrana, with 150.06%, Espírito Santo, with 137.19% and Brazil with 132.69%.

Agricultural activity in line with the sale of chemicals in Santa Maria de Jetibá contributes approximately 46% of GDP at current prices relative to the Central Serrana region, demonstrating its representativeness regarding its economy. Some local conditions, such as climate, humidity, rainfall, the production and supply of local inputs, the improvement of roads and the dedication to work by Santa Marian farmers, Pomeranian descendants, contribute directly to explain the economic power of the municipality.

Allied to these constraints, structural changes in Espírito Santo promoted the vertiginous growth of the population of Greater Vitória, the main consuming center of produce produced by Santa Maria de Jetibá. The municipality is characterized by having a very different agricultural production in relation to the spatial context of Espírito Santo, which is marked by the predominance of permanent crops and destined for the foreign market, especially coffee. Even inserted in this spatial context, Santa Maria de Jetibá follows the opposite path, since horticulture is predominant in the municipality and agricultural production is primarily intended for the domestic market (BERGAMIN, 2015).

Figure 2 shows the percentage of participation of agricultural activities by number of establishments specified in temporary culture, permanent culture, pasture and floriculture. It is possible to evidence that 55.38% of agricultural crops in Santa Maria de Jetibá is associated with temporary or annual crops, 30.25% for perennial crops, 13, 53% for pastures and the rest for floriculture (IBGE, 2019).



Figure 2 - Participation of agricultural activities by number of establishments (2017).

Source: IBGE/Censo Agropecuário, (2019).

Most of the crops on small family farms are vegetables, as they have high yields, but they are intensively and systematically performed with permanent use of pesticides (BERGAMIN, 2015). Investment in increased vegetable production favors the diversification of agricultural pillars contributing to the increase in GDP. It is important to diversify production by planting other types of cultivars so that there is GDP growth and that in times of crisis and decline of one crop, another replaces it without falling GDP (DA SILVA, 2016).

Per Capita GDP in Santa Maria de Jetibá is quite representative, since the city is mostly represented by services and agriculture, mainly governed by family agriculture (Table 7), since each family, in a small territorial space, generates a reasonable income, strengthening trade in the municipality and stimulating economic growth.

The GDP component values for the municipality are represented by 44.82% for services equivalent to R\$ 377.40, except public administration and public administration and 41.19% for agriculture equivalent to R\$ 346.83 of a total R\$ 842.10 (Table 7) and (Figure 3).

Table 7 - GDP components in the municipality of Santa Maria de Jetibá – 2013

GDP components in the municipality of Santa Maria de Jetibá			
	Val	ue (R\$	Part.
Components	mi	lhões)	%
Farming	R\$	346,83	41,19
Industry	R\$	55,68	6,61
Services	R\$	377,40	44,82
Services except public			
administration	R\$	239,23	28,41
Public administration	R\$	138,17	16,41
Taxes, net of product subsidies	R\$	62,19	7,39
GDP at current prices	R\$	842,10	100,00

Source: IJSN (2015) and IBGE (2016).

Figure 3 - GDP components in the municipality of Santa Maria de Jetibá – 2013



Source: IJSN (2015) and IBGE (2016).

From the results obtained in the data of the components of the GDP (Figure 3 and Table 8), it is verified the commercial importance of the agriculture in the municipality and with this the high use of pesticides, to guarantee the productivity.

Table 8 - Share	in % of Espírito So	anto GDP	at Current
	Prices - 2010 to 2	2013	

Share in % of Espírito Santo GDP at Current Prices				
Microregions and			2012	2013
Municipalities	2010	2011	2012	2015
Central Serrana	1,32	1,20	1,31	1,44
Itaguaçu	0,15	0,16	0,18	0,16
Itarana	0,14	0,12	0,13	0,14
Santa Leopoldina	0,13	0,11	0,11	0,13
Santa Maria de Jetibá	0,61	0,53	0,62	0,72
Santa Teresa	0,29	0,27	0,28	0,29

Source: IJSN (2015) and IBGE (2016).

The values of the participation in percentage of the GDP of Espírito Santo in the city of Santa Maria de Jetibá were 0.61, 0.53, 0.62, and 0.72 for the years 2010, 2011, 2012 and 2013, respectively. The municipalities of Itaguaçu, Itarana and Santa Leopoldina obtained a participation of less than 0.20% for all years (2010 to 2013). Santa Tereza, meanwhile, presented an average of approximately 0.28 percent, as shown in Table 8 and Figure 3.

IV. CONCLUSION

The municipality of Santa Maria de Jetibá has agriculture for GDP and this in turn makes the volume of pesticides high in the municipality.

Santa Maria de Jetibá is a municipality with a large agricultural variety clearly showing the influence on pesticide retailing, both in terms of quantity and variety of pesticides, since the use of pesticides may vary in terms of crop. Diversified agricultural cultivation requires a greater number of pesticide types leading to increased local commercial turnover of commercial agricultural retail companies.

The values of the share in percentage of Espírito Santo GDP in the city of Santa Maria de Jetibá were much higher than those of neighboring cities that do not practice intensive agriculture.

The consumption of pesticides in the municipality was increased due to the lack of technical guidance by public sector extensionists, consolidating the assistance to private pesticide resale firms and aiming to increase the productivity of each rural producer.
The amount of poisoning in the city can be large due to the toxicity of these chemicals, and should be analyzed and studied by public and private institutions in attention to human health through actions to be developed by health agencies to control the poisoning of primary, secondary and tertiary levels.

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