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FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-10: 2020 (Oct, 2020) of “**International Journal of Advanced Engineering Research and Science (IJAERS) (ISSN: 2349-6495(P) | 2456-1908(O)**”, an international journal which publishes peer-reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers. Now journal has also been indexed in **Qualis (Interdisciplinary Area) (Brazilian system for the evaluation of periodicals, maintained by CAPES)**.

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

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

With warm regards.

Dr. Swapnesh Taterh

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Future Study of Renewable Energy in Libya

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Abstract— Energy is an essential component of any economic development, and electric power is a fundamental indicator of a country's economic and technological progress. Libya is currently wholly dependent on oil and natural gas to produce electricity. In the wake of dwindling fossil fuel reserves, rising costs of this type of fuel, and negative environmental impacts such as air pollution, acid rain, and associated global warming impacts, renewable energy has gained much attention. Libya has a high potential to benefit from electric power generation from renewable energy, such as solar, wind, and biomass energy. In particular, PV technology appears to be the most reliable in Libya's rural areas for its convenient use and economic appeal. Wind energy is an indirect form of solar energy. Between 1-2% of the solar radiation that reaches the Earth then converted into wind energy. The use of wind energy is also becoming competitive compared to conventional sources of energy. Libya has high wind potential. This massive amount of wind is distributed across the country. In 2013, the Libyan government launched the Strategic Plan for Renewable Energy 2013-2025, which aims to contribute 7% of renewable energy to the electrical energy mix before 2020 and 10% by 2025. It will come from wind power, concentrated solar energy and solar PV, And solar heat.

Keywords— fossil fuel, natural gas, Renewable energy, solar energy.

I. INTRODUCTION

Libya is located in the centre of North Africa, with 1,750,000 km² total land area. One of the largest oil producer countries in Africa, gifted with a 1900 km coastline along the Mediterranean. Its current population is around 6,750,000; most of them live in the coastline area [1,2]. About 88% of its area considered to be desert where there is a high potentiality of solar and wind energy used to generate electricity thermal, photovoltaic, and solar energy conversions. Moreover, it has been estimated that every year, each square kilometre (Km²) of the desert in the Middle East/ North Africa region receives solar energy equivalent to 1.5 million barrels of crude oil [3].

Libya is one of the primary oil producers in Africa. The oil and natural gas exportation is forming approximately the unique Libyan economic revenue. Most of Libya's industrial sectors depend mainly on oil and gas fuels. The clearest example of this sector is the Electricity Facility, which uses gas and oil to generate electricity to meet the demand for the local electricity market. Like all other countries, the energy demand will substantially increase shortly due to the economic development to build new

infrastructure in Libya after the massive destruction that happened during the last four years. This growth in energy demand will result in more oil and gas consumption, which reduces the national economic input and increases the amount of carbon dioxide emission. Therefore, it crucial to start using its alternative energy sources to cover some of its load requirements.

In recent times, Libya has become one of the world's primary energy sources since it is the largest natural gas exporter and oil exporter [4]. Like other countries, Libya suffered from high conventional energy prices, environmental issues, rapid demand growth, and high energy consumption. Libya's primary source of income is oil, and the country depends much on the oil it produces as a significant income [5]. It is worth noting that Libya has a high potential for renewable energies, mostly wind power and solar energy, which can create local jobs, drive local economies, and reduce carbon pollution [6]. However, Libya wants to reduce oil dependence as its source of income through improved natural gas, fisheries, mining, and tourism industries [7]. Libya attempts to use the extensive resources it derives from oil to invest in infrastructures that will support the quick realisation of oil

dependence as its primary income source. Libya wants to achieve these projects by setting up designs, development, and implementations to support this project's achievement. Also, Libya is planning to make itself one of the most influential economic countries that mediate between Europe and Africa in commercial terms. In recent times, there have been signs that Libya is likely to move towards liberalisation, financial reform, and a decrease in the government's direct role in the country's economy [8]. Libya has many plans to reduce oil dependency as the primary source of income and invest more in agriculture, fisheries, tourism, natural gas, and mining. Diversification is a critical issue since the current production rates indicate that the Libyan oil reserves are less likely to last this decade [9]. Demand for oil resources will significantly reduce if the natural gas, tourism, fisheries, and mining industries designed and implemented effectively. With significant investment and implementation of these industries, Libya will reduce oil dependency as a substantial income source. Other renewable energy such as wind energy and solar energy will help Libya reduce its dependence on oil. These renewable energies will help Libya reduce its reliance on oil as a significant income source if its components are correctly and effectively designed, manufactured, and implemented [9]. This article provides an overview of renewable energy in Libya, particularly solar and wind power research [10].

II. RENEWABLE ENERGY IN LIBYA

Libya is one of the countries blessed with a high potential for solar and wind energy. The government currently produces a power of 33 TWh to meet the demand for the local electricity market. The energy demand will substantially increase shortly, leading to more oil and gas consumption, reducing the national economic revenue, and more carbon dioxide emission. Libya's government aims to use renewable energy to produce at least 30% of its total energy demands by 2030 [11]. To achieve this, Libya set itself intermediary objectives, aiming at 20% of total electricity production from renewables in 2020 and 25% in 2025 [12]. Wind energy utilised for water pumping in many cases since 1940. The use of wind energy has not been developed extensively since the exploration of the oil, and later on the natural gas, the country concentrated on developing these resources and ignored these resources. The wind potential is vast, and it must be exploited. According to the World Wind Energy Association (WWEA), wind capacity worldwide has reached more than 282 GW by the end of 2012, out of which more than 44.5 GW was added during the same year. The amount of energy generated by the wind turbines by the end of 2012

is around 580 kilowatt-hours per year. It represents about 3% of the global electric energy demand. WWEA expects that the worldwide wind capacity will exceed 500 GW by 2016 and 1,000 GW by 2020 [13]. The Center for Solar Energy Research and Studies (CSERS) started its wind energy programmer to assess the wind potential since the wind energy department's development in June 1988.

Wind data from meteorological authority analysed for ten years for 16 meteorological stations [14]. Libya's renewable energy authority (REAO) started a measurement campaign in 2004 by installing ten wind data measuring stations over the Libyan coast and several stations around the country. The wind data analysis showed that the average wind speed at 40 m above ground level (a.g.l.) is between 6 to 7.7 m/s [15]. A wind farm of 60 MW is under development at Al-Fataih, close to Dernah on the northeast coast. It is the first notable renewable energy project in Libya that should open the door for many similar projects. This project's total cost is estimated to be around \$180 million (103 million Euros) [15]. REAO's plan comprises several wind farms with a full capacity of a little less than 1,000 MW as follow [16]:

- Dernah wind farm (120 MW in two stages); the load factor of this plant estimated at 40%
- Al Maqrun wind farm (240 MW in two steps)
- western region farms at Meslata, Tarhunah, and Asabap (250 MW)
- southeastern region wind farms at Jallo, Almasarra, Alkofra, Tazrbo (120 MW)

southwestern region wind farms at Sabha, Gatt, Ashwairef (120 MW). Libya also plans to develop solar energy power plants and is already working on expanding photovoltaic (PV) technology to remote areas. Small solar energy stations with different capacities are installed in many locations in oil fields. The total installed capacity of PV systems about 240 kWp [17]. The solar regime in Libya is excellent; the daily solar radiation on the horizontal plane goes up to 7.5 kWh/m² with 3,000–3,500 hours of sunshine a year. The technical potential of concentrated solar power (CSP) in Libya is enormous; it has been estimated at 140,000 TWh/year, equivalent to 27,000 GW of capacity at 60% load factor [18]. The proposed solar energy projects, including PV (centralised and decentralised power plants) and solar thermal technology, are as follow [12]:

- three large-scale PV plants connected to the grid at Aljofra, Green Mountain, Sabha, (5–10 MW each)
- extending the use of PV technologies in remote areas (2 MW)

- 1,000 PV rooftop systems for residential areas (3 MW)
- feasibility study for CSP plant in an unspecified location (100 MW)
- use of 10,000 solar water heaters
- local manufacture proposed for solar thermal water heating and PV modules
- development of a joint venture with local and foreign investors for the manufacture of solar water heaters for the local and export markets (40,000 units/year)
- development of a joint venture with local and foreign investors to manufacture PV systems (50 MW). The Libyan government view of renewable energy is summarised in table 1 [19].

Table.1: shows the plan for developing RE in Libya.

Strategic Plan for developing the RE in Libya (2013-2025)			
Year	2013	2020	2025
Wind	260	600	1000
Pv	85	300	450
Csp	25	150	800
Total power	370	1050	2250
% RE	3%	7%	10%

III. SOLAR ENERGY IN LIBYA

In terms of solar energy, it could be argued that solar energy is the most important renewable energy resource. Based on data acquired from The Centre for Solar Energy Research and Studies, the average annual solar radiation in some areas in Libya is summarised in Figure 8. Solar energy could be considered one of the primary resources due to Libya's location on the cancer orbit line with exposure to the sun's rays throughout the year and with extended hours during the day. The daily average solar radiation on a horizontal plane is about 7.1kWh/m² /day on the coastal region in the north and 8.1kWh/m² /day in the South region, with the average annual sun duration more than 3500 hours per annum.

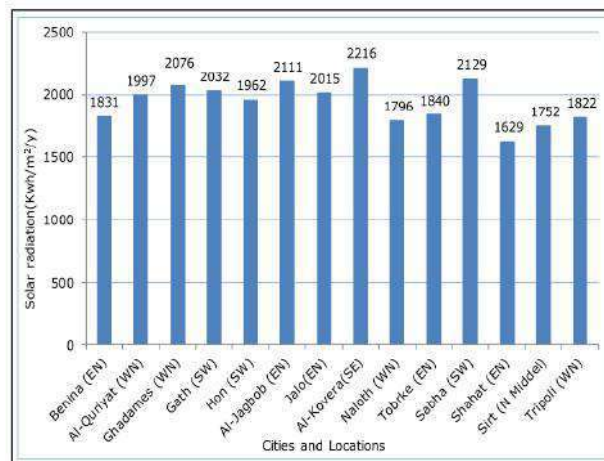


Fig. 1: Average annual solar radiation in some areas in Libya.

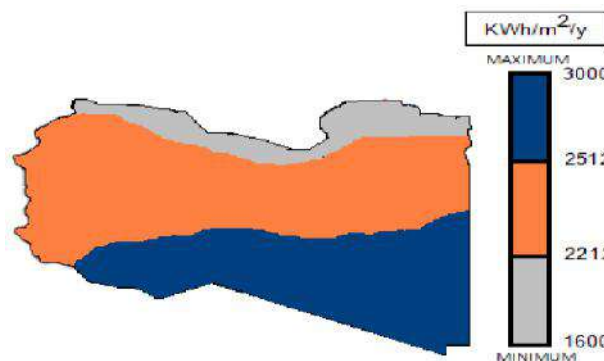


Fig. 2: Estimated average solar energy in Libya in kWh/m² per annum. It concerns wind energy resources.



Fig.3: Shown Libya Construction of 100 MW Solar Power Plant in Kufra Town.

Libya's renewable energy authority stated that the average solar brightness hours are about 3200 hours per year, and the average solar radiation is 6 kWh per square meter per

day. This will equal $= 10^6 \times 1.5 / 365 \approx 4110$ barrels of oil per days. Therefore, if we use only 0.1% of the Libyan area, this would lead to $(0.001 \times 1.7 \times 10^6)$, and this equivalent to $(1.7 \times 10^6 \text{ km}^2 \times 0.001) \times 4110 = 6.986$ million barrels of oil per day of energy. This number is six times more than the current Libyan production of oil. Therefore, wind and solar energy could provide a good complement to meet peak loads. And this, in turn, can be a good reason for encouraging wind and solar energy projects in Libya [3].

Construction of a 100MW solar photovoltaic power plant in the town of Kufra in southeastern Libya has commenced. The Prime Minister of the Eastern Government launched the project and laid the foundation stone for the construction. The solar project is in line with the 2030 vision of the General Authority for Electricity and Renewable Energy, based in the East, which aims to exploit alternative and clean energies, particularly solar and wind power. The power plant will occupy 200 hectares, and construction has entrusted to a Chinese company. Upon completion, it will reinforce the electricity network of Kufra, which is currently supplied by a thermal power plant consisting of 3 units of 25 MW each. The power plant has been out of service for several months due to a fuel supply problem following the unrest in this North African country. Two of the three units of the thermal power plant have recently been rehabilitated.

IV. WIND ENERGY IN LIBYA

Traditional energy sources in Libya are limited to two sources: oil and natural gas. Studies have confirmed that oil resources will not last for more than 50 years of production, while natural gas is expected to continue for a more extended period in Libya.

A previous study reported that the possibility of utilising wind energy in electricity generation in some locations and connecting it with the national grid is high as in Benina, Sirt, Darnah, and Sebha, and Tolmetha [19]. In contrast, in other areas such as Ejdabia and Sorman, it is more favorable to use wind energy for water pumping and other applications. The data extracted from the Wind Atlas of Libya [15].

In general, the average wind speeds range between 5 and 10 meters per second in the Libyan areas. One of the main advantages of the wind in Libya matches the current and electric power demand in most places [20,22]. Furthermore, Libya is exposed to dry and hot winds, which blow several times during the year [23]. The neighboring countries to Libya have started to utilize the wind resource with different scales ranging from demonstration projects

to commercial-sized wind farms, which indicates its feasibility in that region [24].

Table.2. The estimated average wind speed in different Libyan cities.

Location	Average of Wind Speed (m/s)
Ejdabia	2.5-3.0 m/s
Sorman	3.5-4.0 m/s
Benina	5.0-5.5 m/s
Chat	5.0-5.5 m/s
Tolmetha	5.5-6.0 m/s
Sirt	6.0-6.5 m/s
Sabah	6.0-6.5 m/s
Tarakin	6.5-7.0 m/s
Tubruq	7.0-7.5 m/s
Al magrun	7.0-7.5 m/s
Tukra	7.0-7.5 m/s
Jbalzaltan	7.5-8.0 m/s
Al-Fattaih- Darnah	8.0-8.5 m/s



Fig.4: wind turbines.

As far as renewable energy considered, it is not a well-investigated subject in Libya due to the availability of oil as Libya is one of the leading exporters. Although renewable energy, such as solar and wind energy, as discussed above, is widely available in Libya, it remains difficult to break the dependence on oil and natural gas, not only for the power supply but also for revenue to finance community development and infrastructure [3].

V. CHALLENGE OF USING RENEWABLE ENERGY IN LIBYA

The distribution network of electricity in Libya is expensive due to its vast area, with about 200 scattered villages with population ranges between 25 and 500 inhabitants and far away from the grid by not less than 25 km [25]. The distributed generation is a new significant tendency in energy systems, which should be considered an alternative to traditional energy production. This concept is marked to prevent power failure, which can be avoided if an area does not depend only on one energy resource. The utilization of renewable energy resources makes distributed systems more feasible because energy can be produced closer to the demand centers, decreasing the need for long transmission lines, and reducing power loss across those lines. The use of renewable energy resources in its simple form of direct benefit for heating water solar ovens, geothermal heat pumps, and mechanical wind turbines, or in its more complicated way of indirect use in creating other energy sources to produce electricity by means of photovoltaic cells and generation through wind turbines, could save the public budget huge funds, as well as providing exemplary service to people, particularly in remote areas [3].

VI. CONCLUSION

The most important renewable energy factors in any country depend mainly on solar radiation, wind, biomass, and geothermal resources. Wind energy can play a significant role in partially contributing to the energy needs and overall electrical energy demand in Libya so that wind energy can be used for various purposes, such as electricity generation, communication systems, and mechanical activities. Solar energy can be used for street lighting, communication system, home electricity, and swimming pool water heating. It will be beneficial for the country to produce electricity at a low cost and provide economic benefits in terms of revenue. This paper can also conclude that Libya has implemented effective strategies for developing its renewable energy. Still, there are different challenges and barriers, such as legal, political, economic, and financial barriers in implementing and developing renewable energy technologies in Libya. These barriers will make the development of renewable energy in Libya difficult, but it can be resolved by effective planning and its execution by the government. The government will have to take initiatives to improve the investors' conditions to invest in these projects to generate solar and wind energy for the country's benefits. For this, the Libyan government will have to provide financial support and

remove legal and political issues for the investors to be able to invest in energy projects to a great extent. several plants were decided to build as following: wind farms: Dernah (60 MW); Al-Maqrun (120 MW); Western region wind farm (250 MW); Al-Maqrun, 2nd stage, (120 MW) Large scale PV plant grid-connected in different locations about 5–10 MW; Expanding the use of PV technologies to feed remote areas about 2 MW; PV rooftop systems to supply certain residential areas about 500 designs.

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Analysis of the Relation of Social Skills and Successful Aging Strategies in Elderly People Regularly Participating in Digital Inclusion Courses

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Abstract— Social relations contribute to give meaning to life, favoring the organization of identity through the interrelationship between people. Although there are studies that indicate an association between interpersonal relationships, social support and quality of life of the elderly, only a few focus specifically on the social skills of this population and the empirical relationship with successful aging. The objective was to analyze the association between social skills and successful aging strategies. The method had a quantitative, descriptive and cross-sectional design, with a sample of 50 people, between 60 and 84 years old, of both genders, participating in computing groups in Novo Hamburgo/Brazil. The Social Skills Inventory 2 (IHS2-Del-Prete), and the Selection, Optimization and Compensation Inventory (SOC) were used. For data analysis, descriptive, correlation (Spearman) and linear regression (stepwise) analyzes were performed. The results showed that the increase in the use of successful aging strategies is directly related to the expansion of social skills for expressing positive feelings and for social resourcefulness. The strategy of elective selection, for the promotion of successful aging is directly related to the improvement of social skills, especially of assertive conversation and social resourcefulness. The loss-based selection strategy is directly related to the expression of positive feelings and social resourcefulness. Therefore, it is relevant that public actions and policies that promote the development of successful aging strategies are maintained and promoted, as they can assist in increasing the repertoire of social skills.

Keywords— Elderly, Successful aging, Social skills, Digital inclusion.

I. INTRODUCTION

Over the years, in the world, people have lived longer. It is estimated that by the year 2050 the population aged 60 or over may reach 2 billion. In 2015, there were 900 million elderly people. Today, 125 million people are 80 years old or older, and, by 2050, the number could reach 554 million people worldwide. With that, we can see that the number of elderly people has been growing dramatically [1].

Some factors such as older age, the limitations that end up interfering in the functioning of the elderly, not having

children, the losses, the difficulty of living or contacting close family and friends, as well as diseases, are risk indicators of isolation. Each individual builds their social network throughout life. The construction and extension of this network depends on sociodemographic, cultural and personality factors. Throughout the aging process, social networks change according to the changes in relationships, or as a response to the needs of each person. The social network of elderly people may consist of family members (spouse, extended family), friends, neighbors and formal support networks - social support services, social groups,

telephone, internet [2]. The social engagement of these people can be measured through their involvement in activities such as going out with friends, helping with social work, participating in groups, among others. These activities promote companionship and socialization, in addition to bringing benefits to physical and mental health, and reducing isolation [3].

Successful aging, which encompasses a balance between gains and losses, is associated with activity. In this context, the word activity is related to the ability to maintain daily tasks, which include leisure, the practice of physical exercises, health care, performing housework, and it is understood as autonomy and independence [4]. The Selection, Optimization and Compensation system (SOC) is mentioned in several studies [5, 6, 7, 8]. It was developed by Baltes and Baltes [9] who point out that through the selection, optimization and compensation processes, the elderly are able to adapt to the changes that occur in their lives. Such processes end up assuming a great importance in this age group, due to the losses associated with this phase of life.

According to the SOC model, it is possible to use mechanisms of adaptation and organization of life, which allows subjects to increase gains and decrease losses, thus reinforcing successful aging [9]. Considering that, the development of a successful aging process is facilitated through medical, technological, community and social policy interventions and strategies, psychological life management strategies should also be considered, which help in understanding the most appropriate ways to live well, until the age is reached when this is no longer a possibility. When using the selection, optimization and compensation mechanisms as a way to explain how the adaptation of human life occurs successfully, an adaptation model is composed, which can be used in different areas of human functioning (physical performance, social relationships, cognition, etc.), especially after the age of 40 and during old age. SOC is based on the conception that our life course includes regular changes related to the objectives and the meaning of life itself, demanding these changes to be carried out in a systematic way in the distribution of resources [6].

The contacts and activities that are carried out in society can provide an increase in social support networks and assist in coping with different interpersonal demands, which contributes to personal effectiveness, as well as to the development of a positive identity, as well as good self-esteem. Involvement in social activities also contributes by bringing positive effects to cognition, health, longevity and functionality, in addition to stimulating the feeling of being useful, as well as the sense

of belonging and the exchange of help, which need to be encouraged [10].

In general, the behaviors that occur in social interactions can be grouped into two broad categories: antisocial and social skills. Antisocial skills cover a variety of aggressive behaviors, which can be verbal and/or physical, and are highly likely to compromise the quality of interpersonal relationships. In contrast, social skills are groups of behaviors available in a person's repertoire, which contribute to the quality and effectiveness of the interactions they establish with others, in addition to contributing to their effective coexistence in society [11].

These social skills refer to the ability to perform socially imposed tasks, which can be related to leadership, group coordination, stress management and internal, external and group conflicts. As for the context, social skills can be learned, as well as determined by the culture in which the individual is inserted, thus, the opportunities arising from the environment and culture are of great importance. Environmental influence may or may not reinforce the social behaviors that are presented, in the same way that it allows learning new skills through observations and interactions. Some of the environmental elements that exert influence are age, the stage of development, gender, the level of education, the family situation, the cultural context and the socioeconomic and occupational situation [10, 12].

Although there are studies indicating an association between interpersonal relationships, social support and quality of life for the elderly, there is still little research that focuses specifically on the social skills of this population and its empirical relationship with successful aging. Thus, it is possible to assume that the elderly who have a good social support network tend to be more socially competent, and have higher levels of quality of life than those who interact only with their family group and some friends. It should be noted that deficiencies and impairments in social skills are generally associated with difficulties in interpersonal relationships, as well as with various types of psychological disorders such as social isolation, suicide and depression [10, 12, 13, 14, 15, 16].

With this in mind, this study sought to analyze the association between social skills and successful aging strategies in elderly people who regularly participate in computing activities in the city of Novo Hamburgo, Rio Grande do Sul, Brazil. The choice for this subject is justified due to the importance of social relationships in people's lives, as well as its influence throughout the successful aging process. Based on this relation, it seemed important to investigate the social skills present in these

subjects, due to the few studies carried out on this theme. This investigation aims to bring contributions on the issue of social skills in the elderly, seeking to deepen this theme that is increasingly relevant, due to changes in the population and technological profile, which has been increasing people's life expectancy.

II. METHOD

The method used has a quantitative, descriptive and transversal design, and the research was carried out in the municipality of Novo Hamburgo, Rio Grande do Sul, Brazil, in partnership with the Directorate of Digital Inclusion of the Municipal Administration Secretariat (SEMAD) of the Municipality of Novo Hamburgo. A total of 50 elderly people, over 60 years old, of both genders, participated in this study, who regularly attend these groups. The participants have been selected according to their availability and convenience in participating in the research. Data collection was carried out from June to October 2019, weekly on Wednesday afternoons.

The variables analyzed in this study were social skills and strategies for successful aging. The instruments used were the Social Skills Inventory 2 (IHS2-Del-Prette) and the SOC Inventory, which are described below:

- Social Skills Inventory - The IHS2-Del-Prette is a self-report instrument, easy to apply, which is aimed at characterizing the social performance in different situations (work, school, family, everyday), that is, it enables the assessment of the repertoire of social skills usually required in several everyday interpersonal situations, offering diagnosis for use in the clinic, in education, in the selection of personnel and in professional training. It consists of 38 items that encompass essential skills for satisfactory and successful relationships. Each item describes a situation of social interaction and a possible reaction to it, enabling the identification of available or deficient resources in the respondent's repertoire and, consequently, facilitating the planning and monitoring of the intervention to be carried out [17].

- Selection, Optimization and Compensation Inventory (SOC) explain the concept of successful aging, developed by Baltes et al. [18]. In its original version it contains 48 items. However, in this study, the brief version described by Baltes [19] as more favorable was used. This version consists of 12 items that assess the use of SOC strategies by the elderly. Almeida, Stobäus and Resende [20] proposed the Brazilian version of this instrument. Each item consists of two statements; one describing the behavior reflecting the SOC and the other offering a reasonable option, but not related to the SOC. Participants

must decide which of the two alternatives characterizes their behavior. After the classification and planning of the collected data, descriptive, correlation and regression studies were carried out.

The Ethics Committee of the Feevale University approved the study. All participants signed an informed consent form (ICF), in accordance with the resolutions 466/2012 and 510/2016 of the National Health Council of the Ministry of Health that deals with research involving human beings.

III. RESULTS

For the analysis of the results, descriptive and correlation analyses were performed by using the Spearman Correlation coefficient, with acceptance level ≤ 0.05 . For the statistical study, the Statistical Package for the Social Sciences - SPSS - for Windows, v. 25.0 was used. The variables analyzed were mean score, assertive conversation, affective-sexual approach, expression of positive feeling, self-control/coping and social development (IHS2 - Del-Prette), and mean SOC, elective selection, loss-based selection, optimization and compensation (Inventory SOC). The study sample consisted of 44 women and 6 men, totaling 50 participants aged between 60 and 84 years.

In the descriptive analysis of social skills (IHS2-Del-Prette) a great variability in the percentiles obtained was present. This variation occurred not only between the percentile classifications, but also within the intervals for each factor, as shown in Table 1.

Table 1: Participants by percentile range for IHS2-Del-Prette factors

IHS2 factors	IHS2 percentile ranges					Total
	1 - 25	26 - 35	36 - 65	66 - 75	76 - 100	
Mean Score	6	2	19	3	20	50
Assertive Conversation	3	7	23	2	15	50
Affective-Sexual Approach	12	4	11	7	16	50
Positive Feeling Expression	3	0	10	2	35	50
Self-control/Coping	8	6	9	6	21	50
Social Resources	18	2	7	4	19	50

The percentile range from 1 to 25 indicates a lower repertoire of social skills, that is, a need for social skills training. The percentiles between 26 and 35 indicate a lower mean repertoire of social skills, and a necessity for training. The percentile range from 36 to 65 indicates a good repertoire of social skills, with average results. The range of 66 to 75 percentage points indicates an elaborate repertoire of social skills and results within this range are considered above average in most of the items in which they appear. Finally, the 76 to 100 percentile range point to a highly elaborate repertoire of social skills and also represent an above average result in virtually all items in which they appear [17].

The analysis of the IHS2-Del-Prette percentile averages in the female and male sample and in the age groups (60 - 69 years and 70 - 84 years), as well as in the total sample, is shown in Table 2.

Table 2. Percentile presented in IHS2 - Del-Prette by gender and age group

IHS2 Factors	Gender		Age group		Total
	Female	Male	60	70	
			to 69	to 84	
		years	years		
Mean score	66.54	59.5	70.11	60.91	65.7
Assertive Conversation	59.5	46.5	62.61	52.87	57.94
Affective-Sexual Approach	54.38	60.83	58.79	51.25	55.16
Positive Feeling Expression	81.84	73	81	80.54	80.78
Self-control/Coping	59.38	75	62.15	60.29	61.26
Social Resource	50.68	68.66	56.34	49.04	52.84
N	44	6	26	24	50

In general, the sample shows that elderly people have an elaborate repertoire of social skills, with results above average for most of the items and subscales in which they appear. These outcomes are indicative of very satisfactory interpersonal resources. Among all, the factor that obtained the highest percentile was the positive feeling expression, indicating a highly elaborated repertoire of social skills to express and deal with demands when facing the family and others, including giving and thanking

praise, expressing affection and love, talking with strangers and even dealing with fair criticism and defending others in a group. The factor with the lowest average, on the other hand, was social development. However, even with the lowest average, the percentile presented indicates a good repertoire of social skills that express disinhibition and social resourcefulness in the face of interactive demands in general, therefore superimposed on the other factors, in response to demands for interaction with acquaintances, strangers, people with authority and group self-assertion [17].

The female population presented an elaborate repertoire of social skills, with above average results, while the male population presented a good repertoire of social skills, with results within the average. The male sample, despite having a good repertoire of social skills, was slightly below the averages found, but with a balance between resources and deficits. In men, the best performance occurred in self-control and coping, which represents the ability to deal with situations that demand coping with the potential risk of undesirable reactions on the part of the interlocutor (possibility of rejection, reply or opposition), such as reacting to unfair criticism, express displeasure, disagree with a group of acquaintances or people of authority or defend someone who is being criticized. The worst performance in the male sample occurred in assertive conversation that represents skills such as initiating, maintaining and ending conversation, dealing with criticism and praise, approaching authorities, asking questions and asking favors from strangers, negotiating condom use, requiring, starting and maintaining conversation, speaking in public, expressing displeasure and asking for behavior change. In the female sample, the factor that shows the best performance is the positive feeling expression and the worst performance is in social resourcefulness. However, this difference is not significant due to the size of the male sample [17].

Regarding the age ranges, from 60 to 69 years old (26 participants) and from 70 years old onwards (24 participants), those in the first age group had higher percentile averages than those in the latter. However, both were allocated the same percentile ranges in all factors, except for the overall score. Therefore, the sample with subjects above 70 years old, despite presenting a good repertoire of social skills, is slightly below the averages found, but with a balance between resources and deficits. In both age group classifications, the factor that presents the best performance is the positive feeling expression and the worst performance is in social resourcefulness. Therefore, the studied group does not present any indication of deficit and need for social skills training [20].

Table 3 shows the descriptive analysis of strategies for promoting successful aging: SOC, Elective Selection (ES), Loss-Based Selection (LBS), Optimization (O), Compensation (C), according to gender and age group: SOC.

Table 3. Descriptive analysis of successful aging strategies according to gender and age group

		N	Min.	Max.	Mean	Sd	
Male	60 to 69 years	SOC	2	8	11	9.50	2.12
		ES	2	2	3	2.50	0.70
		LBS	2	2	3	2.50	0.70
		O	2	2	2	2.00	0.00
		C	2	2	3	2.50	0.70
	Over 70 years	SOC	4	5	11	8.25	2.50
		ES	4	1	3	1.75	0.95
		LBS	4	2	3	2.75	0.50
		O	4	1	2	1.75	0.50
		C	4	0	3	2.00	1.41
Female	60 to 69 years	SOC	25	3	10	7.12	2.04
		ES	25	0	3	1.84	0.98
		LBS	25	1	3	2.08	0.70
		O	25	0	3	1.72	0.79
		C	25	0	3	1.48	0.82
	Over 70 years	SOC	19	4	10	7.05	1.77
		ES	19	0	3	1.84	0.83
		LBS	19	0	3	2.05	0.84
		O	19	0	3	1.42	0.76
		C	19	0	3	1.74	0.93

Almeida, Stobäus and Resende [21], in their work of adapting the Selection, Optimization and Compensation (SOC) inventory, point out those SOC strategies can be observed in people's daily lives, in which each individual reacts in different ways in the face of the situations that arise, seeking to adapt to the choices necessary to achieve their goals. The selection strategies refer to the need to choose goals and actions. When it is not possible to pursue and achieve all the opportunities that arise, elective selection is used. When losses are faced, it is necessary for individuals to concentrate on finding ways to seek new

objectives and adapt to the new standards presented and in these cases the loss-based selection strategy is used. Optimization strategies can be understood as a process in which resources are acquired, improved and applied to achieve the objectives, in order to maximize the gains. Finally, the compensation strategies elect some strategy to be used in maintaining a specific level of desirable functioning, when losses are suffered.

The participants in this study presented a minimum of 3 and a maximum of 11 strategies, with an mean of 7.28 strategies (sd = 2.000). Loss-based selection was the most used, with a mean of 2.14 strategies (sd = 0.756), followed by elective selection with a mean of 1.86 (sd = 0.904), compensation with a mean of 1.66 (sd = 0.917) and optimization with a mean of 1.66 (sd = 0.753). The male group presented the greatest number of successful aging promotion strategies, especially in the 60-69 year age group.

The SOC Inventory used in this study has the following strategies: Elective selection strategies - focus on a more important objective at a given time. When I think about what I want out of life, I dedicate myself to one or two important goals. I think exactly what is important to me. Loss-based selection strategies - When I can not follow through on what I was doing, I focus on my most important goal. When things do not go well, I pursue my most important goal first. When I can no longer do something as I used to, I think of what exactly I can do in that circumstance. Optimization strategies - I make every effort to achieve a given goal. When I want to go ahead I choose a successful person as a model. I think about exactly how I can best carry out my plans. Compensation strategies - When things do not work as before, I look for other ways to achieve them. When I can not do something as well as before, I ask someone to do it for me. When something does not work as usual, I pay attention to how people do it [21].

Table 4 shows the bivariate correlations performed by using the Spearman test with social skills and strategies for successful aging.

Table 4. Correlation analysis of social skills and strategies for successful aging

		SOC	ES	LBS	O	C
Spearman's rho Social Skills	Coeff.	0.248	0.315*	0.143	0.107	0.010
	Correl.					
	Sig.	0.082	0.026	0.323	0.462	0.942
	N	50	50	50	50	50

Assertive Conversation	Coeff.	0.205	0.282*	0.121	0.129	-0.060
	Correl.					
	Sig.	0.153	0.048	0.403	0.371	0.681
	N	50	50	50	50	50
Positive Feeling Expression	Coeff.	0.296*	0.214	0.305*	0.168	0.038
	Correl.					
	Sig.	0.037	0.136	0.031	0.242	0.795
	N	50	50	50	50	50
Social Resource	Coeff.	0.427**	0.343*	0.295*	0.112	0.202
	Correl.					
	Sig.	0.002	0.015	0.038	0.437	0.160
	N	50	50	50	50	50

*. Significance level = 0.05.

**. Significance level = 0.01.

The correlation analysis showed that the increase in the use of successful aging strategies is directly related to the expansion of social skills for expressing positive feelings and for social resourcefulness. The strategy of elective selection, for the promotion of successful aging, is directly related to the improvement of social skills, especially of assertive conversation and social resourcefulness. The loss-based selection strategy is directly related to the expression of positive feelings and social resourcefulness. The optimization and compensation strategies to promote successful aging and the social skill factors of affective-sexual approach and self-control did not show significant correlations.

In this study, a linear regression analysis was also performed by using the stepwise method, with a significance level ≤ 0.05 , with social skills as a dependent variable.

Table 5. Multiple Linear Regression of the Social Skills variable (n=50)

Model	Non-standard coefficients		Stand. Coef.	t	Sig.
	B	Stand Error	Beta		
(Constant)	75.730	4.847		15.62	0.000
Elective Select	5.930	2.348	0.342	2.525	0.015

In the analysis presented in table 5, a direct relation (signal and intensity) between the social skills variable (dependent, explained) and the elective selection variable (independent, explanatory) was verified. In this model, a R-squared (R^2) = 0.117 was obtained. This coefficient of determination is a measure of the efficiency of the regression equation. It indicates that 11.7% of the variations in social skills can be explained by variations in the use of the elective selection strategy to promote successful aging. In this group, the promotion of the use of elective selection strategies is associated with the increase of social skills.

IV. DISCUSSION

Aging can have repercussions on people's health and social relationships. It may be related to increased morbidity and functional decline, which affects independence and social participation, in addition to causing losses in the social network due to illness and death of relatives, friends and neighbors. Old age can also be related to greater fragility and vulnerability in the face of adverse events, depending on the circumstances of life and genetic and environmental predispositions. In successful aging, there is a balance between gains and losses, which among other propositions help in the proper maintenance of activities. These activities are related to maintaining daily tasks, including health, physical exercises, housework, leisure, among others. In this context, the activities can still be considered a synonym for independence and probably autonomy. With regard to the social network, it has a very relevant role throughout the development and aging process, as the presence of family and friends is associated with the well-being perceived by each subject. This situation contributes to the strengthening of self-esteem and provides channels of communication and confidential relationships [4].

Evidence in the literature points to the importance of quality in social relationships, but does not provide enough data to indicate how to help the elderly to become socially competent. Social behaviors that lead to personal fulfillment, maintenance or improvement of self-esteem, increase in the quality of relationships, as well as respect and expansion of basic human rights are those that contribute to social competence and, for this reason, are called social skills [22, 23].

A good repertoire of social skills helps to improve the health and quality of life of the elderly, providing an increase in social and interpersonal skills to deal with conflicts of interest, defenses of their own rights, as well as an adequate expression of feelings and needs [22]. Del

Prette and Del Prette [23] emphasize the importance of social conversational skills in the behavioral repertoire, as these favor social skills. Through assertive skills, the elderly are able to express their needs appropriately to the context, promoting an increase in self-esteem and avoiding the manifestation of hostile behavior.

The use of selection, optimization and compensation mechanisms can be seen as a way of explaining how the adaptation of human life occurs successfully. Such mechanisms make up an adaptation model that can be used in different areas of human functioning (physical performance, social relationships, cognition, etc.), especially from the age of 40 on and during old age [6]. In order to achieve successful development, the selection includes the search for a better psychic functioning in the face of new challenges, such as learning new behaviors, including minimizing the loss of certain abilities. It is an adaptive task that encompasses environmental demands, motivations and individual capacities [9].

According to Baltes [19], in old age, SOC strategies can assist the elderly in saving resources, allowing them to use fewer actions to achieve a goal, in addition to selecting the most significant goals to focus their efforts on. Thus, as it was possible to observe in the outcomes of this study, SOC strategies optimize or take advantage of the available resources so that the goals are possible to achieve. These strategies also compensate for losses, mobilizing resources with possible alternatives to create viable paths to achieve the desired objectives, for example, using prostheses to supply the lack of teeth.

Baltes [19] also states that to compensate for losses related to biological potential, the elderly have a greater need for culture and education. This situation ends up creating favorable conditions for the compensation and the stimulation of their development in the acquisition of new resources and skills.

Like any other behavior, social skills can be learned throughout life, either formally or informally through interaction with other people. Thus, the learning process ends up being influenced by culture and other aspects related to the environment (family, work, school, leisure, etc.) in which the subjects are inserted. These skills can also be organized based on the social role that each individual assumes throughout their life. Such roles are determined by culture, and involve certain types of behavior, which are expected by the social group in carrying out specific tasks [20].

In the case of our sample, it is clear that engagement in social inclusion activities are part of the spectrum of activities and situations that these people seek to face

adversity and set up strategies to continue maintaining successful aging.

The access of older people to education and learning can act as a resource for transformation, both in conception and in the image of dependence that is imposed on this population. With this, it is possible to create new mechanisms and spaces that are permeated with meanings [24]. Therefore, it can be considered that educational interventions act as agents to promote health and well-being, and contribute to a higher quality of life among the elderly and their communities.

Based on this perspective, it is also possible to infer that educational processes can make the reintegration of these elderly people into society viable, and thus compensate for the withdrawal that normally occurs due to retirement, the children leaving home and the other losses that occur in this period of life. Therefore, the return of these subjects to the context of learning or their engagement in socio-educational processes can provide the conditions for maintaining good health and well-being. The behavioral effects that may arise from these actions may influence new ways of living [25]. The learning process that occurs through social inclusion, which permeates selection strategies, optimization of internal and external resources and compensation for gaps, is enhanced by social integration and the consequent exercise of social skills.

Those who maintain contact with other people tend to have healthier habits and the help they provide or receive contributes to increasing the feeling of personal control, positively influencing psychological well-being. The support that social networks offer reduces isolation and increases the individuals' satisfaction with their lives. It is possible to verify throughout life that the coexistence between people promotes health-monitoring behaviors, corrective behaviors, such as exercises, diet, and adherence to drug treatment, sleep and general health care. Social relationships also help to give meaning to life, enabling the organization of identity through the relationship between people [26].

The IHS2-Del-Prette overall score represents the set of all social skills available, the assertive conversation includes the necessary skills to be able to talk effectively, being able to express, make and receive criticism, making the interaction fluid. The positive feeling expression includes the skills we use to demonstrate our positive feelings (love, friendship, gratitude, etc.), as well as defending people. Integrating social resourcefulness includes the skills necessary for people to be able to themselves in an uninhibited manner, facilitating social

behavior in situations that require interaction with acquaintances, strangers, authorities, groups, among others [17]. In regard to SOC strategies, selection strategies refer to the need to choose objectives and actions to achieve them, either by setting priorities, or to seek adaptation. Through optimization, people use what they have in the best way, seeking to increase gains and decrease losses. Finally, compensation defines the best strategy for maintaining people's operation when suffering a loss [21]. In conclusion, the selection, optimization and compensation strategies influence the use of the most appropriate social skill for each situation, as well as the acquisition of new skills and behaviors.

The computing groups that these elderly people participate can provide new social relationships, restoring the interaction of these subjects with their peers. These groups can also assist these subjects in the development of new social skills, in order to obtain a better relationship with their colleagues and teachers. For this, they can use SOC strategies to define their goals, as well as the best way to achieve them and obtain the best results with minimum losses. It is also worth noting that although all the social skills in our sample were good or very good, two did not show a significant relation with successful aging strategies, demonstrating that the affective-sexual approach and self-control are variables, which, during the aging process, are related to other social and emotional factors.

V. CONCLUSION

In conclusion, considering the outcomes from this study, it was possible to identify the existence of an association between social skills and SOC strategies, which are one of the ways used to achieve successful aging. Such findings reinforce the importance of conducting studies on this topic in this population. In addition, it is necessary to think and develop programs and public policies that enable the training and learning of social skills, since they help to maintain health, improve interpersonal relationships, reduce isolation and facilitate reintegration in the society.

As limitations of the study, it is worth noting the small number of people in the sample in general, especially the number of male participants, as well as being restricted only to elderly people who participate in the computing courses. Therefore, a larger and more comprehensive sample is suggest for future research. Another suggestion is for other instruments to be included, thus expanding the variables and characteristics, such as social relations and

interactions. Although this research has some limitations, its contribution to psychogerontology is quite significant.

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Wind Energy in Brazil: Present Trends and Future Scenarios

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Abstract— Wind energy is becoming one of the main energy sources of the Brazilian Power Sector. The installed capacity increased from 247,00 MW in 2007 to 15.378,85 MW in 2019. This paper aims to examine the current scenario and the perspectives for wind energy in the country, based on an analysis of the institutional framework that developed the wind power sector in Brazil. In order to do this, this study carries out an analysis on two mechanisms that fostered this sector in Brazil: The Incentive Program for Alternative Energy Sources and the Auction of Alternative Sources, based on official data, legislation and specialized literature. The Incentive Program for Alternative Energy Sources enabled the acquisition of many wind farms, as it introduced local content rules. In addition, due to the prices that resulted from generation auctions in recent years, the extreme competitiveness of wind energy in Brazil becomes evident.

Keywords— Wind Energy, Public Policies, Brazil, Auctions, Competitiveness.

I. INTRODUCTION

In Brazil, the development of the power sector was strongly based on large hydroelectric plants with extensive water reservoirs. However, due to the intensification of environmental pressures and the depletion of water potential, the diversification of the Brazilian electrical matrix became urgent. To achieve this objective, one of the main actions was the expansion of national wind farms. According to the Energy Research Company (EPE), from 2007 to 2019 the installed capacity of this source increased from 247,00 MW to 15,378.85 MW, which represents an impressive average annual growth of 40.74% from 2007 to 2019 (EPE, 2020).

This expansion allowed the expressive increase of the participation of wind energy in the national electricity matrix, accounting for 9.0% of the Brazilian matrix in 2019, and thus the third energy source in terms of installed capacity after hydropower¹ (60.5%) and thermal (24.2%) (EPE, 2020).

It is also important to note that the current trend of increase of wind generation in the total mix is progressive. In this sense, according to the Decennial Energy Expansion Plan

2029

(PDE 2029) (EPE, 2019a), the share of wind energy in the electricity matrix in 2029 will be 17.32% (39,475 MW). Therefore, it can be said that the wind energy will be one of the pillars for the sustainable development of the country.

The developed auction system manages to coordinate the expansion of wind energy generation and provides for the allocation of energy generated by them according to the demands of the distribution companies, which are verified through market projections. One of the ways that government promotes the installation of new generating units is through New Energy Auctions. It was through this type of auction that the greatest expansion of wind power generation in Brazil occurred, leading to an accumulated growth of more than 6,000% increase in the installed capacity since 2006 until 2019 (ANAEEL, 2020).

In addition to making feasible the acquisition of many wind farms, the Incentive Program for Alternative Energy Sources (PROINFA) introduced local content rules, with the objective of fostering the national wind-based industry. Moreover, considering the results of electric energy auctions carried out between 2005 and April of 2020, wind power proved to be very competitive in terms of price, as

¹ The hydropower is the total national installed capacity plus the 7.000 MW imported from the Itaipu International Hydropower, due to a contract between Brazil and Paraguay.

can be seen in table 1. Except for hydropower, wind energy was the most competitive source. Therefore, one of the factors responsible for the recent expansion of the wind power source in Brazil is its competitiveness in relation to the other energy sources.

Table 1: Auction's Average Price per Source (USD/MWh²) – 2005 to 2020

Source	USD/MWh
Solar	64.96
Thermal	61.26
Small Hydropower (from 1 to 30 MW)	56.19
Micro Hydropower (up to 1 MW)	55.79
Wind	42.67
Hydropower	36.60

Source: ANEEL (2020), IBGE (2020).

Given this context, the objective of this paper is to present the current scenario and perspectives of wind energy in Brazil, based on an analysis of the institutional framework that led to the development of this sector in the country. For this purpose, the study focused on two mechanisms that fostered the sector in Brazil: PROINFA and the Auction of Alternative Sources. To achieve this objective, this paper is structured in 5 sections, including this introduction. Section 2 discusses the methodology of the paper. Section 3 presents a brief overview of installed wind power capacity in the world and in Brazil, as well as the capacity factor. Section 4 presents the institutional framework for the development of the wind energy industry in Brazil, focusing on PROINFA and alternative energy auctions. Finally, section 5 presents the conclusions and some considerations.

II. METHODOLOGY

The introduction section of this paper provides a literature review on the latest specialized studies on wind energy, with an approach to the scenario of this source in the world and, specifically, in Brazil. In this case, a systematic review of the literature is characterized by required critical appraisal, in addition to a synthesis of the information collected (Sampaio; Mancini, 2007). Section 3 carries out an analysis regarding the installed capacity of wind energy in Brazil and in the world and concerning CF of this source in Brazil. A study was also carried out regarding the evolution of the sector in Brazil and in the world, as well as of the current

scenario and future perspectives for wind energy, based on data from specialized centers in the power sector, such as GWEC and EPE. In section 4, the institutional framework structured to foster this renewable source of energy was presented. Regarding public policies, this section of the article focused only on the PROINFA program, with an analysis based on legislation. PROINFA is the first incentive program, in terms of a targeted government policy, to stimulate wind energy in Brazil. In this same section, a study will be carried out on Alternative Source Auctions, mainly based on data from National Agency of Electric Energy (ANEEL). The analysis of real prices by source is one of the means to evaluate the competitive advantage of wind energy. For this purpose, official data from generation auctions was collected between 2005 and 2019 for each source. From this data, a weighted average of prices for the power auctioned at each auction was done and then updated by the Brazilian Broad Consumer Price Index (IPCA). Finally, to obtain the real prices by source, a weighted average of each auction was made considering the contracted total of each source in other rounds. The renewable auctioning system consists of the determination by ANEEL of the amount of energy that must be auctioned and produced from alternative renewable sources. It is a competitive system, in which the lowest values win the bids until the amount of energy initially fixed by the auction is completed. Subsequently, long-term contracts are signed with the winners.

III. EVOLUTION, CURRENT SCENARIO AND WIND ENERGY PERSPECTIVES

The use of the wind as a resource started with the discovery of the conversion of the mechanical energy generation into something useful. The simplest wind devices date back thousands of years, such as the vertical- axis windmills found on the borders of Persia (Iran) around 200 BC (Kaldellis and Zafirakis, 2011).

The use of wind for electrical purposes is relatively recent, dating to the late 19th century in Denmark and the United States, with the use of machines which generated electricity (Tester et al., 2005). A century later, when electricity was already heavily supplied by fossil fuels, the major energy input at the time around the world, the first oil crisis in 1973 led the USA government to support research and development for wind energy. In this context, wind energy emerged as a viable alternative from the 1970s onwards when the technology for the wind power construction was

² The mechanism used for calculating prices will be explained in the next section

fostered for the first time (Wizelius, 2015; Leung; Yang, 2012; Kaldellis; Zafirakis, 2011).

After 1990, the European market intensified its expansion, both in terms of new facilities and in terms of attracting parts and component manufacturers, as a result of strong incentives from local governments. The promotion of wind energy was based on old issues, such as energy dependency, and new ones, such as environmental concerns focused on reducing greenhouse gas emissions.

In the late 1990s and early 2000s, the wind energy market began to spread around the world, no longer being concentrated only in Europe and the USA. In this sense, new facilities and manufacturers emerged in Asia (mainly India and China) and, still in an embryonic way, in Latin America and Africa. Since the mid-2000s, wind energy was already consolidated around the world, becoming a competitive renewable energy source in the last decade with a significant contribution to the reduction of greenhouse gas emissions (EPE, 2016).

In this sense, economic competitiveness is a key factor for the development of wind energy and its catching-on process (Farris, 2017). Even without public policies to encourage this source, wind energy is becoming cheaper than coal in several countries, resulting in an energy transition in countries such as the United States, China and India (Lucena; Lucena, 2019). Furthermore, due to meteorological variations in wind availability, energy storage is also an important issue of increasing interest for several countries (Stiebler, 2008).

Wind energy is known as a clean generation source, which takes up relatively little space and can produce energy in remote locations, as well as being a rich resource due to its presence in several locations (Lucena; Lucena, 2019). In addition, wind energy technologies can produce up to 10 times more jobs per MW of installed capacity than conventional fossil and nuclear-based generation energies (Sovacool; Watts, 2009).

The wind industry's production chain consists of the wind turbine and infrastructure items in the wind farm, such as foundations, transformers, substation, cables and inverters (ABDI, 2014).

The wind turbine is a fundamental item, as it represents approximately 60% of the total investment in construction and converts kinetic energy of winds into electricity. It is a complex and large machine with capacities ranging from 1.5 to 3 MW (ABDI, 2014).

Wind turbines have differences in terms of technology, which can be classified according to four criteria: (i) speed of rotation; (ii) force regulation or control mechanisms; (iii) drive train; and (iv) type of generator.

In addition to the cost of building turbines, there is a cost regarding transmission lines structuring, network connection and for aligning the foundations, access roads and paying lease to landowners (Farris, 2017).

Considering that wind speed can vary significantly over short distances, the procedures for assessing the location in which wind turbines are to be installed must take into account all locational parameters that influence wind conditions. Among the main influencing factors in the wind regime, the following stand out (Montezano, 2012): variation of speed according to the height; roughness of the land, characterized by vegetation, land use and buildings; presence of obstacles in the nearby areas; conditions of the ground, which can cause an acceleration or deceleration effect on air flow.

The different types of energy sources have diverse impacts on the environment. Fossil energies deplete natural resources and have significant environmental impacts. On the other hand, wind energy is relatively clean, producing less impact than conventional sources of energy generation (Wessier, 2007; Leung; Yang, 2012; EWEA, 2009). In this sense, wind energy plays an important role in combating climate change by reducing CO₂ emissions in generation (EWEA, 2009). In addition, the incentive to wind energy and other renewable sources has a fundamental role in stimulating energy security, making the country less dependent on other energy supplying countries (Lucena; Lucena, 2019).

In general, the cost of producing conventional electricity is determined by the following components: fuel, CO₂ emissions, operation, maintenance and capital. Depending on several factors, such as turbine size, available resources at the site and the operation method, a turbine pays back the energy that has been used to manufacture it in 3-9 months (Wizelius, 2015).

3.1 Installed capacity of wind energy in the world

The use of wind energy for power generation has grown exponentially in the world in recent years. The installed capacity worldwide was 24 GW in 2001, and in 2019 global capacity increased to 651 GW, representing an average growth of 20.33% per year (GWEC, 2020), which is presented in Figure 1.

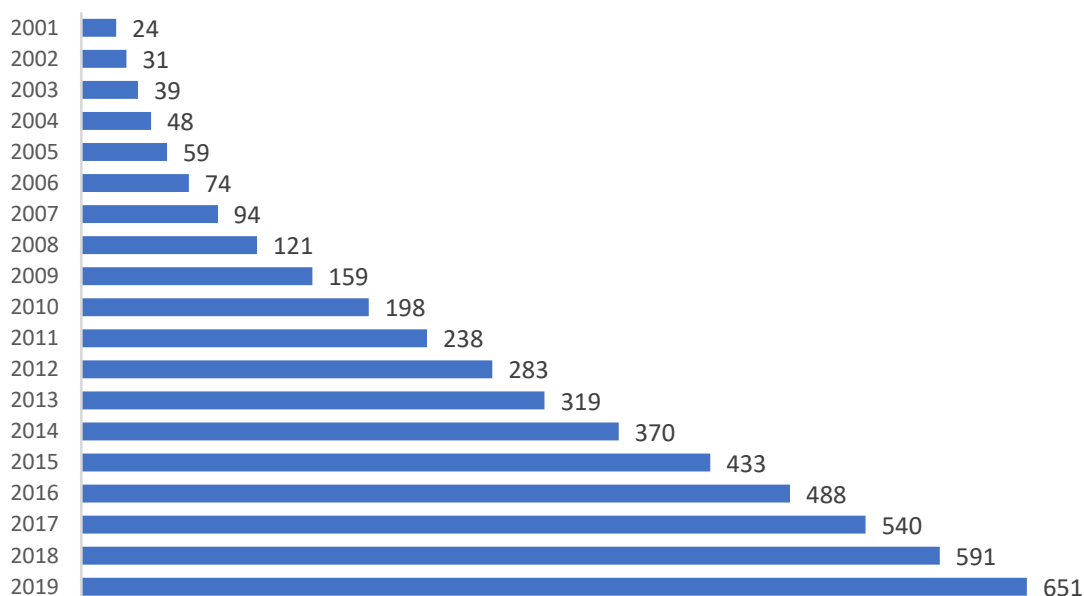


Fig.1: Evolution of the Global Installed Capacity (GW) – 2001 to 2019

Source: GWEC (2020).

Most wind turbines are installed on land (onshore), but a rising number of wind farms have been deployed offshore due to the decrease in appropriate land sites for new ventures (notably in Europe), even though they have higher costs. Of the total installed capacity worldwide in 2019, 83.80% is in only four countries, the two largest being China (36.34%)

and United States (20.82%). Brazil ranks eighth place, with 2.38% of the world's total, consolidating the country in a prominent position in a global scene. Figure 2 shows the top ten countries in terms of installed capacity regarding wind power.

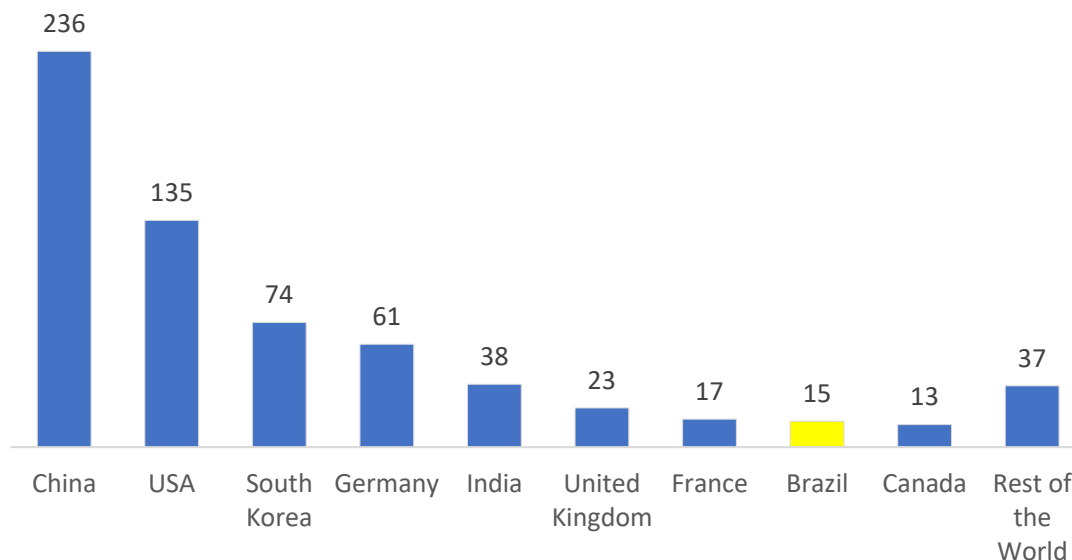


Fig.2: Installed Capacity (GW) by Country - 2019

Source: GWEC (2020).

It should be noted that the exponential growth of wind farms in the world was the result of policies for the promotion and

insertion of renewable energies, such as those adopted in the European Union (European Parliament and Council of the

European Union, 2001; 2009), and the implementation of different mechanisms of support such as tax cuts for renewables, carbon credit, carbon rates, price systems (i.e. feed-in tariffs), quota systems (i.e. renewables auctions) (Butler and Neuhoff, 2008; Couture et al., 2010; Ringel, 2006; Saidur et al., 2010).

Of all the mechanisms used, the most prominent was the feed-in tariff, adopted by at least 78 countries, including the five leaders in installed capacity (EPE, 2016; REN21, 2015). In countries where feed-in tariffs exist, utilities are compelled to permit wind parks to connect to the grid, as well as to pay a minimum fixed price for the renewable energy supplied by entrepreneurs (Stiebler, 2008; Mello, 2013). Feed-in support policies have proved very effective in stimulating the growth of renewables; however, auction schemes have gained popularity between 2010 and 2015, specially in developing countries due to their need to stimulate the implementation of renewable sources because of growing demand and to ensure lower energy costs (EPE, 2016).

The growing interest in auctions is driven by their ability to implement renewable energy according to the needs of the system in a planned way, with several advantages, such as: flexibility, the ability to guarantee greater security in price and quantity, and the transparency of the process (IRENA; CEM, 2015).

3.2 Installed capacity of wind energy in Brazil

The participation of wind energy has increased in the national electricity matrix, rising from 0.25% (237 MW) in

2006 to 9.04% (15,378.00 MW) in 2019 (EPE, 2020).

The main Brazilian study developed with a focus on the expansion of the power sector is the Decennial Energy Expansion Plan (PDE), produced by the Energy Research Company (EPE). Since the PDE is an indicative study, the amount and technological composition of the generation capacity expansion indicated in this document does not directly determine the investments that will be made in the generation system. Therefore, this means that generation expansion decisions are ultimately determined by decisions of agents in a market environment, through energy auctions and by contracting free market expansion. For example, the demand to be contracted is provided by market agents who may use projections different from those stipulated in the PDE (EPE, 2017). According to PDE 2029 (EPE, 2019), the share of wind energy in the electricity matrix is expected to continue to grow, rising from the current 9.04% to 17.32% in 2029.

Figure 3 shows the relative share of each source in the matrix in 2019 (in blue) and 2029 (in red). It is expected that the wind energy will exceed the thermal energy source, in terms of installed power, thus assuming the second position in the Brazilian electricity matrix in 2029, only losing to hydropower. In addition, it is important to state that there is complementarity between the wind source and hydroelectricity, as periods of rain and wind are interspersed (Bittencourt et al., 1999). In addition, wind energy may contribute to reducing transmission losses and reinforcing the grid (Dewi, 2000).

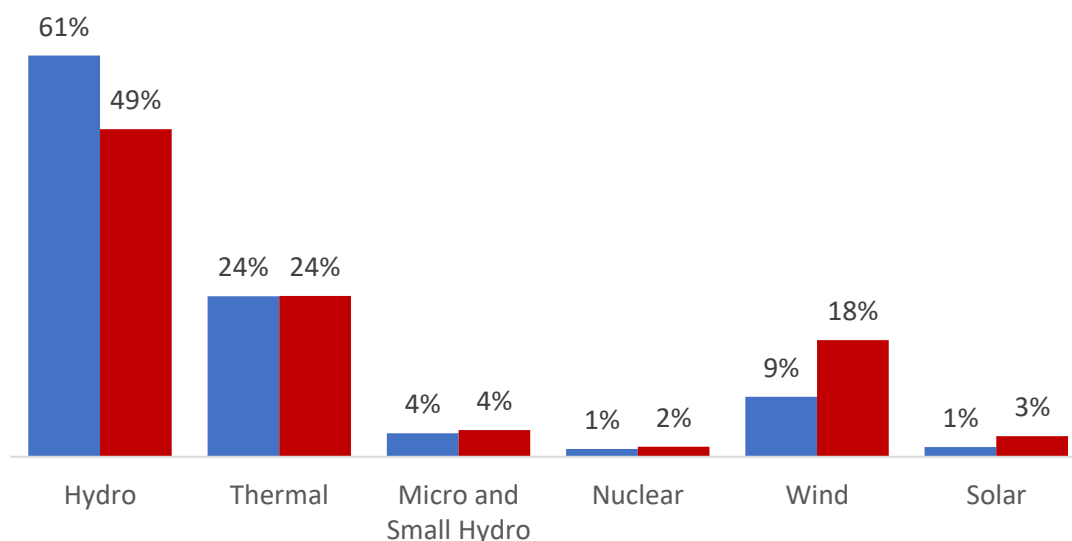


Fig.3: Share of Each Energy Source in the Brazilian Electric Matrix: 2019 and 2029

Source: Own elaboration with data from EPE (2020).

Figure 4 presents the evolution (actual and projected) of wind power in terms of installed capacity (GW). It is possible to analyze the expressive increase of wind energy

in between 2013 and 2018, period in which several parks began their operations and starting generating electricity.

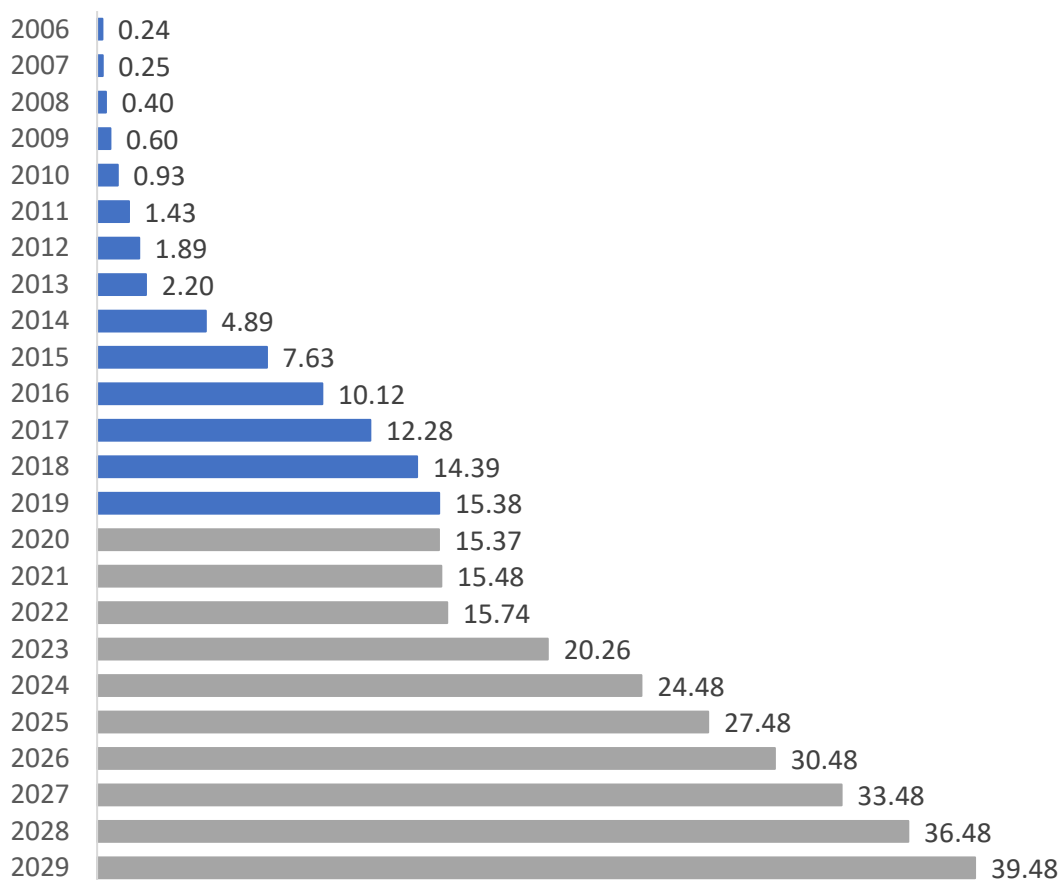


Fig.4: Evolution of the Brazilian Wind Installed Capacity (GW) – 2006 to 2029

Source: EPE (2016; 2019).

In 2018, the largest fraction of the installed capacity of wind energy (85.23% or 12,264 MW) is concentrated in the Northeast region. This region contains the cities with the lowest human development indexes. The wind energy chain generates several jobs for these cities, mainly during the construction period of the plants (Lucena; Lucena, 2019). Large groups that have established businesses in the Northeast region, with their compensatory and social responsibility policies, have fostered socioeconomic development in local communities (MME, 2015).

The Southern region represents a share of 14.58% (2,098 MW) and, with a marginal contribution, the Southeast region holds 0.19% (28 MW) of the country's installed capacity (EPE, 2019b).

In several cases, the construction of wind power plants must take place on private properties, and the construction authorization must come from the owner (Lucena; Lucena,

2019). Unlike hydroelectricity and gas production, wind energy does not pay compensation to states and municipalities, since the main beneficiaries of park facilities are landowners who receive leases for the use of land. In addition, for the installation of wind turbines, it is necessary to obtain authorization from local, municipal, regional and federal authorities, according to local, state and federal legislations and regulations (Lucena; Lucena, 2019).

In Brazil, many suppliers and manufacturers of wind turbine components have reached the market. In addition, a strong decrease in sales prices happened. The strategy of American and, mainly, European companies was to enter the Brazilian market aggressively, lowering prices and supplying cheaper equipment for the installation of manufacturing units in the country (Mello, 2013).

The competitiveness of the wind energy industry in Brazil can also be analyzed through the drop in average investment

value (total Capex), which was reduced by approximately 50% from 2005 to 2012. The initial value of USD 1.62 million per installed MW (PROINFA) was reduced to USD 943 thousand per installed MW in recent projects. This reduction is largely justified due to the technological revolution that the industry has undergone in recent years and, especially, due to the massive entry of wind turbine manufacturers, since 2009 (Mello, 2013).

3.3 Wind energy’s capacity factor in Brazil and in the world

Wind power’s capacity factor (CF) represents the ratio of actual unit generation to total capacity over a period. Therefore, CF can be interpreted as a measure of productivity. Worldwide CF has increased significantly due

to technological advances and increase in the size of facilities, which allows better appropriation of winds. In this context, Brazil has the highest average of CF in the world (MME, 2017), which can be seen in Figure 5. The Brazilian wind energy productivity of recent years has revealed an exceptional performance of the national generation matrix, with a higher CF index than other countries in the world, which reinforces the consolidation of this source in the Brazilian Power Sector (ABEEOLICA, 2018). In this sense, Brazil rose from a 32.42% FC in 2012 to 42.68% in 2019 (ABEEOLICA, 2020). On the other hand, the world average CF for 2016 was 24.7%, reinforcing the successful result obtained by Brazilian wind generation in recent years (MME, 2017).

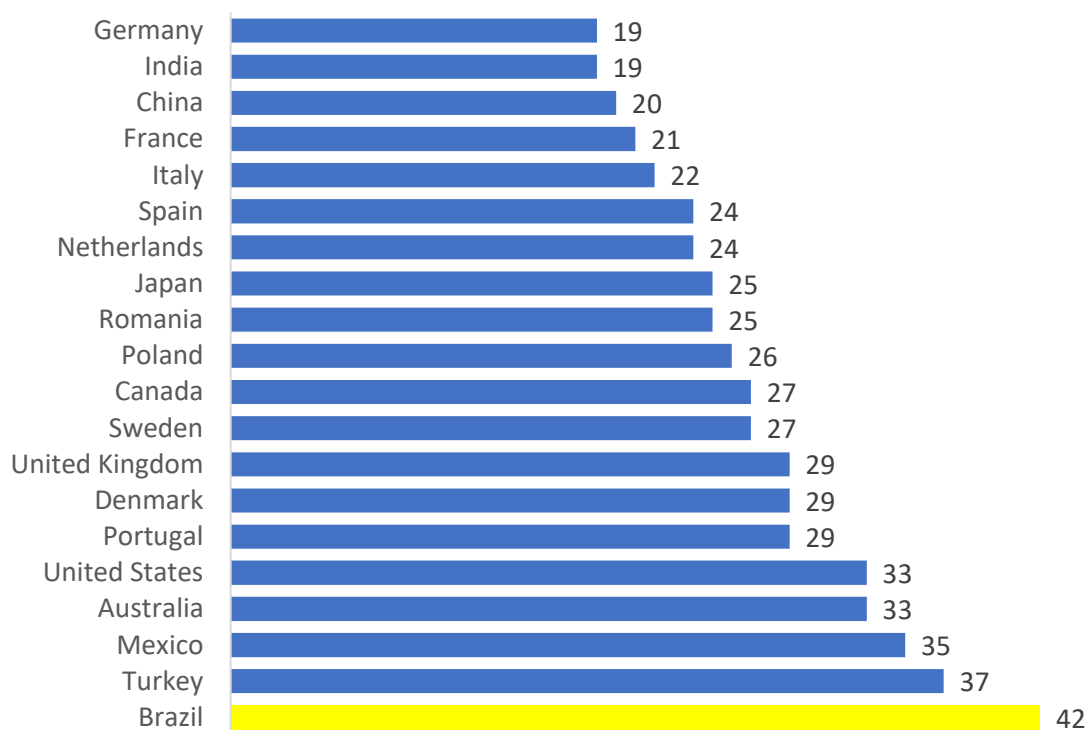


Fig.5: Average Capacity Factor by Country (%) – 2016

Source: MME (2017)

The characteristics of the country display that there is an immense opportunity of growth of the wind source due to the high generation potential still to be exploited; the high rate of usage resulting from geoFigure properties; the economic incentives for the source, such as exemption of taxes; discounts of tariffs; and exemptions on distributed generation.

The seasonality of the wind power source in Brazil leads to

an increase of CF in dry months, from May to November, with a decrease in the wet months, between December and April. Figure 6 shows the average, maximum and minimum annual Brazilian CF. It can be affirmed that a positive aspect of this seasonality is its complementarity with the hydropower source, which concentrates part of the generation in the dry period of the year. This means that stimulating wind energy contributes to the national energy balance.

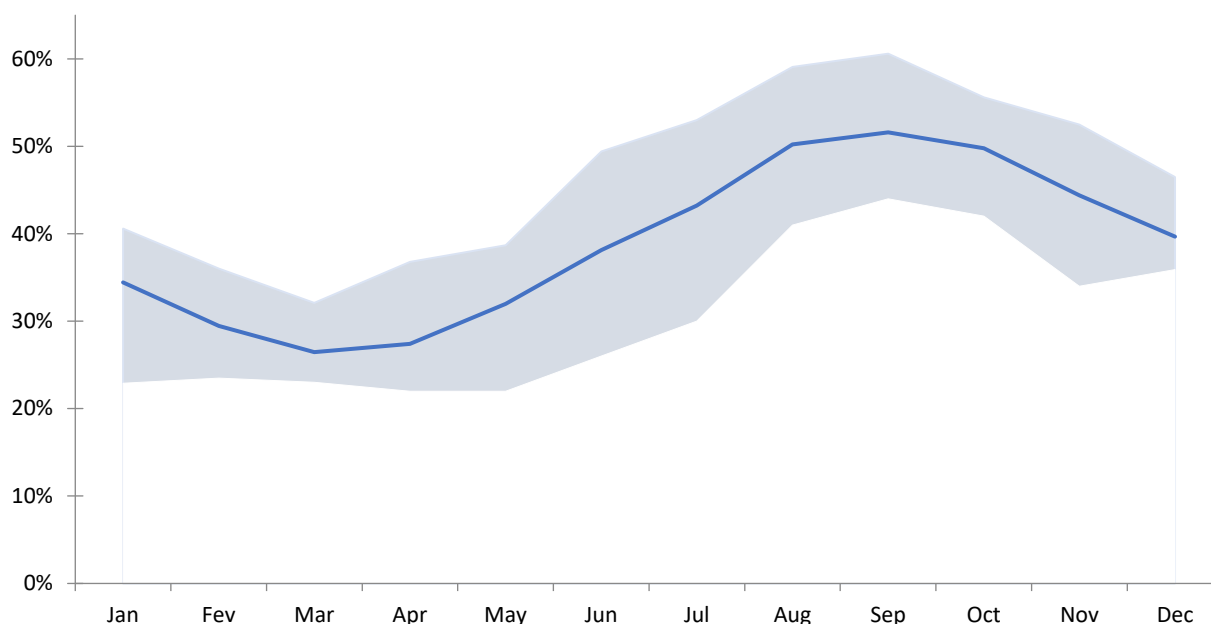


Fig.6: The Average, Maximum and Minimum Annual Brazilian CF – 2012 to 2019

Source: Completed with data from ABEEólica (2020)

IV. INSTITUTIONAL BACKGROUND

The energy thematic has become increasingly important in the Brazilian scenario, especially after the 2001 energy crisis. Since then, the Brazilian government has been concerned with diversifying the sources that make up the national energy matrix, seeking to increase the participation of alternative sources and, consequently, to foster security in electricity supply. As a result, the Brazilian government started to invest in programs that would encourage the production of electrical energy from other clean sources in addition to hydraulics (Tomalsquim, 2000; Pego Filho et al, 2001).

The legal framework and economic rules for the production, commercialization and distribution of energy are defined by the energy policies of national governments (Wizelius, 2015).

For the effective development of alternative sources, the State must create coordinated programs focused on each source to adequately stimulate its expansion.

After the detachment crisis between supply and demand of electricity in 2001, the current model of the Brazilian Electricity Sector (SEB) was created in 2004 through the ordinance of Decree No. 5.136/2004, regulating Law No. 10,848 /2004, which defined that the guiding principle of reasonable tariffs.

The auctions were created to make it possible to contract electrical energy at the Regulated Contracting Environment

(ACR) through price determination and the signature of Energy Commercialization Contracts in the Regulated Environment (CCEAR). The Ministry of Mines and Energy (MME) defines maximum auctions prices for existing projects. Through this methodology, generators receive a “fixed” revenue, based on the expected annual energy production (Mello, 2013). The objective low prices offerings in auctions forces investors to minimize investment, betting on the implementation of smaller wind turbines. Turbines with smaller generators and larger blades are cheaper, although they do not maximize the use of the local wind potential. As a result, these generators frequently operate close to the nominal capacity than the larger ones, having a lower MW ratio per local area and a greater capacity factor, which explains, in part, the high Brazilian capacity factor in wind energy, presented in section 3 of this article (Mello, 2013).

4.1 PROINFA

The first incentive to the wind power source began during the 2001 energy crisis, when the hiring of this type of generation in the country, hitherto insignificant, through the Emergency Wind Energy Program (PROEÓLICA) (Brazil, 2001). The program aimed at contracting 1,050 MW of wind energy projects by December 2003. However, the program did not achieve the expected results. In 2002, PROINFA was created by Law No. 10.438/2002. The main objective of

this program was to promote renewable energies³, diversifying the national electricity matrix and guaranteeing long-term supply of electric energy. More specifically, it sought to promote security of supply, valorization of regional and local characteristics, job creation, training of workers, as well as reducing greenhouse gas emissions (Brazil, 2002).

Initially, PROINFA was divided into two phases: the first for the implementation of short-term projects and the second for long-term implementation, with detailing defined by the law (Dutra and Szklo, 2006). In its first phase, PROINFA could be considered a type of feed-in tariff because it established specific values for commercialized energy by source for a period of 20 years (EPE, 2016). The costs of the program are recovered through a fee paid by the consumer through energy bills. In the case of wind energy, a base value of 46.56 USD/MWh was set, as well as a ceiling value of 52.81 USD/MWh (Brazil, 2004).

To facilitate the contracting of wind farms, the program introduced local content rules, aiming to foster the national wind-based industry as well as other sources involved in this. In addition to the feed-in mechanism, PROINFA presents an instrument of subsidies for investments by providing specific lines of credit of the Brazilian Development Bank (BNDES)⁴ for selected projects. PROINFA initially had up to 80% financing from BNDES and 3,300 MW of installed electricity produced from clean sources, with a nationalization index between 60 and 90% of the equipment and services used in power generation (Ferreira, 2008; Salino, 2011; Mello, 2013).

Currently, PROINFA continues to be an important government mechanism for the promotion of alternative renewable sources in the production of electric energy, by privileging entrepreneurs that do not have corporate ties with generation, transmission or distribution companies. The cost of this program, with energy acquired by Eletrobras, is paid by all final consumers of the National Interconnected System (SIN), except those classified as low-income.

PROINFA, with its maturation, elevated the country to an unparalleled level where currently non-conventional renewable energy sources are contracted without the need for subsidies, such as feed-in tariffs, used in other countries that invest in this source (Mello, 2013).

³ Small hydroelectric plants, wind power plants, and thermoelectric projects with biomass fuel.

⁴ Also known as the National Bank for Economic and Social Development is a federal public company, associated with the Ministry of Development, Industry, and Trade, with the goal of providing long-term financing for endeavors that contribute to the country's development.

Since the second phase of the Program was never regulated, energy auctions for the purchase and sale of energy became the main means of increasing the participation of alternative sources in the generation of electrical energy. Therefore, a new context for the promotion of wind energy in Brazil was consolidated with energy auctions.

4.2 Energy auctions

According to Da Silva (2011), the auctions promoted by the Electricity Energy Trading Chamber (CCEE) have become the main energy trading mechanism between producers and electricity distributors with the advent of the new Brazilian regulatory model after 2004.

Alongside PROINFA, another mechanism was implemented to stimulate the expansion and contraction of renewable sources: The Alternative Sources Auction (ASA). With energy auctions, a share of new renewable sources is negotiated in competitions⁵ promoted by the regulatory agency. In this case, the energy producer's subsidy is the difference between the price determined by the auction and the price of the wholesale energy. Public auctions for electric energy generation have become the system chosen by policymakers to adjust the issue of energy affordability in Brazil: with a target on the lowest energy price, there is lower impact on the cost of electricity to the final consumer (Camillo, 2013).

In its first round of the ASA, in 2007, 9 alternative projects were authorized, which totalized 939 MW of contracted energy. However, wind energy was only included in an exclusive contracting mechanism in 2009, through a Reserve Energy Auction. In this round, 339 projects were enabled, totaling 10,005 MW, of which 1,805.70 MW of wind energy, distributed in 71 parks, averaging 66.88 USD/MW in current prices.

Beginning with the 2009 Reserve Energy Auction, wind energy was presented in 20 specific auctions between 2009 and 2018, as shown in table 2, which displays the amount added in each round. From this, it can be said that the wind power source was contracted basically by three different mechanisms: Reserve Energy Auction (LER), New Energy Auction (A-3, A-4, A-5 and A-6)⁶, and Alternative Sources Auction (LFA).

The year of 2012 presented great challenges and difficulties for wind energy. In 2012, it is worth noting that only one

⁵ Proposals are classified by cost and the competition is determined in terms of price per MWh. Auctions have the role of defining the tariffs that are paid by concessionaires to producers, which will possess a long-term energy supply contract as well as a guarantee of payment according to a stipulated amount.

⁶ Power plants that begin commercial operation in up to, respectively, three, four, five and six years.

auction was held in December 2012, in the A-5 modality. In MW referred to wind energy sources. the event, only 574.3 MW were contracted, of which 281.9

Table 2: Share of Wind Energy in Auctions – 2009 to 2019

Auction	N° of Contracted Projects	Installed Capacity (MW)	Average Real Price (USD/MWh)
03/2009 (LER)	71	1,805.70	66.88
05/2010 (LER)	20	528.20	52.33
07/2010 (LFA)	50	1,519.60	56.29
02/2011 (A-3)	44	1,067.60	40.40
03/2011 (LER)	34	861.10	40.15
07/2011 (A-5)	39	975.70	41.77
06/2012 (A-5)	10	281.90	33.34
05/2013 (LER)	66	1,505.20	39.41
09/2013 (A-3)	39	867.60	43.91
10/2013 (A-5)	97	2,337.80	41.76
03/2014 (A-3)	21	551.00	44.02
06/2014 (A-5)	36	925.55	45.31
08/2014 (LER)	31	769.10	47.37
02/2015 (LFA)	3	90.00	56.30
04/2015 (A-3)	19	538.80	56.31
09/2015 (LER)	20	548.20	61.49
04/2017 (A-4)	2	64.00	29.52
05/2017 (A-6)	49	1,386.62	26.40
01/2018 (A-4)	4	114.40	18.02
03/2018 (A-6)	48	1,250.70	24.17
03/2019 (A-4)	3	95.2	20.39
04/2019 (A-6)	55	1,570.2	23.80
Total	761	19,654.20	-

Source: Completed with data from ANEEL (2020)

The success of wind power is confirmed by the contraction of 19,654.20 MW in the Regulated Contracting Environment (ACR)⁷, between 2009 and 2020. Such success can be attributed to the competitiveness of this source, which, given its relatively low cost in the auctions, has ensured both an indication of minimum amount to be contracted by the government, as well as its effective contracting. This competitiveness is the result of several factors, such as the quality of the wind resource in certain

regions of the country and the signaling provided by the indicative planning, which imply the maintenance of a perspective of wind energy expansion.

Figure 7 gives the average real prices per source for the auctions conducted between 2005 and 2019. From this, it can be said that wind energy had an excellent performance. Regarding the average data observed in the auctions from 2005 to 2018, wind energy ranked as the second most

7 The commercialization of energy in Brazil is carried out in two market spheres: The Regulated Contracting Environment (ARC) and the Free Contracting Environment (ACL). Basically, the

differences between them are the restrictions imposed between the markets. The ACR follows a series of regulatory criteria that are not included in the ACL.

competitive, behind only the hydroelectric plants. In the case of the hydroelectric source, this advantage can be attributed to their technical-economic characteristics, such as the size of the enterprises, which allows economies of

scale, as well as the cost structure, which includes marginal production costs close to zero. However, with the growth in the number of wind farms, and with the advancement of technology, that gap is likely to decrease or even reverse.

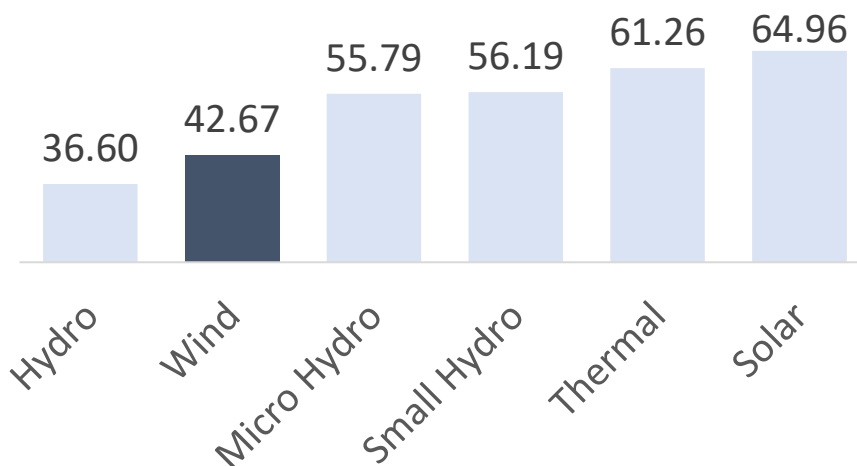


Fig.7: Average Prices⁸ by Source for the Energy Auctions from 2005 to 2019 in USD/MW⁹

Source: Completed with data from ANEEL (2020) and IBGE (2020)

In 2019, the seasonality¹⁰ of contract delivery has been changed for solar and wind energy. In the “A-4” auction, the seasonality of contracts followed the generation profile of the projects, while in “A-6” seasonality was chosen according to the load profile, which allows for a more equitable competition and values developments that best meet consumer requirements. The results of 2019 new energy auctions demonstrated the consolidation of very competitive prices in the regulated marketing environment, especially for wind sources (EPE, 2019b).

The Brazilian Energy Research Company (EPE) is currently studying the possibility of the participation of power plants hybrids and new technologies, such as offshore wind, in future energy auctions. EPE is actively involved discussions regarding these topics. The company notes that it is important to advance in hybrid projects, mainly with wind and solar energy projects that could result in more flexible portfolios and bring benefits to the system. However, regulatory definitions that will contribute to greater clarity of rules and security for entrepreneurs are still needed (EPE, 2019b).

V. CONCLUSIONS

Wind energy has played an increasingly important role in the Brazilian Power Sector. Currently, this source is already positioned as the third in terms of installed capacity in the Brazilian electricity matrix, behind only hydro and thermal sources. In terms of prospects for expansion of wind energy, its importance is even greater. From the plans presented in this paper, it is estimated that the wind power source will reach the second position in 2029, when it will account for 17.32% of the total installed capacity.

The country's wind power generation potential is reinforced by analyzing the capacity factor, which puts Brazil in the leading position in terms of the productivity of this source. This means that not only does the country have high capacity for expansion, but it also has the best performance in wind generation in the world. Furthermore, it should also be pointed wind energy's complementarity characteristic with the country's main energy source: hydroelectric power. When analyzing the seasonal behavior of wind energy, it is observed that it has higher productivity in the dry period of the year, precisely the period in which hydroelectricity presents worse performance.

Regarding the prices that resulted from the generation

8 By order: Hydroelectric Plants (more than 30 MW); Biomass Plants; Wind Power Plants; Small Hydro Plants (1 to 30 MW); Hydro Generating Plants (less than 1 MW); Thermolectric Plants (THER); Solar Plants (SOL).

9 For the conversion, an exchange rate of 3.9453 Reais per Dollar was used, given the Central Bank of Brazil on April 30, 2019.
10 Seasonal adjustment.

auctions of the last years, it can be concluded that there is extreme competitiveness of wind energy in Brazil, which contributes to a lower cost of generation in general. The country introduced some investment coordination mechanisms that have allowed the reduction of risks, making wind energy economically viable in Brazil. In addition, PROINFA remains as an important government tool for the promotion of alternative renewable sources in the production of electrical energy.

In this sense, wind energy stands out in the Brazilian scenario for its contribution to the country's power generation capacity.

Wind energy also stands out for being a type of energy that can minimize environmental impacts caused by the installation and operation of its plants, as well as providing great conditions for the country's sustainable and socioeconomic development, job generation and income, expansion of residential electrical supply through energy renewable, reduction of CO₂ emissions in electricity generation and eventual collaboration and reduction costs in reaching energy demand in times of a hydroelectric crisis.

In summary, the recent development of the wind energy industry in Brazil is explained by important structural factors, with an emphasis on technological progress and wind characteristics, in addition to attractive financing and contracting conditions at auctions.

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Microleakage of Class I cavities restored with hydroxyapatite and glass ionomer cement

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Abstract— *Purpose: The aim was to evaluate the use of hydroxyapatite powder (HDX) obtained from human teeth as a material to filled occlusal cavities compared with glass ionomer cement (GIC) through the microleakage analysis. Methods: Sixty-one permanent teeth were selected. Thirty-nine samples were used to obtain the hydroxyapatite powder and 22 used to obtain specimens for microleakage analysis. The teeth were sterilized. Two standardized Class I cavities were performed on the occlusal surface of each tooth. The specimens were randomly distributed in two groups (n = 11) GIC and HDX. The same sample received in occlusal cavities GIC and HDX restorations. After 24 hours 11 samples were immersed in broth containing *S.mutans* (ATCC 25175) and 5% methylene blue dye (MB + *S. mutans*) and the remaining 11 samples were immersed in 5% MB. Samples were sectioned mid-distally and dye leakage was assessed by three calibrated examiners. Results: The data were analyzed with Kruskal-Wallis test. There was no difference between GIC and HDX ($P>0.05$) and between the MB and MB with *S. mutans* ($P>0.05$). Conclusion: Within the limitations of this in vitro study it can be concluded that hydroxyapatite may be an alternative as a restorative material.*

Keywords— *durapite, dental leakage, methylene blue, glass-ionomer cement.*

I. INTRODUCTION

Restorative dentistry over the last few years improve the development of techniques to solve recurrent caries at restoration interfaces. This approach remains as one of the principal reasons for replacement of restorations [1]. Consequently, on restorative dentistry one of the challenges involves the development of biomaterials that promoting the release of high levels of Ca^{2+} , PO_4^{3-} and F^- on enamel and dentin tissues [2]. Therefore, dentistry search materials with biocompatibility, good cavity Glass ionomer cements have biocompatibility, fluoride release and good adhesion to the dental structure. There are still speculations about the ability to inhibit secondary caries at restoration margins of teeth making them an alternative in patients with increased caries risk such as in pediatric and geriatric dentistry [3,4]. In addition, the coefficient of thermal expansion of the glass ionomer is low and close to the dentin. However, despite its advantages, ionomeric cements have some disadvantages that limit their physical properties and their mechanical resistance such as

syneresis, low tensile strength and inferior flexural fatigue characteristics for the conventional ones [5,6].

Hydroxyapatite $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$, can be found in teeth and bone and is widely used in dentistry applications as a promising material, due to its inorganic composition similar to bone and its biocompatibility and bioactivity [7,8]. In the last years, researchers have synthesized hydroxyapatite by chemical methods. There are many methods available, such as dry methods, wet methods, high temperature processes, synthesis from biogenic sources and combination procedures [9-11]. Nevertheless, hydroxyapatite is brittle, and researchers are still developing a method that prepares the bioactive hydroxyapatite with excellent mechanical properties.

Clinical trials are the greatest to evaluate the biological behavior in the oral cavity, when it is intended to test biomaterials. However, ethical issues with experimental clinical studies constantly happen, so in vitro models, less expensive, without patient dependency, can answer fundamental questions by simulating the human oral

environment [12-14]. Also, clinical studies are lengthy and demand bigger investments [15,16].

The aim of this study was to evaluate hydroxyapatite as a restorative material of Class I cavities by means of the *in vitro* microleakage analysis. The null hypothesis was: There was no difference between HDX and GIC on microleakage.

II. MATERIAL AND METHODS

Experimental Design

This study followed a completely randomized design with two experimental factors: Restorative treatment was two levels: GIC, HDX and, Infiltration solution was two levels for microleakage analysis (MB + *S. mutans* and MB). The factors were tested in an microleakage analysis model using human teeth specimens (n=11). The response variable was the microleakage on the cavity wall (assessed through the leakage score).

Ethical aspects

In the present study, human permanent teeth were used, so an approval from the local Ethics Committee on Research with Human Beings was necessary. Accordingly, this study was performed after approval was obtained (process number: 3.662.955).

Specimen preparation

Sixty-one sound human permanent teeth previously stored into 0.1% of thymol solution (Sigma-Aldrich, St Louis, MO, USA), under refrigeration at 4 °C, until the beginning of the experiment, were selected. Two standardized class I cavities were performed on the occlusal surface of each tooth, under constant cooling, with enamel termination on the cavity surface and dentin on the back wall (The cavities were prepared directly on the occlusal surface, without polishing). Two different materials were evaluated on the same tooth: GIC and HDX. The cavities were standardized with the following measures (3 mm x 4 mm x 3 mm). The cavity measurements were checked with millimeter probe.

Synthesis of hydroxyapatite powder from biogenic source (human teeth)

Extraction of HAp

According with was described by Aarthy et al. [11], thirty-nine teeth were dehydrated in 100 mL of 99.8% absolute ethyl alcohol (NEON, SP, Brazil) with 100 mL of distilled water forming a hydro alcoholic solution. The teeth were placed in a distillation flask (Laborglass, SP, Brazil) that was coupled to a ball condenser through a universal support (Laborglass, SP, Brazil) using a metallic

claw (Laborglass, SP, Brazil) and muffle (Laborglass, SP, Brazil). The reflux process was started by pouring the hydro alcoholic solution into the ball condenser until it reached the distillation flask (Prolab, SP, Brazil). During the heating process, with an ISO 9002 mat (QUIMIS, SP, Brazil) the solution boiled inside the ball condenser (Laborglass, SP, Brazil). On the outside, running water was constantly introduced through a hose connected to the upper end of the ball condenser (Laborglass, SP, Brazil) and dispensed by another hose on the lower end. The running water cooled the ball condenser (Laborglass, SP, Brazil) and the vapor from the solution that was inside came into contact with the cold surface and condensed, remaining constantly in this process of boiling and condensation called the reflux process for four hours thus reaching the temperature of 110 °C.

Sintering of HAp

After the reflux process, human teeth were wrapped in sterile gauze (Medical textil, SP, Brazil) and pressed with a force of approximately 5 tons in a hydraulic press (ACS Group, Madrid, Spain). To separate the larger and smaller granules, a sieve was used, where the larger granules were taken back to the press until uniform granules were obtained. The granules remained in the mortar jar (ABB, Quebec, Canada) and were moistened with running water to be introduced into a muffle (QUIMIS, SP, Brazil) without thermal shock. The moistened granules were separated into small portions and accommodated in porcelain crucibles model A-48 (Chiarotti, SP, Brazil) so that they can be taken to the muffle (QUIMIS, SP, Brazil) remaining three hours until reaching 900 °C and three more hours at a constant temperature of 900 °C. The sample obtained was ground in the mortar jar (ABB, Quebec, Canada). This sample was placed in 150 mL of deionized water Chemistry laboratory (PUC-Campinas, SP, Brazil). The sample remained for two and a half hours in the reflux process in order to dissolve the granules of the powder sample. Soon after, the hydroxyapatite powder was taken to the oven for drying.

Characterization

Infrared spectroscopy (FTIR) of the HA powder calcined

IR spectroscopy was determined based on a method described elsewhere [17] carried out in range of 4000–400 cm⁻¹ at a MB3000-DTGS spectrophotometer (ABB, Quebec, Canada) and analyzed using infrared light using the Horizon MB software for reading. Before measurements, the powdered samples were mixed with a powder of potassium bromide in the ratio of (0.0020 g) of

the sample to (0.1980 g) of potassium bromide and pressed into pills.

Microleakage analysis

The samples were randomly assigned to two groups (n = 11): GIC and HDX (ANOVA), with a minimum difference between the media of 0.27, the SD of 0.18, the number of definitions 4, the test of 0.80 and the alpha 0.05.

The samples were immersed in 2% chlorhexidine solution (Dental Cremer, Campinas, SP, Brazil) for 24 hours. Then, were stored in 0.9% sodium chloride (Ultrafarma, SP, Brazil) before preparation.

Restorative procedure

In this phase, the specimens were randomly allocated into 2 experimental groups (n = 11), according to the treatments described in Table 1.

Table 1. Details of the groups; names, manufacturer, restorative protocol.

Groups	Product/ Manufacturer	Restorative protocol
GIC	Ketac Molar, 3M Deutschland GmbH, Seefeld, Germany	<ol style="list-style-type: none"> 1. <i>Ketac conditioner</i> on the prepared surface for 10 seconds; 2. Wash with water and air dry for 2-3 minutes; 3. Mixing: powder / liquid (1: 1) spatula (n° 24) (Golgran, SP, Brazil); 4. Mixing was done on a mixing block in which the powder was introduced into the liquid in a maximum of two portions, until a homogeneous consistency was obtained (3 min); 5. The CIV application was carried out with an insertion spatula (Golgran, SP, Brazil) with vibrating movements; 6. Surface protection of the CIV with the adhesive system Primer and Bond 2.1 (Dentsply, RJ, Brazil); 7. 24 hours after the insertion of the CIV, the finishing was done with an excess remover (Golgran, SP, Brazil).

Groups	Product/ Manufacturer	Restorative protocol
HDX	-	<ol style="list-style-type: none"> 1. <i>Ketac conditioner</i> on the prepared surface for 10 seconds; 2. Wash with water and air dry for 2-3 minutes; 3. Mixing: powder / liquid (1: 2) (hydroxyapatite powder) using the GIC Ketac Molar Easymix powder dispenser and two drops of Ketac Molar Easymix polyacrylic acid; 4. Mixing (1 min) spatula (n° 24) on a mixing block, until a homogeneous consistency was obtained; 5. HDX application was carried out with an insertion spatula (Golgran, SP, Brazil) with vibrating movements; 6. Surface protection of the HDX with the adhesive system Primer and Bond 2.1; 7. After 24 hours - finishing with excess remover.

All samples were waterproofed with epoxy resin (Araldite, SP, Brazil) and nail varnish (Colorama, SP, Brazil), except 1 mm from the restoration margins.

Microleakage

The samples were randomly distributed in two different methodologies:

a) Bacterial infiltration (MB + *S. mutans*): The specimens were immersed in a broth containing *S. mutans* (ATCC 25175) (André Tosello Foundation, Campinas, SP, Brazil) (0.5 MacFarland) and 0.5% methylene blue dye and incubated at 37 °C for 4 h in zero humidity.

b) Methylene blue staining (MB): The specimens were immersed in 5% methylene blue dye incubated at 37 °C for 4 h in zero humidity.

The teeth were then thoroughly rinsed with water to eliminate excess of dye solution and dried with air spray. They were then bucco lingually sectioned through the center of restoration using a cutting machine (KG Sorensen, Cotia, SP, Brazil) with a double-sided diamond blade with 0.3 mm thickness under water coolant (to prevent over-heating).

Both sections were photographed under a stereo microscope (Stemi DV4, Carl Zeiss, SP, Brazil) at 32x magnification. Three examiners blinded ($P < 0.0001$) to the group allocation of teeth inspected both the enamel and dentin margins in terms of dye penetration.

Microleakage was scored as follows:

Score 0: No dye penetration; Score 1: Dye penetration to half the depth of the cavity wall; Score 2: Dye penetration exceeding half the depth of the cavity wall; Score 3: Dye penetration reaching the axial wall (Fig. 1). These tests were performed according to the ISO/TS 11405:2003 [18].

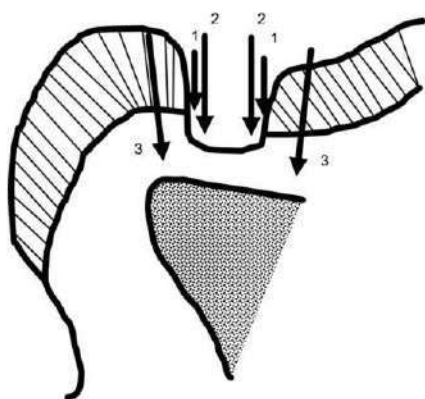


Fig. 1: Schematic picture of microleakage score used for analyzing leakage.

Statistical analysis

To assess the calibration among evaluators Pearson's test was performed. Normality and/or homogeneity were checked with Shapiro-wilk test. Since data did not follow a normal distribution, then Kruskal-Wallis test were performed, considering a significance of 5%. The analyses were performed with the software Biostat 5.3.

III. INDENTATIONS AND EQUATIONS

The evaluators were calibrated as shown in Table 2.

Table 2. Pearson's test of calibration between the examiners.

n (pairs)	R (Pearson)	IC 95%	IC 99%	(P)
44	0.8832	0.79 to 0.93	0.75 to 0.95	<0.0001

There was no statistically significant difference between marginal microleakage comparing GIC and HDX ($P > 0.05$). The methods of microleakage evaluation, methylene blue dye or methylene blue dye associated with *S. mutans* showed no significant difference ($P > 0.05$, Tables 3 and 4).

Table 3. Median and interquartile intervals for the microleakage scores for all groups. Lower case letters show no significant differences between the experimental groups or methodologies.

	GIC	HDX	(P)
Methylene blue (MB)	0.00 (0.00) ^a	0.00 (0.50) ^a	0.7366
MB + <i>S. mutans</i>	0.00 (0.00) ^a	0.00 (0.00) ^a	

Table 4. Frequency of different microleakage scores in the cavity wall of the study groups.

Groups	Microleakage score			
	Score 0	Score 1	Score 2	Score 3
MB/GIC	11	0	0	0
% within group	100%	0%	0%	0%
MB/HDX	8	3	0	0
% within group	72.7%	27.2%	0%	0%
MB+S.mutans/GIC	10	1	0	0
% within group	90.9%	9.09%	0%	0%
MB+S.mutans/HDX	10	1	0	0
% within group	90.9%	9.09%	0%	0%

GIC and HDX scores were 0 and 1. In the evaluation with MB, all GIC samples had no microleakage (score 0). HDX samples and MB had 8 specimens with no microleakage (score 0) and 3 specimens with score 1. In the evaluation with MB + *S. mutans*, 10 GIC samples and 10 HDX samples showed no microleakage (score 0). Only 1 specimen restored with GIC or HDX showed leakage (score 1) (Table 4).

IV. DISCUSSION

This study assessed the microleakage of class I restorations with GIC and HDX using dye penetration test. Microleakage is a passage of ions, molecules, bacteria and liquids through the restorations interface, which is not always clinically detectable [19]. This can lead to the loss

of marginal seal and an emergence of dentin hypersensitivity, recurrent caries, aesthetic issues, pulp damage and failure of the restoration treatment [20,21]. The assessment of microleakage is important to evaluate the bonding of dental materials and tooth structure [20]. Dye penetration test was performed in this study, which is a reliable test for assessment of microleakage and the marginal seal [22].

Most of the currently used dental biomaterials have a lack on completely seal the cavity margins over the time. Then, microorganisms can penetrate into the tooth tissue structure spaces as deep as 1100 μm [23]. Among of the solutions used to evaluate biomaterials adaptation, methylene blue is the most used in microleakage studies, because it has a high leakage capacity, low molecular weight, is similar to the molecules of microorganisms, in addition has low cost and the manipulation is easy [24-26]. In order to provide more similar condition to that found at the oral environment, this study evaluated microleakage using methylene blue dye and *S. mutans*, in the same solution [25,27]. Thereby, it is possible to compare whether there are differences between dye associated with microorganisms and only the penetration of the dye alone, an issue very little discussed in the literature. As results methylene blue dye alone or associated with *S. mutans* did not show difference. One possible explanation for these results could be that the dye can present greater microleakage results than the penetration of bacteria alone that are larger than the dye molecules evaluated [27]. However, the aim of this study was not to evaluate the presence or characterization of microorganisms at the tooth restoration interface. There was no published study evaluating the dye penetration results of dye associated with a bacterium compared with dye alone during GIC or HDX application. So, further microbiological availability analysis and SEM/TEM studies are recommended to analyze the tooth interfaces when using different types of biomaterials.

This study used glass ionomer cement Ketac Molar Easymix (GIC) and hydroxyapatite powder from human teeth (HDX) associated with glass ionomer liquid, there were no differences between the evaluated materials so, the null hypothesis was accepted. Ketac Molar was effective in preventing microleakage [28-30]. One probable reason is due the chemical interactions of polyalkenoic acids and hydroxyapatite's calcium which produce adequate marginal sealing and form a strong chelation reaction with calcium on the tooth surface. In this study we used specimens with cavity preparations on occlusal region with enamel and according another studies cavity margins with this substrate results in stronger bonds

once the inorganic structure is higher in enamel than dentin [29,31]. Another feature of the product to be considered is that Ketac Molar conditioner is an acidic primer (pH 0.7 ± 1.2) that partially removes the smear layer, improves the wettability of tooth, and increases the monomer penetration into the underlying surface [32].

HDX restorations presented very low microleakage, this result can be justified by the fact that hydroxyapatite is a material capable of establishing a good interaction with the dentinal structures, allowing a good cavity seal [33,34]. Different kinds of materials are applied in restorative dentistry, of special importance being hydroxyapatite, which substituted the hard tissues. It is possible due to particular properties of hydroxyapatite, like microstructure, high biocompatibility, non-toxic properties, bioactivity and bioconductivity [10,35]. A bioactive material creates an environment compatible with osteogenesis and dentinogenesis with the mineralizing interface developing bonding between biomaterials due a physicochemical process [35]. Therefore, the results suggest that HDX may be an alternative for restorative material. However, further studies should be carried out with a focus on assessing the applicability and properties of HDX compared to another materials.

The results of the present study showed that HDX is not more advantageous than Ketac Molar glass ionomer cement, were statistical equal, from the perspective of effective marginal sealing in class I cavities. Further studies and long-term clinical data are required to confirm our findings.

V. CONCLUSION

Within the limitations of this in vitro study and regarding the results, it can be concluded that hydroxyapatite may be an alternative as a restorative material.

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Development of proxy models for petroleum reservoir simulation: a systematic literature review and state-of-the-art

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Abstract— Proxy models are derived mathematical functions developed as substitutes for reservoir flow simulators. Several types of proxy models are reported in the literature, for instance, response surface models, surrogate models, or metamodels. These models are fast methods, recommended for their efficient response time to approximate model responses and, therefore, useful in the decision-making process related to reservoir management. These studies focus on modelling a limited set of factors, applications, and case studies of any technique. A systematic literature review (SLR) is performed to gather the aspects prompting the modelling of proxy models in the literature and state-of-the-art. For this, a set of search keywords with appropriate string were utilised to extract the most important studies that satisfied all the criteria defined and classified under journal and conference paper categories. The papers were condensed after removing redundancy, repetition and similarity through a sequential and iterative process. From the analysis carried out, several gaps were identified, especially during the proxy model construction. Proxy models have already been discussed in petroleum engineering as a representation of the real system of reservoir flow simulator software. However, the proxy model response is faster but has yet to establish the issues of uncertainty in the outputs. There is a need for the integration of fast methods and reservoir simulators which can improve and accelerate results within acceptance criteria and accuracy in decision-making processes related to reservoir management.

Keywords— Petroleum Engineering, Proxy Model, Reservoir Simulator, State-of-the-art, Systematic Literature Review.

I. INTRODUCTION

The decision analysis applied to the development and management of petroleum fields involves risk due to several uncertainties, mainly in the reservoir and fluid parameters, economic model, operational availability, and high computational cost. A new methodology based on 12 steps for integrated decision analysis considering reservoir simulation, risk analysis, history matching (HM), uncertainty reduction techniques, representative models, and selection of production strategy under uncertainty, which is necessary for the decision-making process was developed by [1]. The authors used a low-fidelity reservoir simulation model directly to predict field performance and quantify risk.

High (HFM), Medium (MFM), and Low (LFM) Fidelity Models assume reservoir conditions and

characteristics and physical laws (flows in porous media), while proxy models do not. HFM are models whose degrees of representativeness of geological, geophysical, fluid information, and recovery process are notable with high accuracy and precision. MFM are models whose geological, geophysical, fluid information and recovery processes have already undergone simplifications to reduce the degree of accuracy and computational time. These are used in production forecasting processes (mainly probabilistic) or those that demand hundreds and even thousands of simulations. LFM are models whose geological, geophysical, fluid information, and recovery processes have already undergone significant simplifications and their precision, accuracy and computational time are low. More details in [2].

A proxy model also called surrogate model, metamodel or response surface is a representation of a real system or

its simulations [3]. It becomes advantageous, especially when the direct evaluation of the system is either impossible or involves a high computational cost to simulate [4]. Therefore, a proxy model is considered to be an efficient substitute for the simulation tool at higher levels of reservoir study including uncertainty analysis, risk analysis and production optimisation [5], and also to elaborate the risk curves [6], especially time-consuming simulators [3]. In other words, in cases where proxy models can effectively represent important output parameters, they can be used as an adequate substitution for full reservoir simulators [7].

Proxy model constructions are held as mathematical derived functions, which imitate the output of a simulation model to selected input parameters [7]. According to the authors [6] and [8], if reservoir simulation studies were conducted with mathematical and statistical techniques, proxy models could estimate how the variation of input factors affects reservoir behaviour with a relatively small number of reservoir simulation models.

The purpose of the proxy models is to reduce the number of simulated models to evaluate a determining search space. It may lose a certain degree of accuracy due to the process of proxy modelling [9], but there is a reduction in computational time. Due to these reasons, obtaining an accurate proxy model is usually critical, and the model discrepancy has to be taken into account [10]. In petroleum exploration and production, the decision-making process, history matching, production strategy optimisation and economic evaluation of oil field must consider the risk involved through quantifying the impact of uncertainties on the performance of the petroleum field [6].

Numerous practical applications in uncertainty quantification, history matching, optimisation, and forecasting are increasingly involved in proxy modelling. The number and diversity of the proxy models development have widely increased as substitutes for reservoir flow simulators. On the other hand, a lack of better choice of the objective function and the methods able to correlate input and output are identified as the typical characteristics, which cause quality issues that might adversely influence the proxy models development.

Development of proxy models requires considering various factors, such as the selection of statistical and mathematical models, computational time, uncertainty quantification so forth. The initial knowledge on the effects of these factors on the development is fundamental to obtain an accurate model. Hence, a wide variety of proxy model application can be found in petroleum

engineering to investigate the effect of these factors on proxy modelling. However, each study investigates a limited set of particular input and, as a result, an extensive summary of existing literature on petroleum engineering is a valuable source for researchers in proxy model development.

This study aims to present the aspects identified in the studies analysed and thus present the current state of the research. A systematic literature review (SLR) is performed to gather the elements prompting the modelling of proxy models in the literature and state-of-the-art in petroleum reservoir engineering. For this, a set of search keywords with the appropriate string were utilised to extract most important studies that satisfied all the criteria defined in the relation between proxy model developments and classified under journal and conference paper categories. The information obtained in SLR and state-of-the-art is useful for industry experts and researchers.

This paper is structured as follows: Section II presents the background studies of the proxy model; Section III provides an overview of research methodology; Section IV summarises the results, which were essential to answer our research questions; Section V highlights the discussion showing the gaps we identified for future research and the state-of-the-art; Section VI presents the conclusion of the paper.

II. BACKGROUND STUDIES OF PROXY MODEL

There were no systematic reviews that originated under the modelling of proxy models or aspects in petroleum engineering. From the literature gathered, the authors searched and examined the studies performed between the years 2007 and 2017 in digital libraries to develop the SLR. Still, we do not limit to this years to the state-of-the-art aspects showing aspects until 2020.

Development of proxy models has been performed on various models for reservoir flow simulation, which can be used for forecasting, optimisation of production, history matching, characterisation of reservoir properties, uncertainty and risk analysis, and production strategy selection. These proxy models can be polynomial regression models, ordinary kriging models, artificial neural networks (ANNs), and radial basis functions (RBFs), response surface methodology (RSM), design of experiment (DE), and other.

We can find in the literature a wide range of proxy model development for application in petroleum engineering, for example, a new approach to improve Bayesian HM [11, 12]. The authors [13] integrated a framework for field-scale modelling, HM, and robust

optimisation of field scale low salinity waterflooding (LSW). An approach using the SRM for optimisation [14-19]. The authors [20] addressed the decision-making process over the determination of oil & gas production strategies.

Some papers applied ensemble Kalman Filter (EnKF) with an objective, for example, the authors [21-24] for the analysis of uncertainty quantification and optimisation method, [25, 26] to automatise HM, [27] for estimation of channel permeability in a bimodal distribution, and [28] for the integration of well-test data into heterogeneous reservoir models. The authors [29] combined EnKF with Markov Chain Monte Carlo (MCMC) to obtain a more accurate characterisation of uncertainty; [30] combined EnKF with genetic algorithm.

The authors [31] made the comparison of SRM with least square support vector machine. Use of experimental design to develop response surface [32-41], integrated with Monte Carlo simulations to characterise the response surface and to estimate the uncertainty [42, 43]. Application of Bayesian multi-stage MCMC approach, based on an approximation with a linear expansion to reduce high computational costs [44], more accurately obtained model uncertainty and also assists in production-forecast business decisions [45], with Bayesian workflow based on two-step MCMC inversion [46].

In [47] was presented a method to select a subset of reservoir model computing the statistics (P10, P50, P90) of the response of interest; use of the genetic algorithm to improve the process of optimisation [48]. Application of an approach with fuzzy analytical hierarchy process for compositional simulation studies of the CO₂ injection

process [49]. The authors [50] developed a semi-analytical fast model for optimal field development strategy. The authors [51] used principal component analysis (PCA) and elastic gridding. Application of a robust reservoir simulator with the application of kriging models [10; 52, 53]; in a closed-loop [54, 55]. Combination of Karhunen-Love (KL) expansion and probabilistic collocation method for uncertainty analysis [56]. Development of an emulator utilised Bayes Linear [23, 57]; development of a proxy model to predict cumulative oil production and steam injection profiles [58].

The authors [7, 59] proposed the application of polynomial chaos proxy efficiently sample with MCMC and ANNs, respectively. Application of ANNs in the form of gene expression programming is applied through an extensive statistical manner [60] in HM [61-63]. In recent years, ANN training has been accomplished to identify the non-linear relationships between various input and output variables [3, 5; 64-69] used ANNs integrated to polynomial regression for risk analysis and forecasting.

III. PROCEDURE FOR SYSTEMATIC LITERATURE REVIEW

SLR is the best method available to generate scientific evidence based on the summary of the significant publications concerning a specific topic or research question [70]. Due to this, the methodology was undertaken based on [71] to survey the existing knowledge about the development of proxy models for petroleum reservoir simulation. The SLR process applied can be seen in Fig. 1.

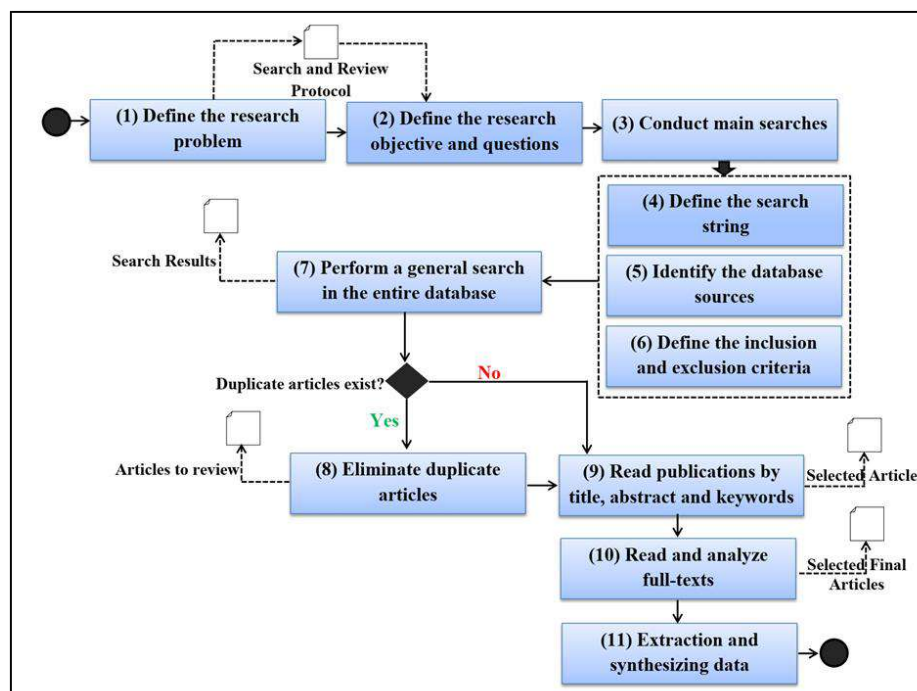


Fig. 1 Workflow with each step achieved in SLR

The authors performed the planning of the review, from which the research problem, objective and questions were defined (steps 1 and 2). Therefore, we obtained the search and review protocols. Afterwards, we performed the definition of the primary searches (step 3) based on search string (step 4), database sources (step 5), inclusion and exclusion criteria (step 6), resulting in the general search in the entire database (step 7). From the results of the examination, the duplicate articles were eliminated (step 8), obtaining a list of selected papers which were read by title, abstracts, and keywords (step 9). After the partial reading, we got a list with the selected final articles which were thoroughly read and analysed (step 10).

We specified the details of the SLR methodology in the following subsections: research questions, search and review protocol, define the search string, identify the database sources, and define the inclusion and exclusion criteria. The extraction and synthesising concerning the general search in the entire database, numbers of eliminated duplicate articles, numbers and criteria of reading publications by title, abstract and keywords, and numbers of reading and analysed full-texts are in Section 4 (step 11).

3.1 Research problem and questions

The identification of the aspects of proxy model development requires a clear and explicit analysis of the research problem and theoretical concept (step 1). From

this, we formulated research questions for this SLR (step 2):

RQ1: How many proxy model studies have been performed from 2007 to 2017?

RQ2: What were the research topics addressed to the publication?

RQ3: What were the problems investigated and presented in the literature to the development of the proxy model?

RQ4: Why use the proxy model?

About RQ1, we identified that the term “systematic literature review” was not in common usage in the petroleum area. In contrast, in Information and Software Technology, Chemistry, Business Administration and Medicine, it is diffused. The authors [71] highlight that there are rigorous example literature reviews before 2004 in the software engineering area. Therefore, based on RQ1, we identified the number of articles published per year, the journals, conferences, and database which published about the development of proxy models. Concerning RQ2 the aspects of the petroleum engineering topic area and the model-based decision were considered (closed-loop reservoir development and management – CLRDM) developed by [1]. For RQ3 the problems in the decision-making process for petroleum reservoir simulation related to the CLRDM model were considered, such as, overcome computational costs, computational time demand and performance of a reservoir simulator, reduced human resources and fidelity model. In RQ4, we considered the

proxy models and emulators identified during the reading of articles.

3.2 Search and Review Protocol

A search and review Protocol is essential in all SLR to guarantee the efficiency of the selected studies. For this, it is necessary to define the research problem in parallel with the research objectives and questions, as shown in Fig. 1 (steps 1 and 2).

The protocol for this review depended on step 3 being developed in three stages (from step 4 to step 6): P1: Define the search string, P2: Select the literature database, and P3: Define the inclusion and exclusion criteria, this defines the protocol that was used to perform the search in the sources defined, which will be explained in the subsections: define the search string, identify the database sources, and define the inclusion and exclusion criteria.

3.3 Define the search string

SLR is a known technique for reviewing the literature with vast search information of the subject in the discussion from all relevant sources. Due to this, a systemic method to formulate search keywords was defined, considering the following issues:

- a) Setting of significant terms based on the research question;
- b) Setting of similar words for significant terms;
- c) Setting of relevant keywords in any applicable studies;
- d) Using Boolean operators “OR” and “AND” as an alternative to linking terms.

We defined the search string with focus on related studies of petroleum simulator and proxy model, i.e., an exact string “(“oil” OR “petroleum”) AND “uncertainty” AND “simulator””. The first part of the string was the focus area of the research. We included the words “*uncertainty*” and “*simulator*” to disqualify studies which are related to fields different from petroleum engineering.

The authors opted not to utilise the words proxy model as the exact phrase since, in most of the search queries, there are numerous studies in which proxy models are related as surrogate, metamodel or response surface. If “proxy model” had been utilised alone, the search would lose significant results that use the terms: surrogate, metamodel or response surface.

3.4 Identify the database sources

To perform the SLR and to find the relevant studies, we searched the following seven major electronic libraries, six general and one specific to the area of petroleum engineering.

- (1) ACM Digital Library (<http://dl.acm.org>)
- (2) IEEE Xplore (<http://ieeexplore.ieee.org>)
- (3) ScienceDirect (<http://www.sciencedirect.com>)
- (4) Scopus (<http://www.scopus.com>)
- (5) SpringerLink (<http://link.springer.com>)
- (6) Web of Science (<http://apps.webofknowledge.com>)
- (7) OnePetro (<https://www.onepetro.org>)

In this research, we did not select the papers manually, and for this selection, we used an automatic selection criteria (scripts in Python language) developed by [72].

3.5 Define the inclusion and exclusion criteria

The definition of the inclusion and exclusion criteria was based on the determination of an objective and question research. We applied the inclusion and exclusion criteria in the resulting publications, after eliminating the duplicated articles and identifying which would be relevant to this SLR. Table 1 shows the inclusion and exclusion criteria considered in the database source.

We initially applied the inclusion and exclusion criteria in the entire database (step 7). The first criterion considered were articles in the English language, published from 2007 to 2017, peer-reviewed publications and whether their abstract contained any word of the string. After the search finished generating the list of articles, we used the string to analyse the full papers. If at least one term of the string had an association with the title, keywords and abstract, we included the article in the significant study list. For duplicated articles in multiple databases, we removed them and used one copy in the analysis (step 8). After, in step 9, in the inclusion and exclusion criteria process, we read the title, abstract and keywords to applicate the five assessments (Table 2). We generated these assessments to analyse the applicability and development of articles as exclusion criteria.

Table 1: Inclusion and exclusion criteria for the analysis of articles selected in the database.

Considered Criteria	
Inclusion	Exclusion
Period of publication from 1 January 2007 to 31 December 2017	Duplicated publications of the same study in more than one database

Publications published in the English language	Non-English Language publication
Publications that were peer-reviewed	Publications without bibliographic information
Publications which address proxy model and reservoir flow simulators software	Publications which do not address proxy model or only include reservoir flow simulator software
Publications that focus on the development of the proxy model	Publications that only identify the technological aspects of the tools used
Publications that presented the keywords which belong to the string determined in this SLR	Publications that do not present the keywords which belong to the string determined in this SLR
Journal with Scimago (SJR) ≥ 0.2 or JCR ≥ 0.5 and Conference (peer-reviewed)	Other knowledge of the area

Table 2: Five assessments utilized for partial analysis of the articles.

Assessment	Description
1	The articles address reservoir characterization and/or uncertainty and/or optimization and/or risk and/or history matching and/or forecasting, it works with reservoir simulator software, but it did not develop a proxy model or apply
2	The articles were applied in another area of knowledge, or they only mentioned reservoir simulator software
3	Revision article: present difficulties to be reproduced, being applied to specific parameters without a new technique development
4	Description of the combination of techniques in oil reservoir with reservoir simulator software
5	Identify the technological aspects of tools used

As an initial step, a general search was made, which was inside the inclusion criteria but was outside the scope of five assessments. It is essential to highlight that; this application is to analyse the significant researches which will be adequate to answer all RQs. Subsequently, we excluded various papers. And we selected 117 articles to read them thoroughly.

In step 10, the full reading of the selected articles, we generated nine assessment questions for data extraction, from QE1 to QE8. An assessment question “Yes(Y)” = 1, “Partly(P)” = 0.5, “No(N)” = 0 or “Unidentified (U)” was also included to evaluate the contribution of each article during the proxy definition and construction. Besides, some articles may have a more straightforward proxy model development, focusing on application without many details and, because of this, various papers were considered unrelated to the development of proxy models, after reading the full article.

- QE1: What was the method used for data sampling?
- QE2: What was the type of proxy model performed?
- QE3: What was the objective function used?
- QE4: Was there any performance addressed to computational time?

- QE5: What were the aspects additionally addressed in the article?
- QE6: What were the problems presented in the article?
- QE7: What was the focus of the article analyzed?
- QE8: Was there any article relevant to the development or application of proxy models?

Concerning QE1, when the method used for data sampling is explicitly defined (Y), it is implicit (P), or it is not defined or cannot be readily explicit (N). For QE2, when the proxy models performed are explicitly (Y), they are implicit (P), or they are not defined or cannot be readily explicit (N). About QE3, if the objective function is explicitly defined (Y); it is implicit (P); it is not defined or cannot be expressly identified (N). For QE4, if the performance addressed was defined for proxy model development or applied the modelling proposed (Y), it was defined for reservoir numerical simulator (P), or it was not implemented (N). Concerning QE5, the additional aspects are explicitly described (Y); they are implicit (P), or they cannot be expressly identified (N). For QE6, the problems presented are explicitly defined (Y); they are implicit (P), or they are not or cannot be expressly specified (N). For QE7, article approached modelling or experiment of the proxy model (Y); it was an application, literature review or technique (P); the paper analysed cannot be explicitly

identified (N). For QE8, the article approached obtained a score of >4.0 (Y); it got a score of ≤ 4 (N). For all questions, we considered (U) in case the information not specified. Table 3 presents the keywords considered in the article as an answer to all questions.

IV. RESULTS

This section presents the results (step 11), which we divided into three parts: perform a general search in the entire database (step 7) and the article selection process (steps 8 and 9); results from article reading and classification (step 10); quality factors.

4.1 Perform a general search in the entire database and the article selection process

We developed an SLR to gather the aspects prompting proxy model development in the literature. For this, we utilised a set of search keywords with appropriate string to extract the essential researches that satisfied all the criteria defined and classified under journal and conference paper categories, in seven scientific electronic library databases, resulting in 4,687 publications from January 2007 to December 2017. We showed the distribution of articles and the types (Journal and Conference) in each database in Fig. 2.

Table 3: Defined answer for application in reading the final articles

QE1	QE2	QE3	QE4	QE5	QE6	QE7	QE8
Random	Multivariate Kriging	Np	Applied in metamodel developed	Uncertainty analysis	Computational Time	Literature Review	Yes
Stratified	Artificial Neural Network	Wp	Applied in a simulator used	History Matching	Computational resource	Application	No
Systematic	Response Surface/ Surrogate	NPV	Applied the modelling proposed	Reservoir Characterization	Type of data	Technique	-
Cluster	Fuzzy Logic	ROI	No measurement implemented	Optimization	Unidentified	Modelling	-
Rank	Bayesian	Capillary pressure	Unidentified	Production Strategy Selection	-	Experimental	-
Unidentified	Kalman Filter	Others	-	Risk Analysis	-	-	-
-	Experimental Design	Unidentified	-	Unidentified	-	-	-
-	Other metamodel	-	-	-	-	-	-
-	Unidentified	-	-	-	-	-	-

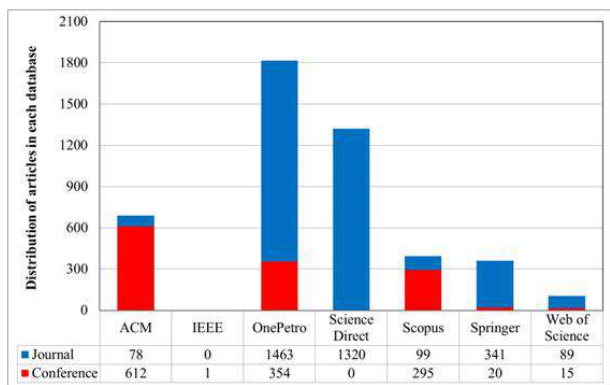


Fig. 2 Results obtained from string application in the databases; in red - the conference numbers and in blue - the journal numbers

It is possible to see the results of the selected articles in Fig. 2, a total of 4,687 papers, where 3,390 were published in journals and 1,297 in conferences. Fig. 3 shows the results of each step of article selection and the percentages of each publication. From the 4,687 publications obtained, we applied the exclusion and inclusion criteria process and resulted in 317 usability publications (in blue), which represents 6.76% of the selected publications per database. We applied a sequential and iterative approach (python script), and we condensed the publication removing redundancy, repetition and similarity (in red), which represented 31.55%. The publications excluded they were in multiple databases. We reduced the publications for the reading of title, abstract and keywords, and after that, we removed 100 publications (46.08%) based on the five assessments shown in Table 2. Finally, we obtained 117 papers to read them thoroughly, representing 53.92% (in green).

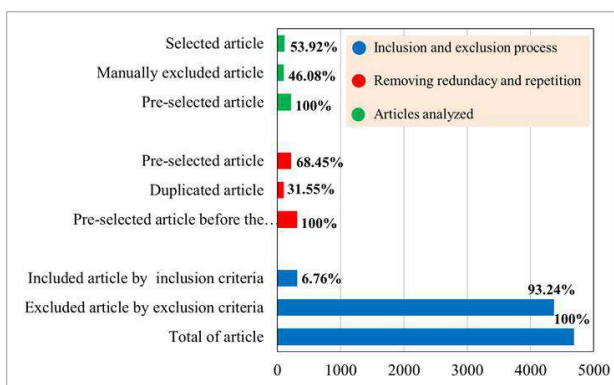


Fig. 3 The number of searches in the database in each step. In blue- the inclusion and exclusion criteria process; in red- the phase after removing redundancy and repetition; in green- the articles analysed.

Concerning the final process of selecting the publications, we initially worked with seven databases. In the chosen article process, only four databases returned publications. OnePetro electronic library produced the highest number of publications (full reading). Fig. 4 shows the distribution of pre-selected and selected publications over the years, which returned the string application in this SLR.

Fig. 4 shows the distribution of publications per year; the blue axis shows the quantity of pre-selected publications, and the red axis indicates the number of selected publications. About the selected publications, it is possible to observe that the years 2008 and 2014 presented the highest number of publications. In analyzing the numbers obtained in 2008, 10 publications were in conferences while seven publications were in journals. In contrast, 12 and 7 publications were published in conferences and journals in 2014, respectively. We noticed that in 2017, one paper was obtained from the conference while eight publications in journals. Other reasons for the changes over the years, we considered only peer-reviewed publications, and the journal must have $SJR \geq 0.2$ or $JCR \geq 0.5$ and focus on the development of proxy models in the petroleum engineering area. We analysed the barrel price of crude oil (Brent) in dollars [73] and observed that when the publication numbers increased, the price per barrel reduced. We performed the Pearson correlation with a 5% significance level. The Pearson correlation between the cost of each barrel and the selected article numbers was -0.65 ($p < 0.031$).

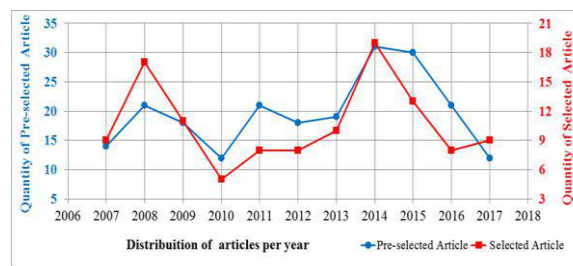


Fig. 4 Distribution of articles per year in the process of selection. In the blue - pre-selected article process and, in the red - selected article process.

4.2 Results of reading and classification of articles

The authors developed nine assessment questions and defined answer for application in reading the final articles presented in Section 3.5. Table 4 shows the classification of the 117 publications selected with the percentage-based in each assessment question (Section 3.5).

Table 4 presents the classification of the 117 publications selected about each assessment question

(Table 3). Concerning QE1, the method most used for data sampling is a random sample, at 63.25%. To QE2, we observed that each ANN and RSM presented 11.96% in proxy model development. QE3 showed that the most utilized objective function was the NPV, at 23.08%. Concerning QE4, the authors used more performance on the modelling proposed. About QE5, which refers to the additional aspects, the one most used was “optimization” and “history matching,” which are essential parts of a reservoir process that highly need proxy models. QE6, the most detected problem is of computational time, while

QE7 shows that the focus of the article is mostly on “application”, at 47.01% of publications.

Table 5 shows the results obtained from 40 publications selected for full reading by score obtained, and the papers presented only study application or technique application. In some cases, it was not possible to identify the procedure used to model the proxy, totalising 34.19% of 117 publications selected. In a total of 32 publications, it was not possible to identify the modelling on the proxy model.

Table 4: Classification of the 117 publications selected concerning each assessment question

QE	Assessment question for data extracted	Answer	Quantity	(%)
1	What was the method used for data sampling?	Random	74	63.25
		Stratified	5	4.27
		Systematic	2	1.71
		Cluster	3	2.56
		Rank	9	7.69
		Unidentified	24	20.52
2	What was the type of proxy model performed?	Multivariate Kriging	6	5.13
		Artificial Neural Network	14	11.96
		Response Surface/Surrogate	14	11.96
		Fuzzy Logic	2	1.71
		Bayesian	8	6.84
		Kalman Filter	10	8.55
		Experimental Design	6	5.13
		Other metamodels	31	26.50
Unidentified	26	22.22		
3	What was the objective function used?	Np	6	5.13
		Wp	2	1.71
		NPV	27	23.08
		ROI	1	0.86
		Capillary pressure	3	2.56
		Others	41	35.04
		Unidentified	37	31.62
4	Was there any performance addressed to computational time?	Applied in metamodel developed	18	15.38
		Applied in a simulator used	6	5.13
		Applied the modelling proposed	56	47.86
		No measurement	8	6.84
		Unidentified	29	24.79

5	What were the aspects additionally addressed in the article?	Uncertainty analysis	14	11.97
		History Matching	29	24.78
		Reservoir Characterization	10	8.55
		Optimization	31	26.49
		Production Strategy Selection	5	4.27
		Risk Analysis	14	11.97
		Unidentified	14	11.97
6	What were the problems presented in the article?	Computational Time	76	64.96
		Computational resource	9	7.70
		Type of data	16	13.67
		Unidentified	16	13.67
7	What was the focus of the article analyzed?	Literature Review	1	0.86
		Application	68	58.12
		Technique	3	2.56
		Modelling	22	18.80
		Experimental	23	19.66

Table 5: Result quality scores of selected publications with a score of ≤ 4.0

Number	Publication	QE1	QE2	QE3	QE4	QE5	QE6	QE7	QE8(Score)
1	[74]	0.0	0.0	0.0	0.0	0.0	1.0	0.5	1.5
2	[75]	0.0	0.0	1.0	0.0	0.0	0.0	0.5	1.5
3	[76]	0.0	1.0	0.0	0.0	0.0	0.0	0.5	1.5
4	[77]	0.0	0.0	0.0	0.0	1.0	0.0	0.5	1.5
5	[78]	0.0	0.0	1.0	0.0	0.0	0.0	1.0	2.0
6	[79]	0.5	0.0	0.0	1.0	0.0	0.0	1.0	2.5
7	[80]	0.0	0.0	0.0	0.0	1.0	1.0	0.5	2.5
8	[81]	0.0	1.0	0.0	0.0	1.0	0.0	0.5	2.5
9	[82]	0.0	0.0	1.0	0.0	0.0	1.0	0.5	2.5
10	[83]	0.0	1.0	0.0	0.0	0.0	1.0	0.5	2.5
11	[84]	0.5	0.0	0.0	0.5	0.0	1.0	0.5	2.5
12	[85]	0.0	0.0	0.0	1.0	0.0	1.0	0.5	2.5
13	[86]	0.0	0.0	0.0	0.0	1.0	1.0	0.5	2.5
14	[87]	1.0	0.0	0.5	0.0	1.0	0.0	0.5	3.0
15	[88]	0.5	0.0	0.0	1.0	1.0	0.0	0.5	3.0
16	[89]	0.5	0.0	1.0	0.0	0.0	1.0	0.5	3.0
17	[90]	0.0	0.0	0.5	0.0	1.0	1.0	0.5	3.0
18	[91]	0.5	0.0	0.0	0.0	1.0	1.0	0.5	3.0
19	[92]	0.0	1.0	0.0	0.0	1.0	0.0	1.0	3.0
20	[93]	0.0	0.0	0.5	0.0	1.0	1.0	0.5	3.0

21	[94]	0.5	0.0	0.0	1.0	1.0	0.0	0.5	3.0
22	[95]	0.5	1.0	0.0	0.0	1.0	0.0	0.5	3.0
23	[96]	0.5	0.0	0.5	0.0	1.0	1.0	0.5	3.5
24	[97]	1.0	1.0	0.0	0.0	0.0	1.0	0.5	3.5
25	[98]	0.5	0.0	0.5	0.0	1.0	1.0	0.5	3.5
26	[99]	0.0	0.0	1.0	0.0	1.0	1.0	0.5	3.5
27	[100]	0.0	1.0	0.0	0.0	1.0	1.0	0.5	3.5
28	[101]	0.0	0.0	1.0	0.0	1.0	1.0	0.5	3.5
29	[102]	0.0	0.0	1.0	1.0	1.0	0.0	0.5	3.5
30	[103]	0.0	0.0	0.0	1.0	1.0	1.0	0.5	3.5
31	[104]	1.0	0.0	0.0	0.0	1.0	1.0	0.5	3.5
32	[105]	1.0	0.0	0.0	1.0	1.0	0.0	0.5	3.5
33	[106]	0.5	0.0	0.0	1.0	1.0	1.0	0.5	4.0
34	[107]	0.5	0.0	1.0	0.0	1.0	1.0	0.5	4.0
35	[108]	0.5	0.0	1.0	0.0	1.0	1.0	0.5	4.0
36	[109]	0.5	0.0	1.0	0.0	1.0	1.0	0.5	4.0
37	[110]	0.0	1.0	0.5	1.0	0.0	1.0	0.5	4.0
38	[111]	0.5	0.0	1.0	0.0	1.0	1.0	0.5	4.0
39	[112]	0.0	0.0	0.0	1.0	1.0	1.0	1.0	4.0
40	[113]	0.0	0.0	1.0	0.5	1.0	1.0	0.5	4.0

Table 6 shows the result quality scores of selected publications with a score of > 4.0. We identified a total of 78 publications as having a real contribution to the definition of a proxy, and the construction method of the

proxy used, totalising 65.81% of the 117 publications selected based on our criteria.

Table 6: Result quality scores of selected publications with a score of > 4.0

Number	Publication	QE1	QE2	QE3	QE4	QE5	QE6	QE7	QE8(Score)
1	[114]	1.0	0.0	1.0	0.0	1.0	1.0	0.5	4.5
2	[115]	1.0	0.0	0.0	1.0	1.0	1.0	0.5	4.5
3	[116]	1.0	1.0	0.0	1.0	0.0	1.0	0.5	4.5
4	[117]	0.5	0.0	1.0	1.0	1.0	0.0	1.0	4.5
5	[118]	0.5	0.0	0.5	1.0	1.0	1.0	0.5	4.5
6	[58]	0.5	1.0	0.5	1.0	1.0	1.0	0.5	4.5
7	[119]	0.5	1.0	0.5	1.0	1.0	0.0	0.5	4.5
8	[120]	0.0	1.0	1.0	0.0	1.0	1.0	0.5	4.5
9	[25]	0.5	1.0	0.0	1.0	1.0	1.0	0.5	5.0
10	[121]	1.0	0.0	0.5	1.0	1.0	1.0	0.5	5.0
11	[122]	1.0	0.0	0.0	1.0	1.0	1.0	1.0	5.0
12	[123]	0.0	1.0	0.0	1.0	1.0	1.0	1.0	5.0
13	[38]	0.5	1.0	0.0	1.0	1.0	1.0	0.5	5.0

14	[50]	0.5	1.0	1.0	1.0	1.0	0.0	0.5	5.0
15	[69]	0.5	1.0	0.5	1.0	0.0	1.0	1.0	5.0
16	[15]	1.0	1.0	1.0	1.0	0.0	1.0	0.5	5.5
17	[22]	1.0	1.0	0.0	1.0	1.0	1.0	0.5	5.5
18	[23]	1.0	1.0	1.0	0.0	1.0	1.0	0.5	5.5
19	[26]	1.0	1.0	0.0	1.0	1.0	1.0	0.5	5.5
20	[34]	1.0	1.0	0.0	1.0	1.0	1.0	0.5	5.5
21	[40]	1.0	1.0	1.0	1.0	1.0	0.0	0.5	5.5
22	[59]	1.0	1.0	0.0	1.0	1.0	1.0	0.5	5.5
23	[124]	1.0	1.0	0.5	1.0	0.5	1.0	0.5	5.5
24	[17]	0.5	1.0	0.5	1.0	1.0	1.0	0.5	5.5
25	[43]	0.5	1.0	0.0	1.0	1.0	1.0	1.0	5.5
26	[44]	0.5	1.0	0.5	1.0	1.0	1.0	0.5	5.5
27	[45]	0.5	1.0	0.5	1.0	1.0	1.0	0.5	5.5
28	[51]	0.5	1.0	0.0	1.0	1.0	1.0	1.0	5.5
29	[21]	1.0	1.0	0.5	0.0	1.0	1.0	1.0	5.5
30	[28]	1.0	1.0	1.0	0.0	1.0	1.0	0.5	5.5
31	[68]	1.0	1.0	0.0	1.0	1.0	1.0	0.5	5.5
32	[5]	1.0	1.0	0.0	1.0	1.0	1.0	1.0	6.0
33	[62]	1.0	1.0	0.5	1.0	1.0	1.0	0.5	6.0
34	[64]	1.0	1.0	0.5	1.0	1.0	1.0	0.5	6.0
35	[11]	0.5	1.0	0.5	1.0	1.0	1.0	1.0	6.0
36	[16]	0.5	1.0	1.0	1.0	1.0	1.0	0.5	6.0
37	[65]	0.5	1.0	0.5	1.0	1.0	1.0	1.0	6.0
38	[125]	0.5	1.0	1.0	1.0	1.0	1.0	0.5	6.0
39	[20]	1.0	1.0	1.0	0.0	1.0	1.0	1.0	6.0
40	[47]	1.0	1.0	0.5	1.0	1.0	1.0	0.5	6.0
41	[57]	1.0	1.0	0.0	1.0	1.0	1.0	1.0	6.0
42	[61]	1.0	1.0	0.5	1.0	1.0	1.0	0.5	6.0
43	[66]	1.0	1.0	0.5	1.0	1.0	1.0	0.5	6.0
44	[7]	0.5	1.0	0.5	1.0	1.0	1.0	1.0	6.0
45	[35]	0.5	1.0	1.0	1.0	1.0	1.0	0.5	6.0
46	[36]	0.5	1.0	1.0	1.0	1.0	1.0	0.5	6.0
47	[37]	0.5	1.0	0.5	1.0	1.0	1.0	1.0	6.0
48	[3]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
49	[6]	1.0	1.0	1.0	1.0	1.0	1.0	0.5	6.5
50	[10]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
51	[12]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
52	[24]	1.0	1.0	1.0	1.0	1.0	1.0	0.5	6.5

53	[29]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
54	[30]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
55	[32]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
56	[46]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
57	[49]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
58	[42]	0.5	1.0	1.0	1.0	1.0	1.0	1.0	6.5
59	[55]	0.5	1.0	1.0	1.0	1.0	1.0	1.0	6.5
60	[9]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
61	[14]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
62	[31]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
63	[41]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
64	[52]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
65	[54]	1.0	1.0	1.0	1.0	1.0	1.0	0.5	6.5
66	[60]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
67	[67]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
68	[126]	1.0	1.0	0.5	1.0	1.0	1.0	1.0	6.5
69	[18]	0.5	1.0	1.0	1.0	1.0	1.0	1.0	6.5
70	[39]	0.5	1.0	1.0	1.0	1.0	1.0	1.0	6.5
71	[19]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
72	[48]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
73	[53]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
74	[56]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
75	[13]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
76	[27]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0
77	[63]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0

We presented in Table 6 the results obtained from 77 publications selected for full reading, by score obtained, and the construction of the proxy model, where it is possible to identify the modelling or experiment developed.

4.3 Quality factors

According to [71], SLRs are literature surveys with defined research questions, search process, data extraction and data presentation, whether the researchers referred to their study as a systematic literature review. Due to this,

we analysed the relationship between the score obtained with the QEs and the date of publication. In this analysis, we deemed the 77 relevant publications to the proxy model development. The average quality scores for publications considered as a contribution in the definition of a proxy model for each year is shown in Table 7.

Table 7: Analysis of quality scores for 77 publications considered relevant in proxy model development

	Years										
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of publications	7	12	9	2	4	5	6	13	7	5	7

Mean	5.79	5.88	5.94	6.25	6.13	5.40	5.67	5.85	5.86	6.10	6.21
Standard deviation	0.52	0.62	0.76	0.25	0.65	0.73	0.62	0.72	0.83	0.80	0.80

Table 7 indicates that for the years 2008 and 2014 have had relatively more publications based on our criteria.

V. DISCUSSION

This section, we present the answers to our questions (Topic 3.1), which reported what has been investigated in the literature and considered in proxy model development.

5.1 How many proxy model studies were performed from 2007 to 2017?

Overall, we identified 117 publications. We extracted data and synthesised them to answer our research questions. We selected 77 publications which they were more relevant because the score obtained with the application of our research question was higher to 4.0. A total of 40 papers we considered less relevant because their application was simple, or it was not possible to identify the proxy model development or the modelling applied.

About analyse the proxy model performed in the literature, we identified six types of proxy models that are more utilised in the publications, others were also identified, and then an “other metamodel” class was created. This class represents 31% of the 117 publications which developed another type of metamodel that is different from the traditional one. It is possible to affirm from the literature that the proxy model is also identified as a surrogate, response surface methodology or metamodel, and emulator. Concerning the objective function used, we analyse 117 publications, and 35.04% used implicit objective functions while 31.62% did not define or it was not explicit. The greater focus of published articles was on “application”, some very detailed and some simple.

This SLR identified 52 articles published in journals, totalising 44.44% used to develop this research. Of these 52 publications published, 23.08% - SPE Journal; 21.15% - Journal of Petroleum Science and Engineering; 9.62% - Journal of Natural Gas Science and Engineering; 7.69% - Journal of Canadian Petroleum Technology; 5.77% - Petroleum Science and Technology; 3.85% - SPE Reservoir Evaluation & Engineering, and 28.85% are distributed in another 14 journals. About the conferences, 65 articles are published in 27 different Annals, totalising 56.56% of the 117 publications. Of these 65 publications, we noticed 18.46% in Proceedings - SPE Annual Technical Conference and Exhibition. Still, if we consider all the conferences organised by the Society of Petroleum

Engineering (SPE), they summarise to 61.54%. From the 27 Annals, we observed 17 organised by SPE. The conferences of ECMOR - European Conference on the Mathematics of Oil Recovery, IPTC - International Petroleum Technology Conference and SPE Canada Heavy Oil Technical Conference correspond to 7.69% each.

5.2 What were the research topics addressed to the publication?

Concerning the subject of the articles, six were related to research trends which belong the tree main petroleum areas: Past, Future (Decision-making) and Future (Reservoir Behavior, Production Forecast), as addressed in the model based on CLRDM by [1]. Fig. 5 illustrates the six topics (3 past factors; 2 future (decision-making); and one future (reservoir behaviour, production forecast)) approached in the publications, we identified them in different colours.

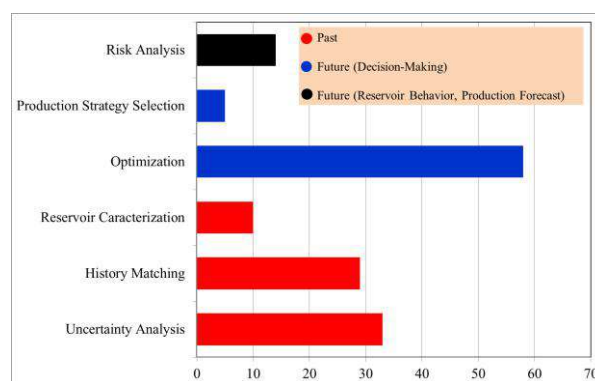


Fig. 5 The three main areas of petroleum reservoir studies related to the development and management of petroleum fields. In red, past; in blue, decision-making (future); in black, reservoir behaviour, production forecast (future).

For past (red) highlighting: uncertainty analysis, history matching, and reservoir characterization. In terms of future (blue) highlighting the aspects that addressed the decision-making process: optimization and production strategy selection. And for future (black) highlighting the elements that addressed reservoir behaviour and production forecast: risk analysis. In the 117 publications, only 14, or 11.97%, were not possible to identify the corresponding area.

It is essential to mention that there are several ways to classify uncertainties in reservoir simulation and

characterization. According to [1] we have: (1) geostatistical realizations of facies, porosity, NTG and permeability; (2) attributes: water relative permeability (krw), PVT, water-oil contact depth (WOC), rock compressibility (CPOR) and vertical permeability multiplier (kz); and (3) economic uncertainties (e.g. market values, taxes, costs and investments). Fig. 5 shows that the term “optimization” was present in most publications. From the data obtained from the production optimisation process, data are generated for running past information, and they are utilised in the future in the production strategy selection process.

There are publications which addressed the production data optimisation, optimisation integrated with uncertainty analysis; risk analysis; history matching; production strategy selection. In some publications the term “optimisation” can be combined to more than one word, for example: “optimisation”, “uncertainty analysis”, “history matching” and “reservoir characterisation”; or “optimisation”, “risk analysis” and “production strategy selection”; or “optimisation”, “uncertainty” and “risk analysis”. Another factor observed in Fig. 5 is the fact that only five publications of the 117 focused on the term “production strategy selection”. This term is essential in future decision-making processes because the development and management of petroleum fields involve risk due to several uncertainties. The authors [1] presented the integration of these six topics step by step with characterisation, long term production data, decision-making process, history matching, details, particularities and complexities.

5.3 What are the problems investigated and presented in the literature for the development of the proxy model?

Concerning the six topics shown in Fig. 5 obtained from SLRs are limited in decision-making, a large number of publications (76 papers) related to computational time as an essential factor in proxy model development. When the proposed proxy model dramatically reduces the computation time, it potentially carries out frequent execution of uncertainty quantification, history matching, risk analysis, and optimisation, resulting in efficient reservoir management and significant computational time reduction. For example: [7, 59] developed a proxy model using Polynomial Chaos Expansion to improve computational time when utilising numeric reservoir simulator. They obtained significant monetary benefits and computational time reduction.

Research on building a proxy model shows that there are critical problems with its development and accuracy. Among other issues, we identified the followings: high computational costs, computational times and performance

of reservoir simulator. Therefore, proxy models should consider development as an essential quality attribute to be achieved, because proxy models do not assume reservoir conditions and characteristics, and physical laws, enabling reduced computational time, reservoir simulator use and human resources.

The development of a proxy model requires considering various factors such as the size and complexity of the model. Knowledge of the effects of these factors in the six topics highlighted in Fig. 5 is essential both for research and practice. Hence, several publications have been performed to investigate the effect of these factors. In 76 publications (from a total of 117), the authors highlighted the importance of computational time reduction; 9 publications highlighted computational resource reduction; and 16 publications highlighted the type of data as an essential factor to be investigated in proxy model development. In another 16 publications, it was not possible to identify the problem present in proxy model development.

Each publication explores a limited set of aspects about proxy model development, and some of them report results which are contradictory to the conclusions of previous work. A good example is the proxy model development process and its execution, where there were no reductions in computational time because it depended on the problem to be more efficient than the application with a commercial simulator. To summarise, this SLR in this field is a valuable source for researchers and interested parties in the development of the proxy model.

5.4 Why use the proxy model?

Numerical reservoir simulators are used at various stages of field development and management phases in the oil and gas industry. Petroleum reservoir engineers evaluate the fluid behaviour and drainage patterns during the production using reservoir simulation models. This procedure is related to the three main areas of field development and management phases, illustrated in Fig. 6.

Reservoir simulation is an essential tool for reservoir studies because it permits the representation of reality (real petroleum field) through a physical model which can be used to describe petroleum production under various operating conditions. Depending on the complexity (size and representativeness) of the model, the reservoir simulation process demands high computational time and resources. The high-level heterogeneity of reservoirs and fluid-type injected to increase petroleum recovery factor often requires high-fidelity models to represent the reality in numerical simulation. Decision analysis related to the management of petroleum fields with high-fidelity models is time-consuming, mainly in probabilistic approaches to

cover all possible solutions. Additionally, the decision involves a risk analysis that accounts for several uncertainties, mostly in the reservoir and fluid parameters, economic model, operational availability, and high computational cost.

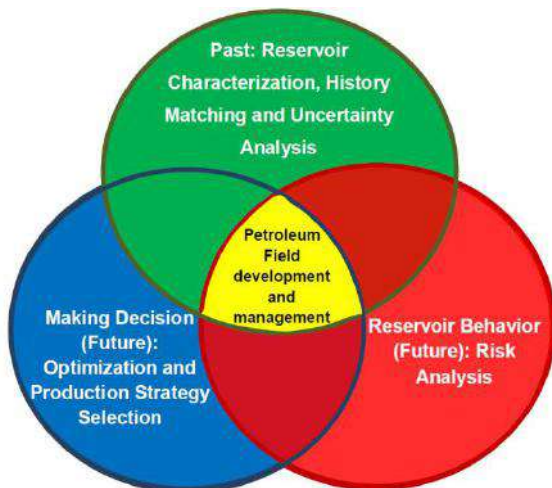


Fig. 6 The three main areas of petroleum reservoir studies where it is possible to apply proxy model techniques.

The authors [1] portrayed the complexity of the process based on 12-step closed-loop reservoir development and management. Several research fields that suggested the investigation of appropriated architectures and methodologies were used as proxies to accelerate some parts of the process. The authors [127] referred to the proxy model as “metamodels”; in other words, it is a “model of a model”. “Model emulation” is another term referring to surrogate modelling (proxy model) [128]. The authors [129, 130] mentioned that the term response surface surrogate in the literature is referring to the metamodel. This way, the proxy model can be defined, such as an approximation of a response function built using data fitting of limited simulation results [131].

Moreover, a metamodel is a relatively simple model used to mimic the reservoir simulator output, reproducing the simulation’s input-output relationships. The quality of the proxy model generated will depend on the mathematical approach, and the input used to build it. There are many motivations to create the proxy model, such as [132-134]:

- Better use of the available, typically limited, computational budget;
- Low-resolution models for simple analysis (predict future petroleum production);

- The models (input and output) are often large and complex;
- Computational demands result in high computer time for obtaining results from such complex models, especially in probabilistic settings;
- Unreasonably high computer times could prevent decision-maker from exploring the design space, resulting in underperforming results.

The main obstacle of the reservoir numerical simulator is the extensive use of the most sophisticated techniques, and the high number of model runs required. On the other hand, the proxy models tend to be fast.

The most used proxy models in the oil industry highlighted in the SLR were: kriging model (KG); artificial neural network (ANN); response surface methodology (RSM), fuzzy logic (FL), Kalman filter (KF), Experimental Design (ED), and Bayesian emulators (EM) and other models such as genetic algorithm (GA), Karhunen–Loève expansion (KL), polynomial chaos expansion (PCE), support vector machine (SVM) and deep learning (DL).

5.4.1 Kriging Model

Kriging (KG) is a geostatistical technique for estimating properties at locations that do not have measured data [55]. In other words, KG is the geostatistical method of predicting values at unsampled points [135], which is a form of multi-dimensional interpolation very commonly used to build the proxy model in petroleum reservoir studies. It uses a variogram model (a measure of spatial correlation) to infer the weights given to each data point.

It is worth mentioning that KG is similar to other interpolation methods, such as radial basis function (RBF) and spline. Besides, it is a combination of a polynomial model, which is a global function over the entire input space, and a localized deviation model based on spatial correlation of samples [133].

According to [135], the main goal of the KG is to predict the values of stationary covariance at the unsampled point concerning the mean squared error. The covariance function is not commonly known and needs to be estimated. There are some types of KG: ordinary kriging, simple kriging, universal kriging, and the co-kriging, [135] presented the details and their mathematical derivation. The authors [55, 135] give more information on this technique.

5.4.2 Artificial Neural Network

Artificial neural networks (ANNs) are structures inspired by biological nervous systems, which can deal with different complex problems. In other words, ANNs are computational models developed on the principle of the biological nervous system [64]. According to [65], it is a virtual intelligence or machine learning technique which is useful for pattern recognition and prediction of a complicated non-linear relationship between input and output.

ANNs can assimilate highly complex relationships between several variables that are presented to the network and learn the characteristics of the dependency between input and output [62, 63]. ANNs are classified in supervised and unsupervised learning. Unsupervised learning is used to classify a set of data into a specific number of features. In contrast, supervised learning classifies patterns and makes decisions based on the patterns of inputs and outputs learned.

The use of ANNs has been increasing in the oil and gas industry over the past decades to solve many complex and highly non-linear problems [136] and uncertain relationships between the input and output for given dataset [68]. According to [61], the results of some applications of ANNs in several research fields suggest the investigation of appropriated architectures for reservoir simulator. They have been successfully applied in several research fields of petroleum engineering to solve various problems, for example, reservoir characterisation, forecasting, risk analysis, history matching, uncertainty analysis, optimisation, production strategy selection, among others. The authors [3, 69] present more application of ANNs in the oil and gas industry.

The difficulty in the application of ANNs as a reservoir simulator proxy is for them to be fully trained, which requires a large number of reservoir simulation runs [61]. Otherwise, ANNs have the benefit over other conventional techniques, such as response surface and reduced models, to perform complex and highly non-linear inputs and outputs accurately and rapidly [69]. According to [137], ANNs offer some advantages, including their capacity of inferring highly complex, nonlinear, and possibly uncertain relationships between system variables, requiring practically zero prior knowledge regarding the unknown function.

5.4.3 Response Surface Methodology

Response Surface Methodology (RSM) is an application of statistical and mathematical techniques useful for developing and optimizing models and parameters [18]. The authors [139] defined RSM as a

combination of statistical methods to build an empirical model for the objective function used in the process.

The authors [69] highlighted various studies which used RSM to calculate the porosity and permeability distribution in a heterogeneous and multiphase reservoir. Also, to replicate the results of a full field simulation model based on time complexity, and to analyse of the uncertainty of coalbed methane production to optimise the performance of a reservoir; among other studies. According to [40], the goal of the experimental design and RSM is to build response surfaces of specific objective functions that genuinely represent the response. For more application using RSM in the oil and gas industry, see [31].

5.4.4 Fuzzy Logic

Fuzzy logic (FL) is a superset of conventional Boolean logic that has been extended to handle the concept of partial values between true and false [139, 140]. In other words, FL is logic or probabilistic form, which deals with reasoning that is approximate rather than exact. It is built with fuzzifier, the inference mechanism, the rules, and the defuzzifier.

In the petroleum industry, there are many different studies with the application of FL, for example, [141] in dealing with the uncertainty of a number introduced a fuzzy analytic hierarchy process. This process describes a relationship between an uncertain quantity and a function which ranges from 0 to 1. The authors [49] present more studies concerning FL.

5.4.5 Kalman Filter

According to [142], the Kalman filter (KF) can be viewed, such as a Bayesian estimator that approximates conditional probability densities of the time-dependent vector. KF is optimal for linear problems for assimilating measurements to update the estimate of variables continuously. Additionally, it is most appropriate when a short number of variables characterizes the issues and when the variables to be estimated are linearly related to the observations [21, 23]. According to [23], this case is not applied to spatiotemporal reservoir problems because the number of model parameters is typically very high, and the relation between the reservoir model and the production observations, represented by a fluid-flow simulator, is highly nonlinear. It is essential to highlight that most data assimilation problems in petroleum reservoir engineering are highly nonlinear and are characterised by many variables.

Several extensions of the KF techniques have been suggested, such as ensemble Kalman filter (EnKF),

developed by [143], and documented by [144-146]. In reservoir engineering literature, EnKF has been primarily used to estimate or stochastically simulate grid block permeabilities and porosities [147]. Therefore, it can be conceptually extended to include other parameters [22].

According to [26], EnKF performs the initial sampling, forecasting, and assimilation steps for automatic history matching in the petroleum industry. EnKF has emerged as an attractive option for reservoir history matching problems because it is simple to implement and can be computationally efficient [27-30; 147]. It can also improve the accuracy and reduce the corresponding predictive uncertainty by accounting for observations [9].

The use of the EnKF is a promising approach for data assimilation and assessment of uncertainties during reservoir characterization and performance forecasting [25]. Many studies using EnKF in petroleum engineering can be seen in [22, 23, 26].

5.4.6 Experimental Design

Experimental Design (ED) can be used to generate a reliable response surface which covers the entire range of uncertain parameters [3]. In other words, according to [148], ED presents a method that investigates the effects of multiple variables on output or response, simultaneously.

The experiment of [39], with the ED application, involved many simulations and are made changes on the input variable. The authors [5] mentioned that, in an experiment, one or more variables could be changed to quantify the effect of inputs on outputs (response variables). ED is used to avoid the time-consuming process to capture all changes with the minimum number of simulator runs [31, 38]. The authors [34, 38, 41] show many studies in petroleum engineering which applied the ED methodology.

5.4.7 Bayesian Emulators

The authors [10] inform that an emulator is usually composed of a predictor (a statistical approximation of the unknown function), and also by predictor uncertainty quantification. In other words, an emulator uses reservoir properties as input in a statistical model constructed from simulator outputs. The emulator response is faster, but there is still a need to establish the issues with uncertainty in the inputs and outputs.

The number of methodologies using Bayesian emulators is increasing [11-13, 62, 149-154]. But, there are still some obstacles in the implementation, especially in production strategy selection stages, as follows:

- The high computational costs in the quantification of probabilistic problems;

- Effective ways to parameterize the geostatistical realization uncertainties (porosity and permeability distribution);
- Analysis of measurement errors of various classes of uncertainties;
- Assessment of model discrepancy for uncertainty quantification;
- Practical techniques for the decision-making process.

This way, the development of emulators requires careful consideration of various factors, such as optimization process, uncertainty quantification and computational time. The initial knowledge of factor effects during the emulator's construction is fundamental to obtain a useful emulator.

It is worth highlighting that there are many uncertainties associated with the generation of geostatistical realizations [8, 155]. These are combined with realizations from the reservoir, technical and/or economic models to compose the different reservoir model scenarios [156]. These scenarios are then used to make decisions without fully accounting for uncertainties and risks.

5.4.8 Other Proxy Models

This section includes a summary of other proxy models found in the SLR.

- Genetic algorithm (GA) – They are stochastic search and optimization heuristics methods from classical evolution theory [157]. Moreover, they require only objective function evaluations to find optimised points, even though the derivative information is not available [48]. Therefore, their extensive application in different fields is proof that they can be applied to various engineering problems [48, 60].
- Karhunen–Loeve expansion (KL) - It is a promising approach for representing random fields from a covariance matrix. It is a linear relation that decorrelates the random field while preserving the two-point statistics of the area [7]. The covariance function may describe the correlation structure of the random field. KL is an optimal technique for parameterization [158] because it approximates the original random area accurately and with a minimum number of inputs [7]. The authors [159] present more details about KL.
- Polynomial Chaos Expansion (PCE) – Wiener (1938) introduced this technique. According to [59], PCE obtained notable of popularity for the uncertainty quantification of dynamic systems. It is worth mentioning that [159] were pioneers in the use of uncertainty quantification. Nowadays, PCE is applied to various problems and studies in petroleum engineering. The

authors [159] used PCE to quantify uncertainty for efficient closed-loop production optimisation. While the authors [59] used PCE as a proxy substitute for the full reservoir simulator proxy when applied to the Markov chain Monte Carlo method and the authors [7] used PCE to predict the production parameters of steam-assisted gravity drainage (SAGD) reservoir. It is worth noting that PCEs have a significant advantage over other proxy models, because of their convergence in probability and distribution to the output random variable of interest [7, 59].

- Support Vector Machine (SVM) – It is a part of machine learning (artificial intelligence – AI), a supervised learning technique, being widely applied in classification and regression analysis. According to [31], AI is an application in the oil and gas industry which has enormous potential to explore the knowledge regarding reservoir characterization, PVT properties, well placement, etc. The authors [8, 161-163] presented an application in the petroleum engineering.
- Deep learning (DL) – We did not identify this technique in the articles analyzed for the development of SLR, but some authors mentioned future work utilizing DL in petroleum engineering. The authors [164, 165] applied DL to petroleum well data.

VI. CONCLUSION

This research enables us not only to know about state-of-the-art proxy modelling but also serves to identify the primary contexts in which to apply it. Besides, it provides us with insight into the criteria used when facing the need to decide on the method based on a context to perform this task. In this SLR, we identified the three main area applications related to the petroleum engineering area: past, future (decision-making) and future (reservoir behaviour, production forecast). These area applications are based in 6 topics (three past, two decision-making and one reservoir behaviour and production forecast): uncertainty analysis, history matching, reservoir characterisation, optimisation, production strategy selection and risk analysis.

Depending on the complexity of the model, the use of reservoir simulator is more efficient than a proxy because of the high computational time and human resources. A total of 64.96% of the 117 publications selected, the authors mentioned that the computational time reduction is essential for the development of the proxy model development. When working on proxy modelling, this becomes even more complex due to high-heterogeneous reservoirs and high-dimensionality problems, especially in

maintaining the geological consistency, which is the main focus of reservoir modelling. The dimensionality reduction is a complex problem and involves thousands of reservoir simulation runs, representing an obstacle for practical applications when we did not define the adequate method and number of dimension.

This SLR has various limitations, mainly in the petroleum engineering area, because it is not a developed research method. Another limitation is the inclusion and exclusion criteria constructed and used in our research. This research relies on certain types of publications in reviewing academic literature. We did not include in the development of the SLR, the scientific articles published as books, technical reports, work in progress, and publications without bibliographical information or unpublished research that were not in the seven databases. Therefore, this research may be missing relevant studies published in other digital libraries, or those did not appear in the search results due to the search string. Due to criteria, we were in line with the exclusion criteria of this study, and with all requirements established systematically, so as not to pose risks for validating the results.

The primary purpose of this SLR was to ascertain existing decision-making and criteria for the comparison and selection of methods for proxy model development in future research. The results may also be useful for researchers as it can help them to analyse the existing publications in the different methods utilized in the metamodel development, identifying gaps to perform further research. Additionally, from the SLR, scientific methods are straightforward and reproducible because their proposed methodology enables an accurate survey and a scientific development of the state-of-the-art in the specific problems of research. For this reason, we could achieve future work about metamodel with the integration of fast methods and reservoir numerical simulator runs. The integration can improve and accelerate results within acceptance criteria and accuracy in the decision-making process related to reservoir management and development, which are necessary for the uncertainty quantification process in the petroleum field.

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Clinical and pathologic patterns of oral leukoplakia: A retrospective study of surgical management and clinical outcome

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Abstract—The aim was to evaluate the clinical-pathological characteristics and to assess the outcomes of the clinical management of oral leukoplakia (OL), considering the clinical-pathological characteristics as predictors of OL progression. This retrospective observational analysis was conducted with patients referred to our university between the years 1998 to 2013. Only the medical records containing age, gender, smoking status, alcohol consumption, clinical, pathological and management documentation were included. A new biopsy was performed in cases in which recurrence or changes in clinical parameters were observed. The association between the clinical, demographic and histologic characteristics and the clinical fate of OL was analyzed with the Fisher exact test. Of 120 patients, 22 presented demographic and clinicopathologic data eligible for further analysis, of which 54.5% were female and 45.4% were male. The mean age was 52.5 ± 13.11 years, and the follow-up period ranges from 12-180 months. Tongue dorsum and buccal mucosa were the most affected sites, with predominance of lesions with $<200 \text{ mm}^2$ (77.3%) in size, with a majority representing the homogeneous type (95.4%). Twenty two percent presented changes in the clinical/histological behavior. Most of the surgically treated cases presented no signs of changes in the behavior. Clinical, demographic and pathologic variables were not significantly associated with remission/stabilization or recurrence of OL ($p > 0.05$). Although the possible bias related with retrospective studies, our results suggests that surgical removal of OL should be performed even in cases without OED. None of the studied clinical traits were reliable in the prediction of the risk of OED worsening.

Keywords—Epidemiology, Oral leukoplakia, Prognosis, Risk factors, Surgery, Treatment.

I. INTRODUCTION

More than 90% of the head and neck malignant neoplasms are Oral squamous cell carcinoma (OSCC), with more than 300.000 arising annually worldwide [1-3]. Over the last 3 decades the survival rates of OSCC have not improved significantly [4], remaining in a 50% to 55% range. Prevention of malignant transformation by the detection and treatment of oral potentially malignant disorders (PMDs) could influence dramatically the patient's survival rates and may contribute to reducing the burden of oral cancer [5].

PMDs can be defined as morphological tissue changes in which there is a higher probability of emergence of malignancies in comparison with normal oral mucosa [5]. Although there is a statically increased risk for PMDs to progress to cancer, malignant transformation rate of these disorders could vary from 0.3 to 27% [6,7]. Oral leukoplakia (OL) is the most common PMD of oral cavity and has been reported as a lesion with an increased risk of progressing to cancer [8-10]. The most recent definition of OL describe this condition as “predominantly white plaques of questionable risk, having excluded (other) known diseases or disorders that carry no increased risk

for cancer” [11]. Clinically OL is classified into homogenous and non-homogenous types, with the former characterized by a uniformly and thin white plaque, with a flat and smooth surface, with occasional shallow cracks, and the latter characterized by the presence of a speckled (white and red in color, also called erythroleukoplakia), nodular (small red or white polypoid outgrowths) or verrucous lesion (white corrugate plaque) [12]. Histologically, this condition may show normal epithelium or varying degrees of oral epithelial dysplasia (OED) [13].

The presence of OED in OL could be associated with a possible progression to malignancy. However, the histologic assessment of OED can carry intra and interobserver variability, and such method should not be considered the only tool to evaluate the risk of malignant transformation [10]. In fact, there are some clinical features that could be also useful in the OL prognosis assessment [14], as anatomical site, size of lesion, clinical type, gender, age and habits¹⁰. According to Van Der Waal (2009) [9] OL localized at tongue or floor of mouth, larger than 200 mm², categorized as non-homogeneous, in female patients, in patients with >50 years-old and/or in non-smokers have an increased risk of malignant progression.

Despite the variety factors that could be related with an increased risk of OL malignant transformation, the prediction of the outcome of an individual patient is a challenging task, since the clinical risk factors could vary between different population, and the histologic grading system could not predict with accuracy the malignant transformation [15]. These factors point out that there is a need for studies to reinforce which clinical features constitute risk factors for OL and OL malignant transformation in the different populations. It is also emphasized that there is no consensus about OL management [5], with a lack of information about the impact of interventions in the prevention of the progression of OL into cancer [14]. The study of clinical and histopathological characteristics of OL, allied to the analysis of the impact of the management modality in the prevention of malignant progression, could aid in the identification of malignant transformation risk factors in different population. Thus, the aim of this study was to evaluate the clinical-pathological characteristics of OL and to assess the outcomes of its clinical management, considering the clinical-pathological characteristics, smoking habit and alcohol consumption habit as predictors of OL progression.

II. METHODS

This study was approved by the Human Ethics Committee of our Institutional Review Board at number 015/2010. Informed consent was obtained from all eligible subjects. A retrospective observational analysis was conducted with patients referred to the oral medicine clinic of our university between the years 1998 to 2013. Only the medical records containing age, gender, smoking status, alcohol consumption, clinical (anatomic location, color and size of the lesion), pathological and management documentation were included. Records of patients under 12 months of follow-up or with uncertainty in OL diagnosis were excluded. Of 120 patients, 22 presented demographic and clinicopathologic data eligible for further analysis (Table 1). The patients were then reassessed in order to update the overall health status, smoking and drinking habits, and physical clinical status (anatomic location, size, color and surface). A new biopsy was performed in cases in which recurrence or changes in clinical parameters were observed.

2.1 Clinical evaluation, management and outcome of Oral Leukoplakia

The management proposed for this sample were assessed according the evolution of lesions, resulting in remission/stabilization or change in behavior/recurrence of the lesion.

Evaluation criteria

1. Remission: when surgical excision was performed, and no signs of recurrence was observed;
2. Stabilization: the lesion remained unchanged during the follow-up period, where the complete excision was not performed;
3. Change in lesion behavior: the lesion had clinical or pathological changes (increase in size, development of erythematous areas or/and progression of dysplastic grading), where the complete excision was not performed;
4. Recurrence: recurrence of the lesion at the primary site or the development of lesions in other sites as a result of field change.

2.2 Histopathological analysis and histological grading of OED

The histological slides of the first biopsies were reviewed by two independent oral pathologists and the histological grades of OED were determined according to the World Health Organization (WHO) [16] criteria in a blinded fashion. According to the clinical evaluation criteria proposed in this study, new biopsy specimens were obtained from 5 patients. The specimens were fixed in

10% buffered formalin (pH 7.4), embedded in paraffin, submitted to 5 µm histological sections for routine staining with hematoxylin eosin (H&E) and analyzed under light microscopy. The histological grades of OED in the new biopsies were also determined by two independent oral pathologists in agreement with WHO criteria. Any disagreement in the findings was discussed among the pathologists to render a final evaluation.

2.3 Statistical Analysis

Descriptive statistics was used to summarize patients clinical, demographic and pathological data. The association between the clinical, demographic and histologic characteristics and the clinical fate (remission/stabilization/recurrence) of leukoplakia was statistically analyzed with the Fisher exact test. Statistical significance was established at $p < 0.05$. Statistical analysis was carried out using the software SPSS version 19.0 (Statistical Package for the Social Sciences, Chicago, IL, USA).

III. RESULTS

The total of 22 patients was included in the present research, of which 54.5% were female and 45.4% were male. The mean age was 52.5 ± 13.11 years, and the follow-up period ranges from 12-180 months (mean= 96.54 ± 52.56). Tongue dorsum and buccal mucosa were the most affected sites, with predominance of lesions with $< 200 \text{ mm}^2$ (77.3%) in size, with a majority representing the homogeneous clinical type (95.4%) (Table 1).

Table 1- Clinical, demographic and histological profile of the patients.

Clinical/demographic/Histologic characteristics	n
<i>Gender</i>	
Female (F)	12
Male (M)	10
<i>Age</i>	
<50.0	11
50.0-59.11	6
≥ 60	5
<i>Site (including recurrences)</i>	
Tongue dorsum	6
Buccal mucosa	5
Mandibular/Maxillary alveolar ridge	5
Lateral border of the tongue	4
Vestibule	3

Retromolar area	3
Hard palate	2
Mandibular/Maxillary gingivae	2
<i>Size of lesion (largest in cases with multiple lesions)</i>	
<200mm ²	5
≥200mm ²	
<i>Clinical appearance</i>	
Homogenous	21
Non – Homogenous	1
<i>Epithelial Displasia</i>	
Without dysplasia	7
Mild dysplasia	9
Moderate dysplasia	6
Severedysplasia	0
<i>Number of lesions</i>	
Single	12
Multiple	10
<i>Smoking history</i>	
Never	8
Past or present	14
<i>Alcohol consumption</i>	
Never	11
Past or present	11
<i>Follow-up</i>	
1 year	2
5 years	9
10 years	7
15 years	4

Among the 22 evaluated patients, 77.3% had complete remission/stabilization of the lesions, and 22.7% presented changes in the clinical/histological behavior or recurrence (Figure 1). Most of the surgically treated cases presented no signs of changes in the behavior or recurrences (Table 2). From all sample, 68.1% presented dysplasia, 45.4% presented multiple lesions, 63.6% were smokers and 50% were drinkers. The characteristics of patients who had changes in behavior/recurrence at the primary site or other sites are presented in Table 3. Clinical, demographic and pathologic variables (age, gender, smoke habit, drink habit, clinical appearance and grade of OED) were not significantly associated with remission/stabilization or

recurrence of OL ($p>0.05$). Conservative and non-conservative management do not differ in respect of OL

clinical outcome ($p>0.05$).

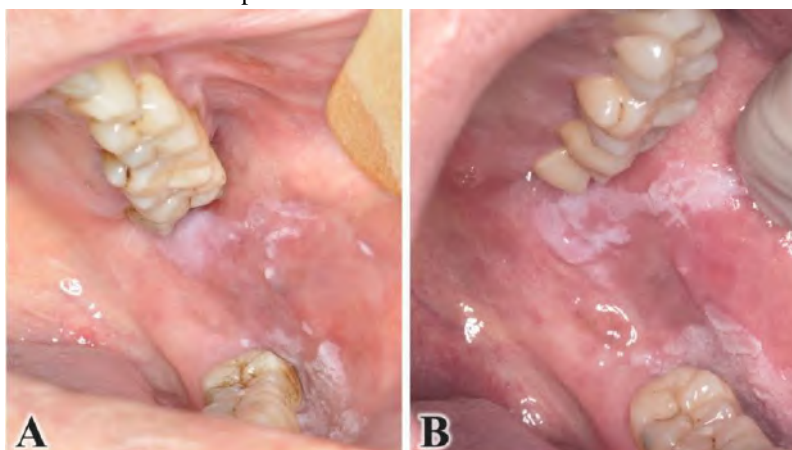


Fig.1: Clinical image of oral leukoplakia characterized by a white homogeneous patch in the left buccal mucosa. (A) Initial clinical presentation. (B) Clinical aspect 1 year after the initial biopsy: Increasing in size and changes in the clinical appearance.

Table 2: Patients outcome according to the management modality.

Clinical/pathological progression	N (%)	Conservative Treatment	Non-conservative treatment (surgical)
Remission/Stabilization	17 (77,3%)	8	9
Change in the behavior /Recurrence	5 (22,7%)	4	1

Table 3 - Clinical, demographic and histological characteristics of lesions that presented changes in the behavior/recurrence

Patients	1	2	3	4	5
Gender	F	M	F	F	F
Age	83	57	40	50	57
Site	Right mandibular alveolar ridge	Lateral border of the tongue	Buccal mucosa	Tongue dorsum	Left mandibular alveolar ridge
Size of lesion	>200mm ²	<200mm ²	>200mm ²	<200mm ²	<200mm ²
Clinical appearance	Homogenous	Homogenous	Homogenous	Homogenous	Homogenous
Smoking history	No	No	Yes	Yes	No
Alcohol consumption	No	No	Yes	No	No
Epithelial dysplasia (first biopsy)	Mild dysplasia	Without dysplasia	Without dysplasia	Without dysplasia	Without dysplasia
Epithelial dysplasia (Follow-up biopsy)	Moderate dysplasia	Mild dysplasia	Mild dysplasia	Moderate dysplasia	Mild dysplasia
Treatment	Conservative treatment	Non-conservative treatment	Conservative treatment	Conservative treatment	Conservative treatment

	tment	atment	atment	atment	atment
<i>Time to recurrence</i>	4 years	11 years	2 years	7 months	6 years
<i>Clinical fate</i>	Progression of the grade of epithelial dysplasia + Recurrence at another site (left mandibular alveolar ridge)	Progression of the grade of dysplasia	Progression of the grade of dysplasia	Progression of the grade of dysplasia + Recurrence at another site (Tongue dorsum)	Progression of the grade of dysplasia + Increased size (4mm – 8mm)

IV. DISCUSSION

The management of OL could be a real dilemma for the clinician, varying from just a long-term observation to surgical excision [9]. Many risk factors should be considered when the treatment modality of OL is debated, this include clinical, demographic and histological characteristics, such as anatomical site, size of lesion, clinical type, gender, age, smoke or drink habits, and the grade of OED [10, 14]. Although some of the mentioned risk factors are apparently established in the current literature, there is a strong variation of these features in the different population [17-20]. This emphasizes the importance of additional studies to reinforce which clinical/demographic features constitute risk factors for malignant transformation of OL in specific population and which management modality could be considered in the presence of the mentioned risk factors.

In the present study it was presented the clinical, demographic and histological data from 22 midwestern Brazilian patients diagnosed with OL with a follow-up period varying from 12 months to 180 months. It was found a slight tendency of OL to occur in female patients, mean age of 52.5 years old, with a predominance of the homogenous type. In relation with age and clinical type, our data are in accordance with the most part of the studies of the population of developed and developing countries, with the mean age above the fifth decade of life [21] with the homogenous form being the most common type of OL [22]. It was found a singular trace in the present sample, which was the higher prevalence of OL in female patients. Most reports showed that female was found to be much less likely to have OL [23]. These findings could be justified by the fact that men are more prone to have the smoking habit [24]. Apparently, in our sample, the female prevalence could be explained by the predominance of the smoke habit in these patients, supporting that local habits, which could vary from the different geographic regions,

could influence in the occurrence of OL. Despite the lack of studies demonstrating the relation of smoke habit with OL in a mechanistic way, a great number of investigations have pointed a relation between smoke and OL [25].

Here we also observed a tendency of OL to present changes in it behavior or to recurrence in female patients, even though there was no significant association between gender and the risk of OL progression. Despite the fact that OL is usually less frequent in females, it was observed previously that female gender has a greater risk of malignant transformation [24]. However, it has not been elucidated why women are more disposed to malignant transformation, and which habits or environmental or genetic factors are involved in this change in the behavior.

One of the main risk factors for progression of OL to malignancy is based on it clinical features, as the clinical type (homogeneous and non-homogenous), size and anatomical site. According to Speight et al. (2018) [26] there is strong association with an increased risk of malignant progression when the lesions are represented by the non-homogenous type, when exceeds 200 mm², and when occurs in the tongue or floor of mouth. In the present investigation the homogeneous type account 95.4% of our sample, with 77.3% of OL samples with less than 200 mm² in size, and tongue dorsum, buccal mucosa, alveolar ridge and lateral tongue the most prevalent oral sites for OL. It was also observed that the homogenous type has a potential to have changes in clinical or/and histological behavior. Although there is no statistical significance, all the cases that showed changes in the behavior or recurrence were homogeneous type at first. In fact, OL is a dynamic condition that could vary in it clinical and histological appearance over the time, and even having a lower risk of malignant transformation compared to the nonhomogeneous type, homogeneous OL carries an increased risk of progression to cancer in comparison with normal oral mucosa [26], indicating that this data should

not be underestimated. Additionally, OED could be more prevalent in specific anatomical sites, such as tongue [27], like we demonstrated in our sample.

There is some evidence that size of OL have a significant correlation with its progression to cancer [23, 28]. According to Warnakulasuriya and Ariyawardana (2016) [23] lesions with more than 200 mm² presents a higher risk to progress to malignancy. In the present study, even homogenous lesions with less than 200 m² progress in the grades of OED. Nevertheless, none of the 22 cases of this investigation presented malignant transformation. The prediction of risk of malignant progression of OL based on the clinical parameters, despite the evidence of its correlation, could be problematic, since these parameters usually are investigated through observational studies, which could present bias and could differ among the distinctive population.

In this report we also analyzed not only the clinical characteristics, but also the grade of OED. OED assessment can be a real challenge in order to predict the risk of progression of OL, owning a subjectivity related to its intraobserver and interobserver variability [29]. Anyway, OED histologic grading remains the accepted method for evaluate OL prognosis [15], with some evidence that the more severe the epithelial dysplasia is greater are the chances to progress to malignancy [20]. However, malignant transformation of mild dysplasia and complete regression of severe dysplasia could be also observed, which raises doubts as to the classification of risk of malignancy adopted in OL [15, 29]. In our findings it was observed that the majority of OL lesions which presented changes in the behavior or recurrence were initially graded as a lesion without epithelial dysplasia. In fact, OED progression could be related with various factors, since the duration of the lesion, habits and infection could influence the dysplasia status [15].

The management of OL should be carefully pondered because an aggressive treatment modality could not be reasonable, considering the related morbidities, and also the fact that lesions, even with mild or moderate OED, could not progress to malignancy. Our results suggested that intervening even in lesions without epithelial dysplasia could be considered, since the observation alone seems to be not satisfactory to prevent progression of OED. Comparably, Arnautakis et al. (2013) [30] evocated that an early excision of any PMD should performed, since they found a high recurrence rate or malignant progression of lesions that were passive observed over the time, even when they were classified as a mild OED.

V. CONCLUSION

Prospective studies with larger sample should be considered to expand our findings, since we evaluated just 22 cases. Although the possible bias related with retrospective studies, our results suggests that surgical removal of OL should be performed even in cases without OED. However, none of the studied clinical traits were reliable in the prediction of the risk of OED worsening.

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Economic Efficiency of Crop Production in Gurage Zone: The Case of Abeshige Woreda, Snnpr Ethiopia

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Abstract— Efficiency is an accomplishment through operation to use least amounts of inputs to achieving a highest level of output it is an important area of study because ensuring efficiency minimizes the wastage of resources while accomplishing the desired outputs. This study was to decide the economic efficiency of crop producing rural farmers in abeshigeworeda or district which is one of the districts in gurage zone, SNNPR. Six kebeles and 399 sample respondents were selected through applying stratify sampling procedure. The descriptive statics, Parametric Stochastic Frontier Production Function, the Cobb Douglas production function and Tobit regression methods were used to accomplish the objective of the study. The rural farmers ranked constraints were analyzed through using Kendall's coefficient of concordance to test for the degree of agreement in ranking. Technical efficiency estimates range from 19.94 percent to 95.16 percent with a mean efficiency of 64.69 percent, while Allocative efficiency estimates range from 15.52 percent to 97.69 percent with a mean of 57.47 percent. The economic efficiency estimates range from 10.9 percent to 81.29 percent with a mean of percent. As the result indicated, crop output was positively and significantly influenced by labor, seed, fertilizer, house hold size and land size. This study therefore recommended that would improve the application of full packages of fertilizer and improved seed, appropriate use of productive labors, line method of seeding and membership of individual farmers.

Keywords— Cobb Douglas, Tobit, Technical, Allocative efficiency and Economic efficiency.

I. INTRODUCTION

1.1 background of the study

There are two basic pressures that enforcing nations, specially developing countries like Ethiopia, in order to increase agricultural production and productivity while the first one is the food security challenges that is demanded to feed the existing population size of the nations. The other force is the demand of producing surplus products to supply to domestic and also to international markets thereby able to earn foreign currency. Ethiopia had designed and implemented agricultural development policy and strategies in 2003 to respond about those basic challenging pressures which is broadly incorporated ensuring of food security and accelerated economic growth through enhancing of farmers market oriented production system. More over the policy document focused up on the subsistent characteristics of the

farms and small scale producers which are the majority of agricultural products have supplied (Alemayehu et al, 2011).

As components of growth, export has been one of the strategic area of the country despite a great gap has been observed between the import and export commodity values of the country. According to CIA 2017, the annual export value of the country was 4.14 billion USD whereas the total import commodity value was 12.08 USD as a result the trade deficit of the country was negative 31% by the year 2016. Ethiopia mainly exports agricultural outputs and imports some sophisticated industrial commodities. The country's production and productivity of the agricultural sector improves in some extent and the overall real economic growth of the country by the year 2017 was around 8.5%, though, it has facing troubles due to low volume and value of export products to foreign trades, the availability of food

insecurity which is not balanced with the current population pressure i.e. 99.47 million with the average growth rate of 2.89 % per year (CIA world fact book, 2018).

In Ethiopia, Pulses are one of agricultural crop grown on 12.4 percent of the total area cultivated, by a total of 6.8 million farmers. Together, these holders produce a yearly average of 1.5 million ton of pulses, which is 8.5 percent of total crop production (Alemayehu et al, 2011). Producing crops has a number of advantages to ensure the food security and economic demands of a producer because it allows for double cropping in a season using early maturing cultivars and it serves for consumption and as a source of cash to farmers. Moreover to this, it contributes towards a balanced diet because of its high protein content and convenient for intercropping because of its short growth duration and diverse growth habit. It serves as an export commodity to earn foreign currency (walegn: 2015).

1.2 Statement of the problem

The global efficiency level is very low when it compared to the expected potential productivity level and hence the attained average yield of the crop so far in the world is 8 qt/ha(walegn, 2015). The presence of such low level of production efficiency at global level is as a result of production efficiency differences between regions and nations of the world. As many of literatures indicated, the efficiency level of crop production is determined by a number of factors of production and their effect is also different from place to place. Some regions like the developed world has a better skills, knowledge, policies, institutional capacity and application of technologies that can lead them to achieve the maximum and potential productivity level of crop whereas countries in the developing world have shown very low production efficiency performance.

The average productivity of the crop in Ethiopia and for SNNPR is recorded as 12.6 qt/ha and 11.46qt/ha respectively (ibid). This implies that as there is a great potential to increase productivity and production of the crop. Improving the crop's productivity and production within Ethiopia should be intensified as a result of its current socio economic and demographic existence that requires equitable source of domestic nutritional food supply, the presence of higher demands for foreign imported products with low capacity of exportable products that has brought unbalanced trade problem and this in turn resulted a great shortage of foreign currency within the country. In other speaking as primary sources of all demands of the country, currently agricultural

production and productivity is not proportionate with the total population demands and the targeted economic growth rate to be achieved(Essa: 2011).

According to Ageteet *al.* (2014), Ethiopia is the top twelve producers of total legumes in the world generally, the current national average productivity of the crop is 14.8qt per hectare whereas the average research demonstrated productivity potential is 34 qt per hectare in the country (Mulugeta et al., 2015). This implies that as there is a great yield differences within the two fields, even the nationally attained productivity result is lower than half of the research demonstrated productivity potential and hence it needs a great attention to improve the existing situation.

To address the causes of the yield gap problem, different works of scholars have been conducted though many of them have considered only the evaluation of technical efficiency and allocative part but they were not include economic efficiency measurements of the crop and hence it needs to asses integrated efficiency measurement applications that must include economic efficiency. On the other hand, from the reviewed sample empirical findings of the previous works, it can be to understand that as there are a number of elements in the variable set that can be determine the efficiency level of agricultural production even they have not been exhausted yet by the previous works completely. Moreover, the already conducted works can be considered as bases for this new research to be conducted to check their compliance or variation with the new findings especially for those models of research which are included similar variables. As a result, this study has the objective of to estimate the economic efficiency of rural farmers and also identify the prompting factors that upsetting the existing level of efficiency. Moreover, the study was conducted on crop production, data taking from SNNPR Ethiopia, Gurage zone, Abeshigeworeda or district.

The main objective of the study is to examine the economic efficiency of crop production in SNNPRS, Gurage Zone: AbeshigeWoreda or district, with having the following specific objectives:

- I. To assess the level of technical, allocative and economic efficiency of rural farmer crop producers.
- II. To analyze the factor affecting technical and economic efficiency of crop production

This research is intended to address the main factors in the process of exported oriented crop production in Gurage zone, Abeshigeworeda or district. Through addressing those

limiting factors of production and also quantifying the levels of their impact on technical, allocative and economic efficiencies that provides the relevant inputs to concerned government organizations like agricultural and natural resource bureaus, national level policy makers and other non-governmental organizations who are engaged in agricultural production generally, crop production particularly.

II. LITERATURE REVIEWS

2.1 Theoretical reviews

Efficiency and agricultural production

The term efficiency in agricultural production system is a simple way of performance evaluation in the relationship between input conversions towards output. In traditional simple straight forward way of measuring efficiency of a farm could be the achievement of yield per hectare of land. But a given output is a function of multiple inputs in the reality, this is very simplistic way of measurement in that it only considers a single of production (Solomon: 2014). Therefore efficiency measurement in agricultural production is very important to optimize or to get the maximum level of output through using of alternative options or combination of inputs among the multiple ones that can influence the level of outputs. The scope of agricultural production can be expanded and sustained by farmers through efficient use of resources (ESSA 2011: Hailu 2005). For these reasons, efficiency has remained an important subject of empirical investigation particularly in the

developing economies where majority of the farmers are resource poor (ESSA, 2011: Umoh, 2006).

Efficiency measurement approaches

Basically there are two approaches in measurement of efficiency. These are input oriented and output oriented approaches. The former one deals with to answer the questions that by how much input of quantities can be proportionally reduced without changing the output quantity produced. This is an input oriented measure of efficiency. The later one deals with the question as by how much output could be expanded from a given level of inputs. However, both measures will coincide when the technology exhibits constant returns to scale, but are likely to vary otherwise (Coelli and Battese, 2005).

Input oriented measurement approaches

In his first work on efficiency, Farrell (1957) illustrated his idea about measuring efficiency with figure, as follow. The SS' is an isoquant, representing technically efficient combinations of inputs, X_1 and X_2 , used in producing output Q . SS' is also known as the best practice production frontier. AA' is an isocost line, which shows all combinations of inputs X_1 and X_2 to be used in such a way that the total cost of inputs is equal at all points. However, any firm intending to maximize profits has to produce at Q' , which is a point of tangency and representing the least cost combination of X_1 and X_2 in production of Q . At point Q' the producer is economically efficient.

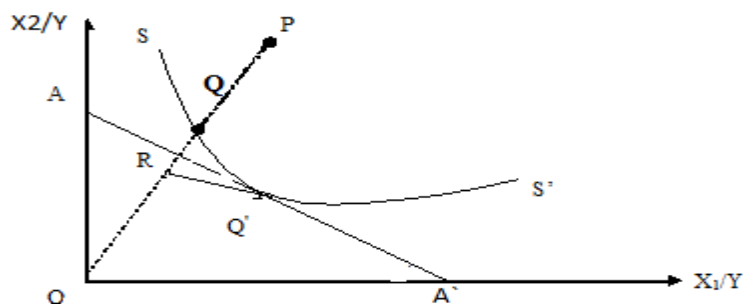


Fig.1: Input oriented measures of technical efficiency; Source: Coelli (1995).

Given figure 1, suppose a farmer is producing his output depicted by isoquant SS' with input combination level of (X_1 and X_2). Production at input combination at point P is not technically efficient because the level of inputs needed to produce the same quantity is Q on isoquant SS' . In other words, the farmer can produce at any point on SS' with fewer

inputs (X_1 and X_2), in this case at Q in an input-input space. The degree of TE of such a farm is measured as OQ/OP , which is proportional in all inputs that could theoretically be achieved without reducing the output. Hence all farmers that produce along the isoquant are 100 percent technically efficient (*ibid*).

ii. Output oriented measurement approaches

In the output oriented perspective, efficiency is evaluated keeping inputs constant. According to Farrell (1957), output oriented measures can be illustrated by considering the case where production involves two outputs (Y_1 and Y_2) and a single input (L). If the input quantity is held fixed at a particular level, the technology can be represented by a production possibility curve in two dimensions

2.2 Empirical Reviews

Efficiency estimation of crop production

Efficiency measurement is an important and it has a vital role to ensure agricultural production and productivity there by enhancing economic growth of a nation especially for those developing economies whose food energy and source of income majorly relied on agricultural production.

According to Tamirat *et al.* (2017) conducted a research on Determinants and Resource Use Efficiency of Haricot Bean Production in Halaba Special District, Southern Ethiopia through the application of estimation of production function, and allocative efficiency index (MVP/MFC). The result of this study revealed that haricot bean output was positively and significantly influenced by plot size, amount of fertilizer applied, labor input in man days, level of education of the household head, farming experience, frequency of extension contact and types of haricot bean seed used. Resource utilization was found inefficient for the crop in the study area. The result of allocative efficiency index indicated, fertilizer (0.4), pesticide (0.2), labor (0.5) and oxen power (0.0) were over utilized resources.

Essa (2011) determined the economic efficiency of smallholder crops production in the central high lands of Ethiopia. He used a two-limit Tobit regression model results revealed that while family size, farming experience, credit access, walking distance to the nearest main market, and total own land cultivated during the long rainy season affect technical inefficiency positively and significantly; age of household head was found to have a negative and significant influence on technical inefficiency. The results also showed that whereas economic inefficiency was positively and significantly affected by family size, farming experience and membership to associations; for household heads having a role in their community contributed negatively and significantly to economic inefficiency. Moreover the study results also showed that about 37 percent of the farmers in aggregate operate under decreasing returns to scale.

Solomon (2014) estimated and investigated those factors which are affecting technical efficiency of major crops in Ethiopia through using stochastic frontier model. According to this study, land and seed were major determinants of maize production in Ethiopia. Generally, all significant input variables were found to be affect output positively, as it was expected. Moreover, the model output depicted that the mean level of TE for major crops, *Teff*, Wheat and Maize production was found to be 63.56, 67.26, 84.16 and 91.41 percent, respectively. The inefficiency effect analysis shown that, age of the household head found to be the determinant of technical inefficiency, of *teff* production. Knowledge about land policy, participation in soil and water conservation activities and education was found to have negative and significant effect on major crops and wheat technical inefficiency (1% significance level). In this study frequency of extension contact, the wealth status of farmers, the fertility status of plots of wheat have affected technical efficiency significantly. Similarly the study investigated flat *teff* and maize plots are more efficient than otherwise. The other plot specific variable that was found to have negative and significant effect on technical inefficiency of major crop production was adoption of improved seed.

A study that had done by Enderias *et al.* (2013), on productivity and technical efficiency analysis of small holder maize producer in southern Ethiopia, used and applied data envelopment analysis model to determine the levels of technical efficiency and a Tobit regression model to identify factors influencing technical efficiency. Based on this study investigation, productivity of maize was significantly influenced by the use of labor, fertilizer, and oxen power. The study also indicated that the mean technical efficiency was found to be 40 percent indicating that there was substantial level of technical inefficiency of smallholder farmers in maize production. Important factors that significantly affected the technical efficiency were agro-ecology, oxen holding, farm size and use of high yielding maize varieties.

As it cited by Solomon (2014), Geta *et al.* (2013) undertook a study in SNNPR having the aim to assess the productivity and Technical efficiency of small holder farmers, from 325 randomly selected farmers from Woliyta and Gamgofa zones of SNNPR and hence found that as there was significant level of inefficiency among maize producing farmers. (They used a two stage estimation technique of TE followed by tobit regression model) to identify factors influencing TE. The result showed that production of maize was significant

influenced by the use of labor, fertilizer and oxen power. The mean TE was found to be 40% important factors that significantly affected the TE were agro ecology, oxen holding, farm size, and use of high yielding maize varieties. However, in this study some important farmer's characteristics like age and sex of the house hold heads were not considered in their analysis. The study also conducted on a single and frequently used by previous researches of maize crops. Moreover like majority of previous research works considered only then evaluation of technical efficiency part but not include economic efficiency measurements of the crop.

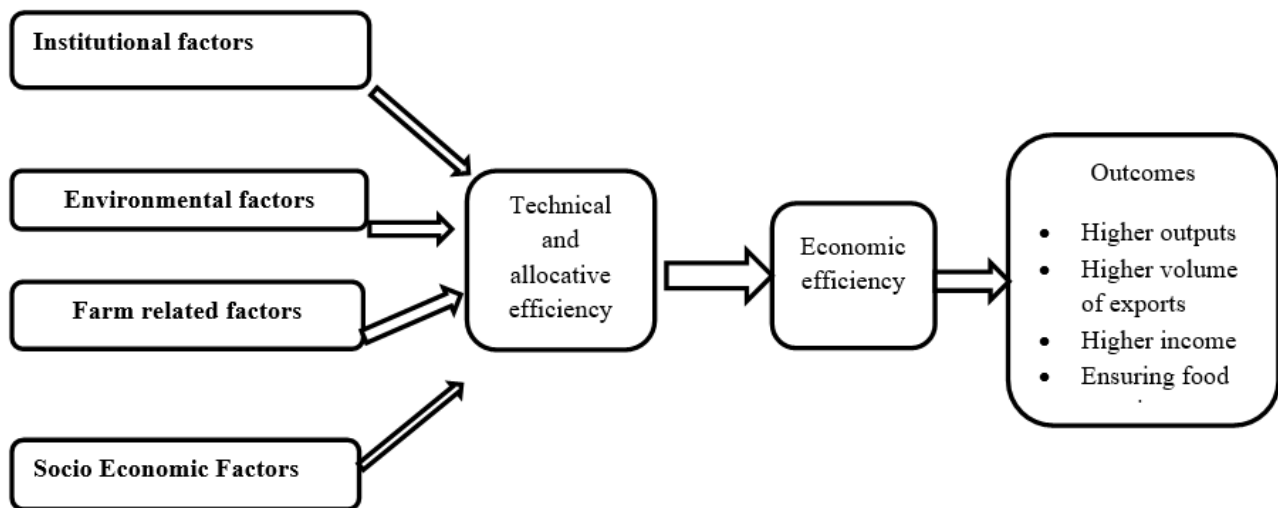
Generally all the previously conducted research findings indicated that as there are a potential to improve crop productivity or the existence of inefficiency of production at different agro ecology and other existed parameters, thus, it needs to provide a strong emphasis to incorporate those findings in policy and institutional frameworks and also making those influencing determinants of efficiency are favorable for agricultural production. These works can be also considered as a base for new researches to be conducted in the areas of efficiency measurement and use to check their compliance or variation with the new findings especially for those models of research which are included similar variables. On the other hand from the above reviewed samples of empirical findings of the previous works, it can be to understand that as there are a number of elements in the variable set that can determine the efficiency level of agricultural production. However, even they have not been exhausted yet by the previous works completely (Essa, 2011). Regarding to the empirical works which have been

conducted in Ethiopia depicted that as a number of efficiency based studies have been conducted at different parts of the country though it demands further investigation at different dimension and parameters because in Ethiopia and in other developing countries, agriculture is a dominant elements of their economy and also this agricultural products are sourced from small holder farmers that were produced in a fragmented lands.

ESSA (2011) explained also such kinds of studies are highly relevant to Ethiopia where resources are meager, opportunities for developing and adapting better technology are scarce and with high population pressure that demands equitable sufficient food source. More over to this, agricultural products are the major components of export goods of the country. The other point that should be raised is most of the conducted researches have concentrated on TE of farmers though it needs to asses integrated efficiency measurement applications that must include economic efficiency. As a result this study has the objective to estimate the economic efficiency of rural farmers and also identify the factors affecting the existing level of efficiency. Moreover, the study was conducted on crop production, data taking from Guragezone, Abeshigeworeda or district under SNNPR Ethiopia.

2.3. Conceptual frame work

Various levels of exogenous and endogenous factors can determine the level of efficiency in agricultural production process. These production influencing factors can be also categorized basically into socio economic, climatic, and institutional and farm related characteristics



Source: own conceptualization.

III. METHODOLOGY OF THE STUDY

3.1 Method of data collection and sources of data

3.1.1 Population and sampling techniques

The total population of this study comprises those farmers who produced crop by the year 2010/2011 spring (locally belg) cropping season at Abeshige districts in gurage zone of southern region. According to the woreda or district’s agricultural office information 125650 households were participated in crop production in 2010/2011 spring (locally Belg) season. Therefore the population size of the study was 125650 rural farm house holds from the woreda or district and the targeted interviewers were selected from the population by the application of stratified sampling techniques. Six potential crop producer’s kebeles or village had been selected randomly out of the identified producer kebeles or village with under consideration of production potential and the accessibility of rural farms. Randomly selected out of the six potential kebeles or villages as a result 399 representative household samples were selected

randomly out of the population of the woreda or district. The total sample size of the study was determined based up onDeVaus (2002) formula below here:

$$n = \frac{N}{1+N(a)^2}$$

Where: n = sample size, N= population universe and a= the level of precision

The formula adopted a confidence level of 95% and the margin of error is therefore 5% which is acceptable in social science research. The break down for each of the group is calculated as follows:

$$\text{Number of respondents: } n = \frac{125650}{1+125650(0.05)^2} \implies n = \frac{125650}{1 + 125650(0.0025)} = \frac{125650}{315.125} = 399$$

Based on the above procedure the selected kebeles or villages are presented in the next table1.

Table 3.1 Sample selected Kebeles or villages

S.n	Name of selected kebeles orvillages	Total rural farmers in the kebeles or villages	Sample rural frames
1	BidoTadale	825	66
2	Fitejaju	1050	85
3	borar	964	78
4	Boketaserite	585	47
5	Nachakulit	675	54
6	chisanagafersa	850	69
Total		4949	399

3.1.2 Analysis of data

The data analysis of this study was conducted by using both methods of analysis, namely descriptive statics and parametric (econometric) analysis.

3.2 Descriptive analysis

In this method of analysis the descriptive statically technique was applied in order to explain those institutional, socio economic and demographic characteristics of rural crop producers. By using this method of analysis the level of input uses in the production, and related out puts and the distribution of efficiency among rural farmers were presented by using percentages and by a central tendency measurement tools such as mean, frequency, standard deviations.

3.3 Econometric analysis

According to Farrel (1957) agricultural production efficiency measurement has three components. These are technical, allocative and economic efficiency components and out of these components, the two (technical and allocative) efficiencies can be computed from production function whereas the economic efficiency of a farm can be computed from the combination of technical and allocative efficiency results.

Technical efficiency of an agricultural production represents the ability of a farm to maximize output for a given set of resource inputs whereas allocative efficiency indicates the extent to which farmers make efficient decisions by using

inputs up to the level at which their marginal contribution to production value is equal to the factor cost (Nay, 2012). Among the components of the econometric models, the stochastic frontier production function together with the maximum likelihood measurement approaches are used to estimate the impacts of productive inputs on the outputs of crops production and also Tobit regression model was used to identify the level of economic inefficiencies that are emerged as a result of potential factors affecting in the production processes.

3.3.1 Cobb-Douglas Stochastic frontier production function

According to Battese and Coelli, (1992) The technique assumes that farmers may deviate from the frontier not only due to measurement errors, statically noises or any systematic influencing factors but also because of technical inefficiency. In addition the model allows the estimation of farmers as well as the determinants of technical efficiency simultaneously by the maximum likelihood method

There are two steps of procedures in order to applying this method of analysis. The first one is the impact of productive input use on the output value of crop producers which was determined through the application of the Cobb Douglas production function estimation and through using the ordinary least square method. The second step is the estimation of the TE level of crop producers within the study area through applying stochastic frontier production function (SFP) model. As a result Cob-Douglas production function that was fitted with the stochastic frontier models of crop production is as follows:-

$$Y_i = f(X_i, \beta) + \varepsilon_i \quad (3.1)$$

Where Y_i is the output of the j^{th} farm, X_i is a vector of inputs, β is a vector of unknown parameters, $\varepsilon_i = V_i - U_i$, V_i represents the random error term which is out of the capacity of rural farmers to control, U_i represents the technical inefficiency parts of farm production.

3.3.2 Empirical models

I. Technical Efficiency model specification

As the production of individual farm assumed to be characterized by Cobb-Douglas production function then the empirical normalized stochastic frontier production function can be specified as indicated below here.

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + e_i$$

Where

Y_j : crop outputs of j^{th} rural farm in (kg/ha), \ln : denotes the natural logarithm, β : Stands for the vector of unknown parameters to be estimated, X_{1i} : is a variable that denotes the amount fertilizer used by the rural farmer in (kg/ha), X_{2i} : labor (man per day/hectare), X_{3i} : seed amount used in (kg/hectare), j :- represents the j^{th} observation of the sample, i :- represents the i^{th} rural farmer within the sample and $e_i = V_i - U_i$ where V_i are two sided normally distributed random error

The definition of variables for Cob Douglas Production Function

The lists of variables which are included in the analysis of this study are production amount and seed, labor, fertilizer which are the inputs used for crop production.

Output(Y) is the total quantity of crop produced by each rural farmer household in 2010/2011 spring or (locally belg) cropping season. It is measured in kg per hectare.

Fertilizer(X_1) it includes NPSB fertilizers which was inorganic and bought and used by producers during spring or (locally belg) season of 2010/2011 production year and measured in kilograms).

Labor(X_2) considers all labor activities that applied for crop production. It is measured as adult man days per hectare and is the sum of family labor and daily laborer.

Seed(X_3) the amount of seed volume that was used by crop producers in 2010/2011 and measured in kilograms.

Allocative Efficiency model specification

As of the literature written by Chukwuji et al. (2006) indicated the allocative efficiency analysis of agricultural production can be performed by estimating a Cobb-Douglas function through using the ordinary least squares (OLS), followed by computing the value of marginal products (VMP) for each particular factor of production, then after compare it with the marginal input cost (MIC). Using the coefficient estimates from the analysis, the marginal product (MP) of the i^{th} factor X is calculated as

$$MP = \frac{\partial Y}{\partial X} = \beta \frac{Y}{X_i}$$

Where, Y is the geometrical mean of crop yield (mean of natural logarithm),

X_i is the geometrical mean of inputs, β_i is the OLS estimated coefficient of input.

The value of the marginal product of input (MP) can be obtained by multiplying marginal physical product by the price of output (P_y).

Thus, allocative efficiency (AE) = MP/P_i , where P_i = marginal cost of the i^{th} input. Since rural farmers are price takers in the input market, the marginal cost of input i approximates the price of the factor i , P_{xi} . As a result of the above computation we can conclude the following points. If $MP_i > P_{xi}$, the input is underused and farm profit can be improved by increasing the use of this input. Conversely, if $MP < P_{xi}$, the input is over used and to raise farm profits its use should be reduced. The point of allocative efficiency (maximum profit) is reached when $MP_i = P_{xi}$.

III. Economic efficiency model

The economic efficiency level of farmers can be obtained by multiplying its respective technical and allocative efficiency levels.

$$Eindx = \beta_0 + \beta_1 gen + \beta_2 age + \beta_3 edu + \beta_4 hfsz + \beta_5 cop + \beta_6 tpseed + \beta_7 frql + \beta_8 mdseed + \beta_9 rfsz + \beta_{10} lown + \varepsilon_i$$

Variable Description, measurement and Tobit regression mode

Efficiency indices (Eindx): - are the dependent variable which represents the technical, allocative and economic efficiency scores of an individual crop produced rural farmer or farm of Abeshigewpreda or district. The efficiency level of the rural farmers was obtained from the calculation of frontier production function. The description of independent variables expected to influence the dependent variable are listed below here and if the respective parameters signs of variable is positive it can be to conclude as it has a positive effect on production efficiency where as if it is negative implies that it has a negative impact on production efficiency.

Gender of household head (gen):- Gender is a binary variable where 1=male and 0=female, that is included to estimate the impact of gender on technical efficiency level of farmers. Female headed household would have better opportunity to carry out frequent follow up and supervisions of the rural farm activity on their plot.

The house hold head age (age):- Age is defined as the age of the respondent that measured by years and is also considered as the experience of the farmers in primary decision making in the farming operation or the number of years the farmers have being involved in crop farming. As different literatures have shown, negative coefficient is expected to inefficiency effect.

Household's family size (hfsz):- Household Size measures the number of people (adult men and women and children) who were living with the rural farmer during the 2010/2011

3.4 A Tobit regression Model specification

According to Hosmer et al. (2000) the two limit tobit regression model is binomial that refers to the instance in which the observed outcome can have only two possible types (e.g. "yes" vs. "no"). Regularly, the outcome is coded as "0" and "1" in binary Tobit regression as it leads to the most straight forward interpretation. The target group (referred to as a "case") is usually coded as "1" and the reference group (referred to as a "non-case") as "0". The Specification of a two limit tobit Regression Model for this study is constructed to show the relationship between inefficiency index with farm and farm head related attributes as follow:

spring (belg) cropping season. The expected sign for household size is positive.

Education (edu):- Education is a continuous variable measured by the number of years spent in school. Education as a human capital variable is a relevant factor in technology adoption. Educated farmers easily adopt improved farming technology and therefore should have higher efficiency scores than farmers with low level of education (Seyoumet al., 1998). Educated farmers are expected to acquire, analyze and evaluate information on different inputs, outputs and market opportunities much faster than illiterate farmers. The expected impact of education on efficiency is positive.

Cooperative membership of rural farmer (COP):-The effect of this variable is captured by the existence the farmer whether he is a member of a seed multiplication and a multipurpose cooperatives or not and it is a binary. If a farmer is a member of a cooperative, he will be the more efficient, thus, positive coefficient is expected.

Types of seed used (tpseed):-Improved Seed was a measure of the amount of crops seeds in kilograms (kg) used in 2010/2011 spring or (locally Belg) cropping season. This is a dummy variable and takes a value of 1 if a farmer uses improved seed and 0 otherwise. Improved seeds are associated with high productivity level and better capacity to resist diseases (Abay, 2007). Therefore, use of improved seed is expected to have positive effect on haricot bean output surplus.

Frequency of land plough for crop (frql):-The effect of this variable would be examined the land preparation of a

farmer measured by a number of land plough activities before sowing of seed. It is expected to have a positive influence on technical efficiency.

Method of crop seeding (mdseed):-It is binary variable having value of 1 if household applied a row planting, and 0, for broadcasting. The effect on the production of farmer being involved in a row planting is easier to carry out agronomic management practices and It gives more yield and hence positively complement farm activities.

Rural Farm land Size (rfsiz):- Farm size is the area of land in hectares of haricot bean cultivated. The variable was used to investigate its influence on output. During the survey, the data on size of land was collected in terms of hectare. Basically, land is the main factor of production and thus positive coefficient is expected.

Land ownership status of the rural farmer (lown):- This refers to the farm land ownership status of the house hold measured from 1 to 4 if the farm land is its own= 1, if the farm land is rental=2, if the farm land is share cropping =3, for any other type =4 . If the farm land is owned by the house

hold, farmer’s efficiency will be expected to increase. Thus, the sign of this variable is expected to be positive.

IV. RESULT AND DISCUSSION

Empirical results of the study

The main purpose of this study is to assess determines the level of crop output efficiency which was produced by abeshigeworeda or district and the related influencing factors of crops production. The production of individual farm was characterized by Cob-Douglas production function.

4.1 Results from Cobb Douglas production function

The concern of this production function model is mainly to determine the level of crops production yield which was attained by producers in the study area and also to identify the influencing factors in each output level. The variables that used in the production function were presented below here and it indicated the average yield of the survey was 1135.039 Kg/ha with the minimum amount of 333.33 Kg/ha and maximum amount of 2400 kg/ha.

Table 4.1 Summary of variables used in crops production function

Variable	Units	Means	Std. Dev	Min	Max
Yield	kg/ha	1135.04	437.50	333.3	2400
Seed	kg/ha	68.60	24.05	30	120
Fertilizer	kg/ha	58.02	51.17	0	200
Labor	Man day/ha	9.7	4.09	1.33	200

Source: Primary data (2010/2011 spring (locally belg) cropping season)

Based on the above statically variables, the maximum likelihood estimation (MLE) of the production parameter of crops producers of Abeshigeworeda or district in guraze zone are presented as follows.

Table 4.2 The MLE of the Cobb-Douglas stochastic frontier production Function

Variables (Output)	Parameter	MLE		
		Coefficient	Std. Error	Z-Statistics
Constant	β_0	5.120***	0.3920	13.06
Fertilizer	β_1	0.3061***	0.0604	5.07
Seed	β_2	0.1919**	0.0942	2.04
Labor	β_3	0.1141***	0.0548	2.08

Wald chi-square	48.24 (0.000)***
Model Variance	0.0994
Gamma	0.6076
Log Likelihood	-35.807997

Source:- survey data 2010/2011 spring (locally belg) cropping season

All the three coefficients have positively influenced crops production and also they were statically significant at 5% and 1% levels. This implies that as each of these variables is increased and the other factors affecting are remaining constant, the output of crops will be increased. The coefficient that representing the volume of fertilizers which was used by producers has a positive sign and revealed 1% level of significance relationship with production outputs. This implies that a percentage increment on the volume of fertilizers can increases the volume of crops output by 0.31 percent. This result is supported by the findings of Tewodros (2015).

The coefficient of seed was found to be positive and statistically significant at 5% level. The implication of this result is a percent change in the volume of seed used by the farmers can increased the yield of crops by 0.19 percent. In the contrary of this result, the study result conducted by Tamirat (2017) revealed that seed has negative and insignificant impacts on crops yields. The other variable coefficient is labor and it was estimated with a positive and significant at 5% level. This result showed that the output can be increased by 0.11 percent with a percentage increase in labor. The result is consistent with the findings of Tewodros (2015) and Tamirat (2017) which found the similar results that labor has positive and significant influences on crops yields.

Since results of the valid chi-square statics is 48.24 with p-value 0.000 and at 1% significant level, it can be to conclude that there is inefficiency in production of crops production with in the study area. The coefficient score of sigma is about 0.6076 this implies that the proportion of variation in the model is as a result of technical efficiency. As the score indicated about 60.8% of the variation in crops output was as a result of the differences in technical efficiency. In other words about 61 percent of the variation with in the error term was due to the inefficiency component. Based on this information it can be to conclude that about 39% of the variation was due to random shocks that cannot be controlled

by rural farmers. Therefore, if it can to minimize the gap of technical inefficiencies between producers there is the opportunity to maximize the crops out puts with in the study area.

4.2 Efficiency analysis

The technical, allocative and economic efficiency of crops farms were estimated to develop holistic analysis of then existing farm's performance with in the study area.

4.2.1 Technical Efficiency Analysis

The results of this study showed that technical efficiency of the farmers ranging from 19.95 percent to 95.17 percent with a mean value of 64.69 percent. The implication of this result is that the best performing producer attained at 95.17 percent efficiency while the least performing farmer achieved about 19.95% efficiency level.

4.2.2 Allocative Efficiency analysis

The allocative efficiency score of crops producer rural famers with in the study area is ranging from 15.52 to 97.69% with an average score of 57.47%. This result revealed that crops producing rural farmers have the room to increase their allocative efficiency level by 42.53% if production constraints are solved.

4.2.3 Economic Efficiency analysis

Table 4.3 below here indicated also the economic efficiency score of crops producing rural farmers of Abeshigeworeda or district in guraige zone. These efficiency scores has gotten from the combination effect of the technical and alloctive efficiency factors. As the result of the study revealed, the average economic efficiency of the farmers in the study area is about 35.94% whereas the scores ranging from the lower value 10.9% up to the maximum value of 81.29%. When we are comparing the EE against the TE of the study, it is clearly observable that the TE is higher than the EE. The important point to realize here is providing a great attention to maximize the EE of rural farmer crops producers in the study area.

Table 4.3 Frequency Distribution of Technical (TE), Allocative (AE) and Economic (EE) of crops producing rural farmers.

Efficiency scores (%)	Technical efficiency		Allocative efficiency		Economic efficiency	
	Freq.	%	Freq.	%	Freq.	%
<=20	1	1	1	1	16	16
21--40	10	10	26	26	50	50
41—60	34	34	30	30	24	24
61—80	29	29	22	22	9	9
81---100	26	26	21	21	1	1
Mean (%)	64.70		57.48		35.94	
Minimum (%)	19.95		15.52		10.9	
maximum	95.17		97.69		81.29	
Std. Dev.	19.55		21.99		16.13	

Source:- survey data 2010/2011 spring (locally belg) cropping season

Based on the frequency distribution indicated in the above table 4.3, the highest number of producers has the TE between 41% and 60% which is holding 34% of the rural farmers under the study. Regarding to AE the greater number of farmers achieved the AE between 41% and 60 which representing 30% of total respondents. Lastly, the EE scores of producers is higher with in the group between 21% and 40% achieved group which comprises 50% of the total producers.

Factor affecting efficiency in crops producer in the study area

Based on the estimated parameter resulted from Tobit regression model, the influencing factors impact on production and their respective signs were identified. The positive or negative signs indicated the effects of each explanatory variable on the scores of TE, AE and EE of production. Therefore those variables with a higher impact value should be given an attention in order to improve the existing efficiency level of crops production in Abeshigeworeda or district and results of the variables are presented below here.

Gender of the farmer showed that female crop producers have a negative relationship with TE but a positive relationship with AE and EE. Therefor based on the result, it can be to conclude being a male has higher TE has ability

reduced inefficiency but lower AE and EE. This study result is agreed with the findings bakery et al (2015).

Household family size the result coefficients of the TE for showed a negative and insignificant relationship. But the estimated coefficients for the allocative and economic efficiency groups for the variable showed a positive relationship with the independent variable and it was statistically significant at 5% level. This result is similar with the findings of Essa (2011) that economic inefficiency was positively and significantly affected by family size but showed variation on the results of TE.

As the estimated coefficients result for **education level** of the farm head indicated, it has a positive relationship with TE and EE but negative relationship with AE of a farmer. This finding showed a compliance with the findings Tamirat(2017) and Tewodros (2015). As education is a fundamentals tool for crop production and development there might be knowledge and skill ignorance by some farm house holds or the farm households missed the application of their knowledge and skills of production. This might be one of the reasons for the existence of poor resource allocation during the haricot bean crop production.

The estimated coefficient for **membership in cooperative** revealed a positive relationship with EE of the farmers. Farm heads that had joined cooperative institutions showed a

tendency of increasing efficiency against non-members in crop production. This happening is as a result of providing the cooperative institutions particularly different service like timely input supply, mechanization, credit, storage and technical training services to their individual members which might be the sources of motivation of the small scale crop producers in Abeshigeworeda or district. Similar result was found by Bakary and *et al.*(2014).

The estimated coefficient of **land size** is directly related with all the three categories of efficiencies at a significant level of 1%. As the size of land increases, motivation of the farmers in the study area also increased in turn enable to increase all the three efficiency categories. This has an agreement with the study's results conducted Bakary *et al.*(2014) who found land size have a positive and significant influence on outputs.

Though significant, all the three estimated coefficients of **land ownership status** indicated a negative relationship with all three efficiency categories and the AE and EE are significant at 1% level of significance. Regarding to this variable, there were different dummy variables which the above results were bases upon. The results were obtained by performing each dummy variable against the remaining counterparts. If we assigned 1 for owned land status, then all the remaining three dummy variables take 0 and the like. The above result interpretation is that land owned farm heads were less efficient technically, allocatively and economically when they compared to those farmers who didn't have their owned lands.

Table.15. The estimated TE, AE and EE results of Tobit regression model

variable	Technical Efficiency		Allocative Efficiency		Economic Efficiency	
	coefficient	Std, Error	coefficient	Std, Error	coefficient	Std, Error
constant	0.4556	0.1130	0.4889	0.1230	0.2320	0.0895
gender	-0.009	0.0336	0.0642	0.0366	0.0355	0.0266
age	0.0035	0.0022	-0.004	0.0024	-0.008	0.0017
Household size	-0.006	0.0073	0.0251	0.0080	0.0120	0.0058
Education level	0.0082	0.0046	-0.006	0.0049	0.0002	0.0036
Coop membership	0.0350	0.0382	0.1037	0.0416	0.0634	0.0302
Types of seed	0.1090	0.330	-0.154	0.0360	-0.028	0.0262
Freq of land ploug	0.0123	0.0240	0.0044	0.0259	0.0125	0.0188
Method of seeding	0.2331	0.0367	-0.054	0.0399	0.0999	0.0290
Land size	-0.279	0.0854	0.7408	0.0929	0.3284	0.0676
Land Ownership	-0.043	0.0625	-0.167	0.0680	-0.173	0.0495

Source: survey data 2010/2011 spring (locallybelg) cropping season

V. CONCLUSION AND RECOMMENDATION

The results of this study showed that technical efficiency of the farmers ranging from 19.95 percent to 95.17 percent with a mean value of 64.69 percent. The implication of this result is that the best performing producer attained at 95.17 percent efficiency while the least performing rural farmer achieved about 19.95% efficiency level. The allocative efficiency score of crop producer farmers with in the study area is ranging from 15.52 to 97.69% with an average score of 57.47%. This result revealed that crop producing farmers

have the room to increase their allocative efficiency level by 42.53% if production constraints are solved. As the result of the study revealed, the average economic efficiency of the farmers in the study area is about 35.94% whereas the scores ranging from the lower value 10.9% up to the maximum value of 81.29%. Regarding to the yield of crops per hectare of land is ranging from 3.33 q/ha and 24 q/ha with a mean yield amount is 11.35 q/ha.

From Tobit regression model, among the socio economics attributes of farmer and farms, particularly for method of

seeding and farmers applying line sowing are more efficient than those farmers who used broadcasting seeding method with high significant level under TE and EE. The farmers who are a member of cooperative institutions are highly efficient when they compared to non-members with the significant level under all the three efficiency categories. Respondent farmers who have the experience for a well land preparation showed higher positive relationship for the entire three efficiency category. Farmers who plough their land more than three times before sowing were more efficient when compared to those farmers who plough less than 3 times. Based on the above obtained the three categorical mean efficiency level of crop producing farmers with in the study area, the farmers were not operating at maximum level of production.

Based on the above findings of the study the proposed recommendations are provided below here.

- As the results of the study indicated, among the basic production inputs the application of fertilizer and improved seed have shown a positive impact on efficiency though the farmers used under the recommended dose. Therefore the zonal and woreda level agricultural bureaus should promote strongly to change the existing under dose application and also the rejection of inputs completely. Not only can the recommended rate of inputs increase the output of the crop but also increasing the number of technology adopting farmers.
- Since membership in cooperative institution particularly in seed production and marketing cooperatives has shown a positive impact on crops production efficiency, therefore the formation of similar institution and also bringing nonmember farmers to membership is must be a strategy to enabling farmers to use a modern agricultural production services like timely and a better quality input access, input and output marketing, credit services, mechanization and storage facility services etc.
- The other findings of this study was increasing the frequency of land plough is positively affected production efficiency. Therefore agricultural, development agents should promoting a better land preparation by farmers through increasing the number of plough 3 and more than 3 times hence it can helps greatly the efforts to increase the productivity of the crop. Promoting line sowing is also crucial against broad casting methods to increase the yield of the crop.

The above listed points are the major recommendations which drawn from the finding of the study.

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Cultura Organizacional Nas Auditorias Internas: Administrando A Mudança Cultural Em Busca Da Excelência Em Seus Serviços

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Resumo— *O gerenciamento da mudança cultural é necessário a partir do momento em que inovar é imprescindível para manter uma organização em um determinado cenário. Esse processo de mudança pode vir por meio da criação de um plano estratégico de longo prazo. Em seguida, uma internalização dos objetivos e metas definidos no plano a fim de que todos os colaboradores tenham conhecimento da situação atual e da situação prevista, aquela que se deseja. A nosso ver, uma mudança cultural partindo desse ponto é bem mais aceita do que aquela em que se deseja implantar repentinamente, o engajamento de toda a organização é bem maior. No entanto, existem algumas particularidades quando o assunto é administração da mudança cultural e gestão de pessoas na Administração Pública, pois o gestor está adstrito ao que determina a Carta Magna de 1988, em seu artigo 37. É salutar, no entanto, que as Normas Brasileiras de Contabilidade (Auditorias Internas Privadas) bem como os Manuais da Controladoria Geral da União (Auditoria Internas Governamentais) preconizam que a Auditoria Interna deve estar ligada à alta administração (de preferência ao Conselho de Administração, se houver) para que tenha a autonomia necessária na realização dos seus trabalhos. Nesse ponto, evidencia-se que, em que pese a legislação (no âmbito das Auditorias Governamentais) ser um limite para uma administração da mudança organizacional pública, este setor ainda possui uma maior autonomia para isso dado seu posicionamento hierárquico.*

Palavras-chave— *Cultura. Auditoria. Organização. Mudança. Qualidade.*

Resumen— *La gestión del cambio cultural es necesaria desde el momento en que la innovación es fundamental para mantener una organización en un escenario determinado. Este proceso de cambio puede producirse mediante la creación de un plan estratégico a largo plazo. Luego, una internalización de los objetivos y metas definidos en el plan para que todos los empleados estén al tanto de la situación actual y de la situación prevista, la que se desea. En nuestra opinión, un cambio cultural a partir de este punto es mucho más aceptado que uno en el que se quiere implementar de repente, el compromiso de toda la organización es mucho mayor. Sin embargo, existen algunas particularidades a la hora de gestionar el cambio cultural y la gestión de las personas en la Administración Pública, ya que el directivo está obligado por lo que determina la Constitución de 1988, en su artículo 37. Es sano, sin embargo, que las Normas Las Sociedades Contables Brasileñas (Auditorías Internas Privadas) así como los Manuales de la Contraloría General de la Federación (Auditorías Internas Gubernamentales) recomiendan que la Auditoría Interna debe estar vinculada a la alta gerencia (preferiblemente a la Junta Directiva, si la hubiera) para que tenga la autonomía necesaria. en la realización de su trabajo. En este punto, es evidente que, a pesar de que la legislación (en el ámbito de las Auditorías Gubernamentales) es un límite para una administración de cambio organizativo público, este sector aún tiene mayor autonomía para ello dado su posicionamiento jerárquico.*

Palabras clave— *Cultura. Auditoría. Organización. Cambio. Calidad.*

Organizational Culture in internal Audits: Managing Cultural Change in Search of Excellence in its Services

Abstract— The management of cultural change is necessary from the moment that innovation is essential to maintain an organization in a given scenario. This change process can come through the creation of a long-term strategic plan. Then, an internalization of the objectives and goals defined in the plan so that all employees are aware of the current situation and the predicted situation, the one that is desired. In our view, a cultural change from this point is much more accepted than one in which you want to implement suddenly, the engagement of the entire organization is much greater. However, there are some particularities when it comes to managing cultural change and managing people in Public Administration, as the manager is bound by what the 1988 Constitution determines in its article 37. It is healthy, however, that the Norms Brazilian Accounting Companies (Private Internal Audits) as well as the Manuals of the Federal Comptroller General (Government Internal Audits) recommend that Internal Audit must be linked to senior management (preferably to the Board of Directors, if any) so that it has the necessary autonomy in carrying out their work. At this point, it is evident that, despite the legislation (within the scope of Government Audits) being a limit for an administration of public organizational change, this sector still has greater autonomy for this given its hierarchical positioning.

Keywords— Culture. Audit. Organization. Change. Quality.

I. INTRODUCTION - ORGANIZATIONAL CULTURE AND SPIRITUALITY

Contrary to what we imagined in the first contact with the term, we are not talking here about God or a Theology within Organizations.

Spirituality in the work environment "only recognizes that people have an interior life, which nourishes and is nourished by meaningful work carried out in the context of a community" "is the search for meaning in work".

Why spirituality now?

In fact, in other times, organizations believed that it was necessary to eliminate emotions within their environments and spirituality is just the opposite, as it recognizes and even encourages the expression of the "inner life" that each one has.

- Characteristics of a Spiritual organization.
- ❖ This theme reinforces words that have been widely discussed in the academic environment, such as values, ethics, motivation and balance between professional and personal life.
- ❖ Although studies on spirituality in organizations are beginning, the main characteristics of this aspect are:
- ❖ Strong sense of purpose: it has purposes greater than the profits themselves; they give value to complete

customer satisfaction, for example, social responsibility, among others.

- ❖ Focus on individual development: recognize the value of the human being; seek to create cultures that stimulate learning and continuous growth.
- ❖ Trust and transparency: they are characterized by mutual trust, transparency and honesty. Administrators are instructed to admit their mistakes and to be honest with suppliers, customers and employees.
- ❖ Strengthening the worker: employees are believed to be able to make informed and sensible decisions and they are encouraged to make decisions by strengthening the worker and the teams.
- ❖ Tolerance of employee manifestations: allows and even encourages employees to express their moods and feelings.
 - Criticism of the spirituality movement.

Critics highlight two points: legitimacy - could organizations impose spiritual values? - And the reconciliation between spirituality and profitability.

Studies in organizations that have adopted this culture show that trying to make sense of work contributes a lot to the goals of organizations.

As for spirituality combined with profitability, it is clear that it is very possible for the two words to go together.

Although we recognize the importance of the topic, a point that we believe to be debatable would be absolute sincerity in all sectors of the organization.

We agree with the proposal and that its insertion in the organizational culture of companies would be extremely important, but because we are talking about large and small organizations and, mainly, people, we do not believe it is possible to measure such a possibility.

II. MANAGEMENT AND QUALITY IMPROVEMENT PROGRAM IN GOVERNMENT INTERNAL AUDITS.

When dealing with the subject of quality management and improvement, one should take as a basic theoretical reference what predicts Normative Instruction No. 03, of the Ministry of Transparency, Inspection and Comptroller General of the Union, of June 9, 2017, which Approves the Technical Reference for the Government Internal Audit Activity of the Federal Executive Branch in conjunction with the Manual of Technical Guidelines for the Government Internal. Audit Activity of the Federal Executive Branch of the Ministry of Transparency and the Comptroller General of the Union.

The duty to institute and maintain the Quality Management and Improvement Program - PGMQ, by the Government Internal Audit Units - UAIG, arises with the need to promote a synergistic culture between the audited Units and the auditors, aiming at the delivery of products with high added value, and the entire Internal Audit unit is responsible for observing good practices, laws and manuals in force.

According to the dictates of Normative Instruction No. 03, of the Ministry of Transparency, Inspection and Controllershship-General of the Union, of June 9, 2017, when dealing with internal and external evaluation, there is in its Section III - Management and Improvement of Quality:

107. The program should provide for internal and external evaluations, aimed at assessing quality and identifying opportunities for improvement.

108. Internal assessments should include continuous monitoring of the performance of the internal audit activity and periodic self-assessments or assessments carried out by others in the organization with sufficient knowledge of government internal audit practices.

109. External evaluations should take place at least once every five years, and be conducted by a qualified and independent evaluator,

evaluation team or other UAIG, external to the UAIG structure. The assessments provided for in this item can be performed through self-assessment, if it is submitted to independent external validation. In all cases, reciprocal evaluations are prohibited.

In addition to the periodic evaluations, whether internal or external, the person responsible for the UAIG is responsible for reporting the institution's governance, whether made to the Council or the top Director, a situation that highlights the need for joint action by the UAIG and the administration. In a complementary way, it can be inferred that the results of the evaluations, both positive and negative, should be formally communicated to whom the UAIG is linked. Regarding the declaration of conformity and non-conformity with the Technical Reference, it is expressed in Normative Instruction No. 03, of the Ministry of Transparency, Inspection and Comptroller General of the Union, of June 9, 2017:

113. UAIG can only declare compliance with the precepts of this Technical Reference and with international standards that regulate the professional practice of internal auditors if the PGMQ supports this statement.

114. Cases of non-compliance with this Technical Reference that impact the general scope or operation of the internal audit activity must be communicated by the UAIG Officer to senior management, the board, if any, and the respective unit responsible for technical supervision, to establish actions aimed at remedying reported non-conformities.

In order to complement the understanding on the subject of Quality Management and Improvement, in December 2017, the Ministry of Transparency and Controllershship-General of the Union published the Manual of Technical Guidelines for the Government Internal Audit Activity of the Federal Executive Branch . Considering the peculiarities of each of the UAIGs of the Federal Government, the aforementioned Manual seeks to standardize the procedures and methods for making the PGMQ.

It is observed in the Manual of Technical Guidelines for the Governmental Internal Audit Activity of the Federal Executive Branch, when dealing with evaluations, whether external or internal, that:

The assessments should include all phases of the government's internal audit activity, namely, the planning, work execution, reporting and monitoring processes, and also:

- a) the scope of the purpose of the internal audit activity;
- b) the conformity of the works with the provisions of IN SFC n° 3, of 2017, with other regulations that define attributions for the internal audit activity, with the applicable national and international good practices and with the operating manuals or procedures established by UAIG itself ;
- c) the ethical and professional conduct of the auditors.

One of the fundamental pillars of the PGMQ is continuous monitoring, which the Manual of Technical Guidelines for the Government Internal Audit Activity of the Federal Executive Branch defines as:

3.5.1.1.1 Continuous monitoring. It constitutes a set of activities of a permanent nature, operationalized through processes, standardized professional practices, tools, perception research and management indicators. It aims to monitor the development of UAIG's activities to ensure compliance with applicable professional and conduct standards and the efficiency of processes.

The culture of synergy between UAIG and the institution's management is made clear in the Manual when establishing interactions between auditor and auditee, evidencing research methodology of broad perception and specific assessment research, as transcribed in the definition put forward by the Technical Guidance Manual of Government Internal Audit Activity of the Federal Executive Branch:

The feedback from managers and stakeholders should preferably be obtained through surveys or structured interviews in order to collect their perception regarding the relevance, quality and benefit of UAIG's activity, in the following modalities:

- a) Broad perception survey: carried out with the organization top management and interested parties, preferably annually, aimed at gathering information on the general perception of UAIG's performance and the added value promoted by the government's internal audit activity;
- b) Punctual assessment research: carried out with the managers of the audited areas, after the completion of the audit work and the disclosure of the corresponding result, with a focus on assessing the quality of the audit process, the

report (or other form of communication) produced and the professional conduct of the auditors.

Regarding the establishment of criteria and assessment instruments for the PGMQ, it is important to highlight in particular: scripts, questionnaires, checklists and indicators. The evaluations carried out by the Auditors may be made using the universe or sample of the actions carried out during the year as a parameter. After the evaluations have been made, the person responsible for the UAIG should report to senior management, either to the top manager or to the board, where applicable. The objective of the evaluation and reporting cycle is a structured process of continuous improvement, where managers and the person in charge of UAIG will be able to direct resources to areas with greater weaknesses or deficiencies.

Regarding the communication of the results of the evaluations, the Manual of Technical Guidelines for the Government Internal Audit Activity of the Federal Executive Branch, clarifies this need and defines the elements that must contemplate the interaction process between UAIG and the administration:

This communication aims to promote and reinforce the sponsorship of senior management and the board in relation to the internal audit activity. Communications should include:

- a) the scope, frequency and results of the internal and external evaluations carried out;
- b) the level of compliance of the UAIG, according to the scale adopted;
- c) the opportunities for improvement identified;
- d) the weaknesses found that could compromise the quality of the internal audit activity;
- e) corrective action plans, if applicable;
- f) the progress of actions to improve the internal audit activity;
- g) the qualification and independence of the advisory or evaluation team, when applicable.

III. ETHICS FROM THE VIEW OF INTERNAL AUDITS

In the context of this thematic, it is up to the internal audit to break paradigms with regard to the organizational culture of companies, and in the public service, given the need to improve tools capable of turning auditors into vectors of

behavioral change. In this pitch, the professionals who work in the control need to be committed to the zeal, honesty, technical capacity, and other quality that can always guarantee the auditor's professional independence. In this sense, we present important highlights of the Code of Ethics of the National Supply Company (CONAB) public company, linked to the Ministry of Agriculture, Livestock and Supply (Map), below:

"1. The internal auditor must guide a conduct within the principles explained below, in the development of the activities that are affected.

1.1 Professional independence: The auditor must concentrate his professional activities in the exercise of the audit, including in it, the functions that, by definition of his own activity and the regulatory powers of the area, refraining from practicing or participating, in any way, in other activities incompatible with its fundamental postulates.

1.2 Independence of attitudes and decisions: Notwithstanding the employment relationship maintained with the organization in which it provides services, the auditor must obey the principles of ethics and observe the technical norms and the audit standards, as a standard of professional conduct.

In the performance of his auditing activities, he will always act with absolute independence and, under any obligation and under no circumstances, at his own or third parties' convenience, will condition his acts, attitudes, decisions or pronouncements to precepts other than the postulates of his profession .

The auditor cannot, directly or indirectly, receive earnings or rewards of any kind, from persons appointed and / or involved in his work, except for his prices and other official advantages granted by the employer.

1.3 Non-transferability of functions: The qualification of auditor is individual and non-transferable, not extending to any subordinates or assistants. In the exercise of his professional activity, the auditor will act on his own behalf, assuming full technical responsibility for the audit services provided by him and, under no circumstances, will he allow another person to do it on his behalf, unless he indicates his official appointment, when then respond to them jointly for their respective acts.

1.4 Technical efficiency: In view of the scope established for the audit service, the auditor must, before an adequate examination, judge the technical feasibility of its execution, in terms of terms, the availability of accounting and support elements and the extent and complexity of audit checks, ensuring that your work meets the conditions for satisfactory technical performance. The auditor's plan should be guided by the scope, extent and limitations of his work, in order to avoid doubts or controversies.

The auditor will not issue reports or provide information that does not result from an adequate technical and documentary examination, in accordance with the prescribed audit rules and procedures, observing:

the examination was carried out by him or under his supervision.

that the report is written in an objective manner and in such a way as to clearly express its opinion;

that, in case of lack of data or evidence, or even a situation that inhibits a safe decision, make the reservations in your report. "

Therefore, for internal auditing to survive cultural and organizational change in a globalized and competitive world, it is necessary to be implementing within the Organizations, whether they are state proven, the Audit Code of Ethics. In addition to the permanent need for professional training and diversified knowledge, such as such as: accounting, information technology, strategic planning, human relations, and legislation, among others. However, despite all the legal frameworks for professionals working in the control area, it is healthy not to distance yourself from the behavioral norms expected from auditors, especially in times of social networks, as the profession of auditor is also based on trust and commitment with governance.

IV. CONCLUSION

The strength and culture of an organization has a strong influence on the ethical behavior of its members. An organizational culture most likely to achieve a high ethical standard is one that administrators support for their employees to take risks and be innovative, even if restricted to the dictates of the Law and the Statute of Public Servants. Carefully evaluating not only the results of the objectives achieved, as well as the way in which they are planned and

executed, paying attention not only to what objectives were achieved, but also in their manner, thus causing the behavior of the workforce to be strong and positive.

For managers to be able to create a more ethical organizational culture, it is necessary to combine some practices in order to develop the following aspects, for example, the behavior of high-ranking employees. Employees model them, so they must be positive examples within the organization. An organizational code of ethics can be established with rules established so that all employees respect them. To disseminate this code, among other things, ethical training can be offered to members, through workshops etc. Within this context, it is up to the manager to be consistent with regard to his conduct before the organization, rewarding those who have always been publicly ethical, as well as those who violate the code must be punished in an exemplary manner. It is worth safeguarding the employee's safety within the code, so that he is not afraid of reprisals when reporting to discuss violations of the code itself by other members, so that he has the discretion to discuss a certain issue transparently and without fear of reprisals. .

In spite of this work advocating the management of change in the scope of Internal Audits in search of excellence in the provision of its services (both in the public and private sectors), the aspect of objectivity in the auditor's work is also brought up for discussion. internal. In this regard, the Manual of Technical Guidelines for the Internal Government Audit Activity of the Federal Executive Branch highlights as a situation that threatens objectivity:

Cultural, ethnic or gender bias: if internal government auditors are prejudiced against practices or customs different from their own, a particular ethnic group or a specific gender, their objectivity may be compromised when auditing an audit object managed or composed of servers / employees that fit these conditions. In this case, the auditors may unduly assume excessively critical attitudes, not consistent with reality.

In the challenges, therefore, future analyzes are proposed on how to align the cultural change of the Internal Audits in a way that does not compromise the objectivity of the Auditor's work.

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Mechanical and Bio-Chemical Characteristics of Cashew (*Anacardium Occidentale L.*) Nut Sizes

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Abstract— Dried cashew nuts at 8.2% moisture content from the store of Cocoa Research Institute of Nigeria, Ibadan were used for this study. The cashew nuts were categorized into sizes following reported standard and processed according to the recommended procedures. Kernels obtained were also similarly processed. Mechanical related and biochemical characteristics of the nuts and kernels were investigated. True density of the nut sizes showed wide range average values which were statistically not significantly different ($P \leq 0.05$). Co-efficient of friction among nut sizes was significantly different with average values that were marginally different. Shelling or whole kernel recovery after shelling and percentage white whole kernel after peeling indicated wide range difference according to nut sizes. Peelability decreased from 0.93 to 0.14 Kg/hr from extra large to madras nut sizes. Almost all the biochemical characteristics were marginally different. The oil content of the kernels was 45.5- 48.5% (w/w) which were 2.2:1 – 2.1:1 kernel to oil ratio. Cashew Nut Shell Liquid (CNSL) content ranged from 39 -49.7% (w/w). Differences in kernel and testa contents were also marginal ranging from 29.4 to 36.2% and 7.3 to 13.2% respectively. Similarity and differences in the characteristics of cashew nut sizes as revealed can be a good tool for decision-making by engineers, producers and processors for general development in cashew business.

Keywords— Cashew, characteristics, bio-chemical, mechanical, nut sizes, variability.

I. INTRODUCTION

1.1 Importance of cashew

Cashew is an economic crop and a major source of income and employment for many nations. Cashew is currently popular for consumption in forms of apples and kernels. It is also medicinal because of its high Vitamin C content and other related constituents. Recent development in technology has led to production of cashew milk from the kernel and meat from the apple through value addition. Cashew kernel and nut contain oil and Nut Shell Liquid (CNSL) by [1] and [2] respectively in reasonable amount comparable to other crop of importance. The kernel oil which stands out among other oil seeds because of its high crude fat content [3], has great use in coking and pharmaceuticals [1]. CNSL is a natural resin, hosted in the structure of the shell, containing 90% anacardic acid and 10% cardol [4]. The shell oil (CNSL) is used in brake linings due to its efficient heat absorption. CNSL is also useful in paint production for enamels and lacquers as further reported. Nuts are very important in diets of many civilizations and cultures since long because of their high energy and nutritional values, huge flavour varieties and distinct taste with chemical constituents and bioactive

substances of vital health benefits [5]. The most important economic part of cashew nut is the white or creamy coloured edible kernel. Consumption of cashew kernel is held in high esteem in various customs as its nut ranked third among tree nuts in world production. Cashew kernel is first among the world nut snacks because of its nutritional advantages: it has high amount of protein, soluble sugar and rich in polyunsaturated fatty acid that lowers blood cholesterol [6]. Globally, the kernel which is highly priced food delicacy due to its pleasant taste and flavour is often eaten roasted with either light addition of salt or sugar or coated with chocolate [5]. It was added that many beneficial effects on health conditions: hypertension, coronary heart diseases and diabetes were linked to high unsaturated fatty acids content of the kernels according to research findings.

1.2 Cashew Nut Production in Nigeria

Nigeria was second among the top ten cashew producing countries in the World [3]. Nigeria ranked 2nd in the World cashew nut production and top in Africa with 0.95 million tonnes export in 2013 according to [5] and [6], but Cote d'Ivoire became the top African producer in 2014 with 109,583MT nuts [5]. This is a signal to dwindling

production which may call for improvement in production, processing and utilization. Cashew thrives well in nearly all the agro-ecologies of Nigeria from North to South as it flourishes at Lat. 6° 21' North in West Africa with yearly average rainfall of 1,331mm and about 88% RH [7]. Expanse land area of Nigeria has been reported suitable for commercial cashew production as this can be done in 27 out of 36 States. But the country's production potential has been adversely affected by poor capacity building and lack of relevant machines to carry out some tedious operations, including processing, among others. Lack of relevant machines has led to high field losses and drudgery. Sales of nuts have also been poor owing to low nut quality [6]. The cashew nut is the source of the delectable kernels and serves as seed which generally differ in their sizes, shape, colour and other morphometric characters; metric measurement which are important in characterization and evaluation [8]. Cashew varieties cultivated in Nigeria are of variable nut sizes which were introduced at different periods between 16th century and 1982 by Portuguese explorers. Most of this introduction has grown in the wild very old plantations, usually referred as 'local variety' while the most recent introduction from Brazil is termed 'exotic'. Oro Cashew collection which currently serves a lot of Nigerian farmers and processing companies were grown from local and Brazilian varieties [6]. Cashew nut weight corresponded with the nut categories while cashew tree is an out-crosser, producing variable nut sizes due to segregation as further stated. Moreover, most cashew farms in Nigeria are grown from seeds rather than grafted productive varieties, thus exhibiting much variation in all traits including nut yield and size. Differential cashew nut sizes, shapes, shell thickness and proportion of kernel within the raw nuts are dependent on many factors such as genetics, edaphic and the climate.

1.3 Cashew nut processing procedures

Nut size and quality of kernel are determinants of acceptability and pricing; such that larger nuts and kernel command higher prices. Criteria for the assessment of the quality and price of the raw cashew nuts may involve physical appearance of nuts and kernels. Nut appearance include colour, shape and brightness while important kernel quality are the nut count (nuts/Kg), the defective nuts rate, moisture and Kernel Output Ratio (KOR) as reported by African [9] and [10]. The smaller the nut count, the bigger are the nuts and it ranges from 150 to 240 nuts/Kg. KOR fluctuates between 40 and 50 pounds per 80kg nuts while the moisture content of the raw nuts should be 7 - 10% w.b. The kernel colour and the quantity of kernel making up a pound (454g) provide the grade ratings in the world cashew market [6]. The highest and

the least grade range of kernel is W160-180 and W450 whole, white kernel count in one pound respectively. Jumbo nut is believed to possess the highest kernel grade of W180 (266-395 kernels/Kg). However, very large nuts usually have inferior kernel with low density and poor germination as further reported. Kernels are separated into good (100% accepted), spotted/premature (50% accepted) and mouldy/stunted (100% rejected) during processing according to [10], and [11]. Increased profitability will be greatly enhanced by the establishment of plantations with clones of high quality and productivity potentials, such as cashew with larger nut and high kernel proportion [6]. Cashew production and processing in Nigeria, therefore, requires a boost for better income generation. Specifically, increased production of quality cashew nuts and their products will assist the current economic diversification and poverty alleviation policy of government.

The primary processing of raw cashew nuts includes drying to storable moisture content and removal of the outer hard shell (Shelling) and inner thin silver testa (Peeling). This stage is followed by roasting/frying, milling/grinding depending on the tradition and product to be obtained. The nuts are boiled or steamed for about 30 minutes or roasted in oil, then air-cooled while kernels are oven-dried, occasionally humidified, and air-dried to make shelling and peeling comfortable [3], [9] and [11]. Kernels were dried at 70 – 80°C for about 6 – 8 hrs in a cross-flow drier [12] or at 50 - 70°C for 4 hrs in a mud oven [5] to make peeling easier and effective. The time required to peel is normally used as an indicator to determine the ease of removing testa (peelability) according to [12]. Most of these operations are currently performed manually in Nigeria resulting in poor quality products [9] and [11]. Cashew nuts have been grouped into six size categories of Madras, Small, Medium, Large, Extra Large and Jumbo based on weight of individual nut [9], [11] and [13]. Morphological and structural characteristics of seeds are important component in the determination of yield, protein, and seed oil content [6]. Moreover, physical properties of the seed are important in the determination of their shape which is required for the development of equipment for post-harvest operations and industrial processing [8].

1.4 Relevance of this study

Mechanical properties of agricultural products play a crucial role in predicting design parameters of machine components. Coefficient of friction, true density and axial dimensions are important for designing machine components such as hopper, fan and sieve/concave designs. Although drying impart positively on the taste of kernels, increased brittleness results in high percentage of

broken kernels during subsequent processing stages, including peeling, due to reduction in compressive strength of the kernels. Low whole kernel yield of less than 50% and 25 – 40% was reported for mechanical peelers by [12] and [3] respectively. Machines are usually evaluated on such parameters as efficiencies, grain damage/breakage and seed losses. Grain breakage is dangerous for grain storage because of possible microbial infestation. Uniformity is also very crucial in processing activities such as drying, separation and roasting for good results. Uniform products also attract high premium in the market as merchants/industrialists highly desire products of high uniformity. This is why most processing operations involve activities such as separating, sorting, grading using sizes, colour and density among others. Commercial processing operations for export require machines with precision as there is a global standard for acceptability of kernels in term of grades (white wholes, white pieces and scorched) reported [11].

Understanding relevant properties of cashew nut and kernel, and relationship between the nut and kernel could provide a significant insight into economic and mechanical valuation of cashew nut as the kernel is currently the most economic part of cashew in Nigeria. [6] investigated the diversity in the quantitative and phenotypic traits of six cashew nut sizes in commercial cultivation in Nigeria. Crackability and chemical composition of three cashew nut sizes (small, medium and large) was studied by [3], using major axis dimensions, of nuts from a farmer's plantation in Iwo, Southwest of Nigeria. [14] studied some physical and mechanical properties of cashew nuts and kernels grown in Ghana. Effect of moisture on engineering properties of cashew nuts of Ivory Coast was investigated by [4]. The study of some engineering and biological properties of nut categories which is relatively scarce is necessary, particularly nuts from Cocoa Research Institute of Nigeria, the only institution which has research mandate of the crop in Nigeria, considering the out-crossing nature of cashew tree. This study investigated the similarity and variability in mechanical and bio-chemical properties of some cashew nut categories to determine possible areas of comparative advantage. This information will be useful for effective machine and technology development by assisting both the producers and processors in selection of nuts with the best comparative advantage for improved production and utilization.

II. MATERIALS AND METHODS

Dried cashew nuts were obtained from the store of Cocoa Research Institute of Nigeria (CRIN) which has

plantations with various sizes of cashew nuts. These plantations were grown from materials collected from the germplasm of this Institute. Some quantity of the nuts was drawn, foreign materials were removed and bad nuts were sorted out based on physical appearance. The nuts at 8.2% wet basis (w.b) moisture content were categorized into 5 sizes Madras, Small, Medium, Large and Extra-large as described in Table 1 by measuring the weight of individual nut, using a digital weighing balance of 0.01g accuracy (KERRO BL5002 electronic digital scale).

Table 1: Categorization of raw Cashew Nut sizes

Categories	Sizes (g)
Jumbo	≥ 16
Extra large	$>12 < 16$
Large	$>8 \leq 12$
Medium	$\geq 6 \leq 8$
Small	$>2 < 6$
Madras	≤ 2

Source: Adeyemi, 2017 and Ogunwolu *et al.*, 2019

The co-efficient of friction and true density of individual nut selected randomly were determined using inclined plane and water displacement respectively as reported in previous studies such as [4], [12] and [15]. Each of the measurements was replicated 10 times and the means were used as the representative result. Data obtained were used as in the following expressions (1) and (2):

$$\rho = M/V \quad (1)$$

ρ , M and V are true density of the nut, mass of sample and volume of water displaced or true volume of sample respectively.

$$\mu = \tan \alpha \quad (2)$$

μ and α are co-efficient of friction and angle of tilt of the inclined plane respectively.

Standard methods for cashew nut processing described by [5], [9] and [11] were followed prior to shelling, peeling and oil and CNSL extraction. All categories of nuts under investigation were steamed over hot water at 75°C for 20 minutes at once to avoid biasness. Nut samples were then air-cured under room temperature so as to warm up to this condition. Shelling was done with a locally fabricated manual cutting knife. The kernels obtained were oven-dried for 5 hours at 70°C which was within the range reported by [5] and [12]. Kernels were later refrigerated briefly for sudden cooling to make

peeling easier. Humidification of kernels for shrinkage of testa and easy peeling had been reported [11]. The kernels were re-dried in open air before peeling was carried out with stainless knife. Good kernels (wholesome without flaws) which were described as 100% accepted by [7] and [10] were taken from small, medium, large and extra-large categories for oil and CNSL extraction. Equal weight of shells and peeled kernels of each of the categories were used for the extraction. The standard procedure reported by [1] and [2] was employed for the extraction, using Soxhlet apparatus and n-hexane as solvent. Peelability was determined by dividing the amount of whole kernel by the time taken to peel equal weight of whole kernels of each nut categories given in (3):

$$\text{Peelability} = \frac{\text{Weight of whole kernel} \times 60}{\text{Time taken in minutes} \times 1000} \text{ Kg/hr} \quad (3)$$

Owing to high premium placed on whole kernels, percentage white whole kernels recovered after peeling operation as compared to the total white kernels peeled was determined to measure the effect of peeling action on the kernels. Whole kernel recovery after shelling operation, testa, oil and CNSL contents were also determined as the amount of each of the respective parameters in one hundred of its processed corresponding material quantity.

III. RESULTS AND DISCUSSION

3.1 Mechanical related characteristics of cashew nut

The nut count Table 2 ranged from about 79 to 623 nuts/Kg from Madras to Extra large respectively. These values agree with 197 recorded by [3] and reports of earlier studies that the higher the nut count, the smaller the nut [10] and [11]. Table 2 shows the values obtained for mechanical related properties as investigated. Static coefficient of friction on mild steel which increased as nut size increased, ranged between 0.41 and 0.53, showing marginal variation among nut categories. Similar observation and figures, ranging 0.44 – 0.52 for graded nuts and 0.55 – 0.63 for ungraded nuts, were reported by [4]. Coefficient of friction of 0.45-0.65 on galvanized steel at varying moisture contents for cocoa beans, 0.45 on mild steel for parchment coffee and 0.51 on galvanized steel for palm kernel have also been reported by [16], [15] and [17] respectively. Similar and uniform shape of the nut sizes, irrespective of the categories which made them to slide alike on the structural surface, might have been responsible for the close values. [14] and [4] respectively had reported sphericity of cashew nut as 0.637 - 0.64 and 0.64 – 1.18 at different moisture. It implies that cashew nuts will flow similarly on the surface of a particular

engineering material irrespective of nut sizes and mixture of nut sizes does not pose a serious problem in this respect. The true density in Table 3 was between 1,028.6 and 1,518.9 Kg/m³. These values are comparable with 1100.16 to 1209.51 and 1066.2 to 1107.3 Kg/m³ recorded by [14] for cashew nut in Ghana and [4] for graded nuts of Ivory Coast respectively. Similar values of 1051, 1143.8, 1082.8 and 1090 - 1170 Kg/m³, based on varieties, were reported by [18], [19], [20] and [17] for avocado pear, fresh coffee berry, kola nut and palm kernel respectively. Apparently, smaller nuts had higher particle densities as Madras had the highest of 1518.9 followed by large with 1259.0 Kg/m³, while small, medium and extra large marginally range from 1028.6 to 1040.7 Kg/m³. True density of nuts increased as moisture content increased from 6 to 10% (w.b) as stated by [4]. Practical observation had revealed that the bigger the nut size, the more the tendency of its higher proportion to float in water, but floated nuts germinated well into plants with good vigour, implying nut quality may be irrespective of floatation. Wide range of sizes within nut categories might have resulted in the pattern of the density observed, which may require further investigation. Wide range of variation can be utilized in separation of mixture of cashew nut sizes. The mean significant difference at P≤0.05 in Table 3 revealed no significant difference in the true density of nut categories studied but they were significantly different in regard to the coefficient of friction. Extra large had the highest statistical mean of coefficient of friction of 0.53 while Madras was the lowest with 0.39 which was statistically different from other nut categories. It could be deduced that despite the close margin in the average of coefficient of friction of these nut sizes, there was some difference which has to be noted when handling mixtures of nut sizes. Highest peelability of 0.93 Kg/hr was comparable with 0.75 – 1 Kg/hr reported by [12] and difference may be attributed to categorization of nut sizes which might make removal of smaller nut's kernel more difficult as earlier stated. Peelability decreased with decrease in nut weights, implying that testa removal becomes more difficult for smaller nuts. Percentage white whole kernel increased with increase in nut sizes as white broken kernel (in parentheses) increased with decrease in nut sizes. [3] had stated that larger nut generally gave higher whole kernels. Whole kernel recovery after shelling, which is similar to crackability described by [3], portrays the ease of removing kernel from the shell (shelling efficiency). Considering 82 and 52% obtained for Extra-large and Madras respectively, and relative high decrease among the nut sizes, it may be deduced that shelling became more difficult as nut sizes reduced. Similar trend was reported

by [3], but higher values were obtained. The difference in values may be due to sources of materials, pre-treatment and machine, including operators. However, this factor

should be given reasonable consideration when designing machine for this operation, especially when handling mixture of nut sizes.

Table 2: Mechanical characteristics of cashew nut sizes

Nut Sizes	Coefficient Friction	True Density Kg/m ³	Whole kernel recovery after shelling (%)	Peelability (kg/hr)	White whole kernel recovery after peeling (%)
XL	0.53	1040.7	81.6	0.93	92.7 (7.6)
LG	0.50	1259.0	78.7	0.57	84.3 (15.7)
MD	0.46	1037.9	69.2	0.34	82.8 (17.2)
SM	0.43	1028.6	54.5	0.29	76.1 (23.9)
MR	0.41	1518.9	51.9	0.14	56.5 (43.5)

XL – Extra large, LG – Large, MD – Medium, SM – Small and MR – Madras, Percentage broken kernels are in parentheses.

Table 3: Mean values of true density and coefficient of friction of cashew nut categories

Nut categories	True density	Coefficient of friction
XL	1350.7a	0.53a
LG	1035.1a	0.50ab
MD	1032.1a	0.46bc
SM	1970.6a	0.44cd
MR	1350.7a	0.39d

Means with the same letter along the column are not significantly different at $P \leq 0.05$

XL - Extra large, LG – Large, MD – Medium, SM – Small and MR – Madras

3.2 Bio-chemical characteristics of cashew nuts

Bio-chemical characteristic values obtained for this study are described in Table 4. Percentage kernel content varied marginally from 29.4 to 36.2. Medium and Madras respectively had the highest and lowest content of kernel. Testa composition varied slightly and apparently increased as nut size decreased; extra large was the minimum with 7.3% while madras recorded the highest figure of 13.2%. The variation may be due to genetic factor. These results will be useful for machine design such as capacity determination and for making appropriate decision for selection by farmers and processors. Each of oil and CNSL occurred in the kernels and shells of cashew nuts respectively in almost equal proportion of 40 - 50% but

with slight differences among nut categories. Small and Large sizes had the highest content of oil (48.5%) and CNSL (49.7%) respectively while the least oil and CNSL was contained in the Medium (45.5%) and Extra large (39%) respectively. Kernel/oil ratio of 2.1:1 – 2.2:1 implied that each category of kernel can approximately produce at most oil equals one-half of its weight. These values were in the range of the findings of [1] for cashew kernel oil (48.8%) and [2] for CNSL (30.23%). The slight variation may be due to sources of nuts and nut categorization. Relatively high oil content had been reported by [18] for avocado pear (74-75%), [21] for oleander seed (60-65%), [22] for Almond nut (50%) and [17] for palm kernel (44-53%).

Table 4: Bio-chemical characteristics of cashew nut sizes

Nut Sizes	Nut Count Kg/hr	Oil Yield (%)(w/w)	Kernel oil ratio (w/w)	CNSL Yield (%)(w/w)	Kernel Content (unpeeled) (%)	Testa content (%)
XL	78.95	46.3	2.2 : 1	39.0	34.2	7.3
LG	107.36	46.0	2.2 : 1	49.7	30.5	8.5
MD	151.38	45.5	2.2 : 1	46.0	36.2	9.0
SM	247.13	48.5	2.1 : 1	48.0	32.5	8.1
MR	622.95	-	-	-	29.4	13.2

XL - Extra large, LG – Large, MD – Medium, SM – Small and MR – Madras

IV. CONCLUSION

Nut categories were similar in some mechanical related characteristics but shelling percentage and peelability were affected by nut sizes. Most bio-chemical properties of the nuts indicated no serious differences. However, there were relative areas of comparative advantage of nut classes that can be utilized for processing and production. Generally, bigger nuts are comparatively at better advantage according to the characteristics studied. The variation indicated among nut sizes is a signal that care is required in handling operation and machine design, particularly precision operations. Revelation of variation and similarity in the characteristics of nut sizes can be useful for making the right decisions by farmers, processors and engineers for overall development of cashew business.

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Systematization of Nursing Care for patients with Dimorfa leprosy undergoing treatment for type 2 disability

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Abstract— Objective: to report the experience of applying Nursing Care Systematization to users with Dimorphic Leprosy in reaction treatment for type 2 disability. Method: This is a descriptive study, like an experience report. The NCS was applied to the user during the nursing consultation to continue to control the Hans de Mal program and n in

a Family Health Strategy, located in the Administrative District of Bengui in the city of Belem - PA ; in order to construct the present report, it took five moments . Results: In order to build this report, it took five moments: in the first moment, the ACS responsible for the micro area in which he resides was aware of the patient's history; then, the consultation at the clinic ; the second moment, the problems encountered during the consultation were listed ; in the third moment, the adequate elaboration of the affected Basic Human Needs ; In the fourth moment, the Nursing Diagnoses based on the North American Nursing Diagnosis International and the International Classification of Nursing Practices in Public Health were applied ; In the fifth moment, the expected results were drawn and Finally, in the sixth moment, the nursing interventions and prescriptions were scored . Then a care plan comprising 10 interventional plans. Conclusion: The importance of nursing care for the contribution to the quality of life of the patient, family and community is emphasized, even in difficult moments as in the present study, thus demonstrating the importance of these services at all levels of care.

Keywords— Nursing Care, Nursing, Leprosy, Wounds and Injuries, Health.

I. INTRODUCTION

The report for Assistance of Nursing (NCS) used by nursing professionals as a tool, regulated in Brazil, to give organization to work and check quality and the management of care provided as well as allow better planning of the assistance to be develop lives [1], [2].

In this sense, the nurse faces a complex process to structure and implement their managerial and care practice, considering that carrying out the nursing process in order to promote, maintain or recover the patient's health is influenced by the organization, which is a very difficult administrative action, due to the innumerable ways to carry out these commands, in addition to challenging the fragility of a line of care fragmented by the various professionals who promote health care [3].

In that way, nursing services are configured as an important action to be developed for the prevention, control and treatment of leprosy. Furthermore, the NCS is of fundamental importance for the elimination of the disease as it provides enough autonomy to the professional nurse foster care actions with a view to ensure comprehensive care with a view to remedial measures [4].

The use of NCS to improve care and overcome difficulties in the various health institutions is a concern the scope of the nurse, it is a management methodology that enables service quality, based on a systematic care, despite the difficulties that contribute to full application of this practice in the care process; working using the NCS benefits the assistance to the patients with leprosy, as it favors the application of nursing care and enables the best possible ways to assist the patient [5].

NCS was performed during a follow-up consultation in the Hansen's disease program (MH) of the Ministry of Health to the patient living with Dimorfa Hansen's disease (HD) with Multibacillary classification and in type 2 reaction treatment, by the nurse, obeying the steps of SAE,

which includes the collection of history and anamnesis, survey of Nursing diagnoses, establishment of expected results, Nursing intervention, prescription and evaluation of results [6].

The North American Nursing Diagnosis Association International (NANDA-I) and the International Classification of Nursing Practices in Collective Health (ICNPCH) were used to perform the Nursing Diagnoses (ND). Considering that both have the same perspective of achieving the expected results, aiming at the complete improvement of the client, both were used as complementary [7].

Leprosy is a pathology that involves biopsy, economic and social aspects, which directly impact on the development of the disease. Otherwise, leprosy is a chronic, granulomatous, infectious disease caused by the bacterium *Mycobacterium leprae*, also known as Hansen's bacillus. characteristic of being mandatory intracellular, showing a peculiarity of predilection for skin cells and peripheral nerve cells [8].

When not diagnosed and treated early and appropriately, the disease progresses to physical disability and deformities, which leads to decreased ability to work, restriction of social life and psychological problems. The degree of disability is determined from the neurological evaluation of the eyes, hands, feet and its result is expressed in values ranging from 0 (zero) to II (two). So, grade 0 is determined when there is no disability in the eyes, hands and feet; grade 1 when there is disability (decrease or loss of sensation in the eyes, hands or feet) and grade 2 when there is disability and deformity in the eyes, hands and feet [9].

Justified the choice of this theme due to the endemic distribution the disease in Brazil and the difficulty faced by professionals of health services to detect early mind new cases, demonstrating one weakness in the care line,

with delayed treatment and presence of disabilities physical problems, deficiency in the prevention of infection of the contact persons and ignorance of the population about the disease [10].

So, the aim of this study is to report the experience of applying the Nursing Care Systematization (NCS) to users with Dimorfa Hansen's disease in reaction treatment for type 2 disability.

II. MATERIALS AND METHODS

This is a descriptive study, like an experience report. The sample selection followed the non-probabilistic criterion, where the participant was included in the study for convenience. NCS was applied to the user with Hansen's disease Dimorfa with Multibacillary classification and undergoing reaction treatment for type 2 disability, experienced during the nursing consultation to continue the control of the MH program in a Family Health Strategy (FHS), located in the District Administrative Department of Bengui (DABEN) in the city of Belem -PA.

NCS was applied by the nurse of that ESF, with the assistance of nursing students from the 9th period who were experiencing the supervised internship in Primary Care of a Private Higher Education Institution located in Belem-PA. The consultation took place on 8/3/2020, shortly after receiving information from Community Health Agents (CHA) about the patient's complaints.

To build the present report, it took five moments: in the first moment, the CHA responsible for the micro area in which he resides was informed of the patient's history; then, the consultation at the outpatient clinic was structured and planned to receive and carry out the appropriate management of patients with Tuberculosis and Leprosy, in which the nurse, together with the students, was able to prepare the Nursing History (NH). In the second moment, the problems encountered during the consultation and listed for the NCS were listed, with a view to resolving the patient's complaints.

In the third moment, the adequate elaboration of the affected Basic Human Needs (BHN) was carried out, in a systematic way to provide a better handling of the patient's complaints, as well as working through an organized care line. Furthermore, there is a picture of BHN divided into physiological, security, love / relationship, esteem and personal fulfillment.

In the fourth moment, the Nursing Diagnoses (ND) based on the NANDA-I and ICNPCH were applied. In the fifth step, the expected results were drawn according to the demand for each problem encountered during the

consultation. Finally, in the sixth moment, the pertinent Nursing interventions and prescriptions were scored.

III. RESULTS

It is reported that during the nursing consultation, user data collection was carried out in a comprehensive manner, to provide students with learning and demonstrate interest and respect for the client. Then, the Nursing history is reported: "User, 54 years old, male, attended the EC to continue the control of the MH Program. At the moment, he complains of arthralgia, asthenia and pain in the Lower Limbs (lower limbs). Resides in own masonry house with 04 rooms and a bathroom.

Divorced, he reports being abandoned by his ex-partner when he received the MH Diagnosis; he currently has his son with him; reports having running water and garbage collection weekly. Family income for the benefit of a minimum wage, claims that he worked as a bricklayer in a construction company and left to perform the treatment of rheumatoid arthritis and that was when he was diagnosed with MH, being referred to the Reference Unit Marcelo Candido, located in the municipality of Marituba-Para, where he began treatment for MH on 04/09/2018 with an end date on 11/12/2019.

Morbid family history: Refers to the mother and three siblings with rheumatoid arthritis. Life Habits and Personal Morbid Antecedents: He reports having been an alcoholic for 6 years, had drunk alcohol for about 19 years and smoked for about 10 years. does not perform physical and / or occupational activities for fear of falling, as he reports having bone fragility and three fractures in the lumbar spine due to this condition. He reports allergies to some foods and red meat, under the accusation that purulent and foul-smelling bubbles appear after eating these foods and, she believes that it is due to the medication she is using (Thalidomide and Prednisone) and allergy to Benzetacil.

Food Standard: refers to having 05 meals a day and accepts all types of food well, with little intake of frying, fat and sugars. Good water intake, several times a day. Impaired sleep and rest pattern, as it complains of loss of sleep and that it is not sleepy.

Currently, he continually uses the medication Thalidomide (100mg), two pills at night, Prednisone (60mg) when he has a reaction crisis and informs that the doctor makes progressive weaning, as his symptoms improve. He reports using the vitamin on his own, as he has already fainted due to moments of asthenia and hypotension. He was diagnosed with MH with clinical classification Dimorfa, through the clinical examination, in the chart of counter reference issued in the URE, on

03/12/2018, presenting five lesions, presence of spots, nodules and infiltrations in the skin.

The therapeutic regimen listed by the physician was Adult Polychemotherapy / Multibacillary (MDT / MB), with the number of doses administered in the ERU: 01 unit on 03/12/2018. The leprosy reaction diagnosed was TYPE I with a scheme to control the reaction (neuritis) with Prednisone with an initial dose of 40mg. Complementary diagnostic tests were performed: Lymph BK examination performed in 2018: Bacilloscopic Index: 3.5, Morphological Index: 6%; Bacilloscopy examination of the intradermal shaving for Leprosy performed in January 2019: Right ear lobe: 4+, Ear lobe left: 4+, right elbow: 4+, Injury: 4+, Bacilloscopic Index: 4.00, Morphological Index: 0% and Classification of the degree of disability using the simplified neurological assessment form, carried out on 03/16 / 2018, by the nurse of that ESF, as Grade I.

Physiological patterns of elimination: Inform present and spontaneous diuresis, but with difficulty in evacuation.

On physical examination: general appearance in a regular, oriented physical state, dry, dehydrated skin, presence of skintears in the hands, numerous and small subcutaneous inflammatory nodules in the upper limbs (upper limbs), chest and lower limbs (lower limbs). Presence of scars due to the appearance of purulent and foul-smelling blisters on the chest, abdomen and lower limbs. Mucous membranes, dried and pale, infiltration in the face, in the eyebrow region, alopecia in eyebrows; photoreagent pupils, presence of senile halo, eyelid muscle strength and corneal sensitivity preserved. Nasal fossae with alopecia and septum perforation. Oral cavity without significant changes. Symmetrical chest, refers to pain on deep palpation in the region of the nipples bilaterally. Cardiac auscultation: Normophonetic heart sounds in 2 times present without murmur. Pulmonary auscultation: vesicular murmurs present, without changes. Abdomen: flat, tympanic, massive, hydro-aerial noises present and hypophonic. MMSS: decreased strength in the fingers, decreased sensitivity to 2g monofilament (lilac). LL: bilateral edema (locker ++ / +++), nails with onychorrhexis and yellowish color. Presence of an erythematous plaque, with fading external edges and internally well-defined with a hypopigmented oval center with a fovea aspect in the Right Lower Limb in the internal fibular region.

Nursing conduct: reinforcement of the guidelines regarding hydration and lubrication of dry parts, exercises to increase muscle strength, use of appropriate shoes, care when walking and use of sunscreen. Reinforced as to the

importance of returning consultations, asked if there was any doubt in what was passed on for clarification and given relevant guidance to what had been identified.

IV. DISCUSSION

For each Nursing problem (NP), a Nursing Diagnosis (ND) was applied, classifying the Affected Standard (AS) and the NHB, as well as its assistance plan with Expected Outcome (NP) and the Nursing Interventions (IE) reporting the client's clinical status, then we have the following assistance plan.

1st EP: Septum perforation; PA: Mucous Cutaneous Integrity; NHB: Security; DE: Skin lesions in patients with MH (ICNPCH); RE: User will not present other lesions on mucous membranes, as well as improvement in the present lesion; IE: To advise on the hydration and cleaning of the area; ask questions about the situation.

2nd EP: Fear related to illness; PA: Perception; NHB: Security; DE: Fear (NANDA-I); RE: Wish the client to break this barrier by clarifying the disease.

3rd EP: Sleep and rest impaired; PA: Sleep pattern; NHB: physiological; DE: Sleep pattern disorder (NANDA-I) related to health status characterized by the user's report; ER: it is estimated that the patient will recover the sleep pattern in four days; IE: guide the importance of preserving sleep and rest for health.

4th EP: difficulties to evacuate; PA: Elimination pattern; NHB: physiological; DE: Constipation (ICNPCH); RE: will show improvement in comfort by 03. IE: Encourage increased water intake, stimulate fiber intake in the diet; encourage walks and advise on the possible reactions of the treatment performed.

5th EP: Pain; PA: Perception; NHB: Physiological; DE: Acute pain (NANDA-I) related to health status, characterized by the user's verbal report. RE: Will improve pain perception in up to 03 days. IE: advise on comfort massage; guide how much care with feet and hands to decrease pain; forward the ERU; forward for consultation with the doctor.

6th EP: Intolerance to activity; PA: Activity / rest; NHB: Security; DE: Impaired walking (NANDA-I) related to fear of falling, characterized by the user's verbal report. User will be available for activities and / or walking within two weeks. refer to the specialized reference service, guide how much risk of falling; refer to physiotherapy; refer to the psychologist.

7 ° EP: Dry and dehydrated skin; PA: Activity / Rest; NHB: Physiological; DE: Risk of impaired skin integrity (NANDA-I) related to drug treatment. RE: User

will not present skin lesions, as well as improve hydration and dryness of the dermis within two weeks. IE: guide how much skin care; encourage water intake, advise on the use of sunscreen and hydration cream.

8th EP: Edema in lower limbs; PA: Activity / Rest; NHB: Physiological; DE: Ineffective peripheral tissue perfusion (NANDA-I) related to the current health status, characterized by a locker test ++ / +++ . RE: User will show edema reduction for up to one week. IE: advise on comfort massage; encourage water intake; guide comfort position for lower limbs; request laboratory tests to prevent circulatory changes.

9th EP: Decreased sensitivity; PA: Perception; NHB: Physiological; DE: Impaired peripheral sensitivity (ICNPCH); RE: User will not have burns, falls and cuts during the period being monitored in the MH program; IE: advise on the use of light and appropriate clothing; guide how to massage the feet and hands; guide how much skin care; advise on how to care for injuries in daily tasks advise on the risk of accidents.

10th EP: Abandonment; PA: Coping / Stress; NHB: love / relationship DE: risk of impaired resilience / disable family coping (NANDA-I) related to ineffective coping with the disease, characterized by verbal reporting. RE: User will have an improved disposition for family coping, as well as no resilience loss in coping with the disease; IE: Welcome the user; encourage going to support groups; refer to the psychologist; forward the case to social service.

V. CONCLUSION

It was possible to identify, when carrying out the consultation, factors indispensable for the maintenance of the community's health, facilitating the understanding of factors of prevention, promotion and recovery of diseases. It is also inferred that the use of therapeutic listening, the establishment of an interpersonal relationship between the patient and the professional and an integral look at the subject enable full knowledge of the patient's history and the development of an ideal care plan that allows the patient enter into a resolute, comprehensive care line that generates customer satisfaction through the quality of Nursing Care.

It is also emphasized the importance of nursing care for the contribution to the quality of life of the patient, family and community, even in difficult moments as in the present study, thus demonstrating the importance of these services at all levels of care.

The main limitation of this study was the opportunity to accompany the patient in a single consultation, without

the academics knowing, thus, if the NCS idealized by them met the patient's demands.

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Study on the effect of ferrite number on impact toughness of austenitic stainless steels at low temperatures

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Abstract— All ferrous materials, except the austenitic grades, exhibit a transition from ductile to brittle when tested above and below a certain temperature, called as ductile to brittle transition temperature (DBTT). In order to better understanding the effect of the volume fraction of δ ferrite in the impact toughness of austenitic stainless steels at low temperatures, the microstructures of welded joints of austenitic stainless steel produced through SAW, were studied. The groove welds were produced using welding electrodes and flux of the same specification, ER 316L 3.2 mm and a fluoride basic flux ($\text{CaF}_2\text{-Al}_2\text{O}_3\text{-SiO}_2$). The filler metals used are from different heats with different chemical compositions resulting in different ferrite numbers. The base metal used is AISI 316L TYPE plates of 25 mm thickness. The chemical compositions and the variation of the volume fractions of δ ferrite in the deposits were measured. The welded coupons were tested at -196°C to measure the impact toughness. The results confirm that the volume fraction of δ ferrite is of paramount importance in the impact toughness of austenitic stainless steels at cryogenic temperatures. Complementary techniques of microstructural analysis were used, such as optical emission spectrometry, optical microscopy and quantitative image analysis.

Keywords— Austenitic Stainless Steels; Impact Toughness; Ferrite Number; Cryogenics; DBTT.

I. INTRODUCTION

The ductile to brittle transition temperature (DBTT) is a phenomenon that is widely observed in metals. Below critical temperature (DBTT), the material suddenly loss ductility and becomes brittle.

All ferrous materials (except the austenitic grades) exhibit a transition from ductile to brittle when tested above and below a certain temperature, called as ductile to brittle transition temperature.

The ductile to brittle transition behavior of a wide range of metals falls into three categories determined by their yield strength and crystal structure. Metals with a face centered cubic (FCC) crystal structure do not undergo the transition

and retain their ductility at low temperature. This is because FCC metals present large number of slip systems in their crystal structure which allow dislocation slip to occur, even at very low temperature. Aluminum is an FCC metal and, therefore, does not become brittle at low temperature. Most hexagonal close packed metals (HCP), including magnesium and α titanium alloys, also do not undergo the transition effect. Metals with a body centered cubic (BCC) crystal structure often display ductile to brittle transition properties. Fracture in many BCC metals occurs by brittle cleavage at low temperatures and by ductile tearing at high temperature. [1]

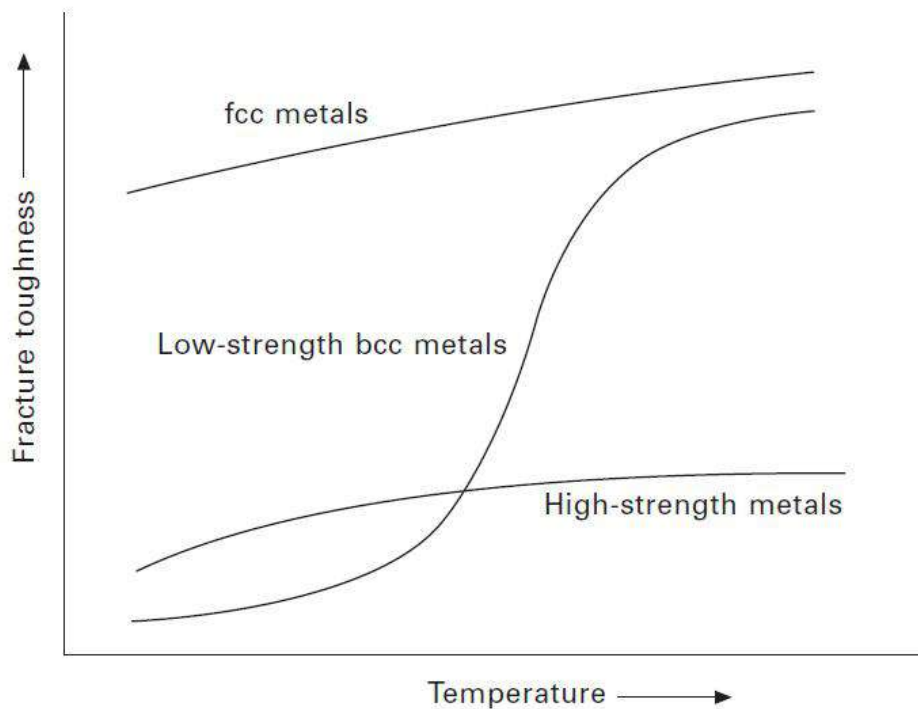


Fig.1: General trends of the ductile to brittle transition effect for different groups of metals. [1]

The ductile to brittle transition effect occurs because the development of the plastic zone in some types of metals is a temperature dependent process. At high temperatures, there is enough thermal energy in the crystal structure to aid the movement of dislocations under an externally applied stress. This allows the plastic zone to develop at the crack tip which then allows cracking to proceed by ductile fracture. The thermal energy to assist dislocation slip drops with temperature, and this makes it harder to develop the plastic zone. Dislocation mobility and, hence, the size of the plastic zone decrease rapidly below the transition temperature which results in a large loss in fracture toughness. Dislocation slip virtually stops below the transition temperature, which causes the metal to fracture by brittle crack growth. As temperature increases, the atoms in the material vibrate with greater frequency and amplitude. This increased vibration allows the atoms under stress to slip to new places in the crystal, break bonds and form new ones with other atoms. This slippage of atoms is seen on the outside of the material as plastic deformation, a common feature of ductile fracture. When temperature decreases however, the exact opposite is true. Atom vibration decreases, and the atoms do not want to slip to new locations in the material. When the stress on

the material becomes high enough, the atoms just break their bonds and do not form new ones. This decrease in slippage causes little plastic deformation before fracture. Thus, a brittle type fracture takes place. [1,2]

The higher the dislocations density, the more brittle the fracture will be in the material. As dislocations density increases in a material due to stresses above the materials yield point, it becomes increasingly difficult for the dislocations to move because they pile into each other. It is important to emphasize that as grains get smaller, the fracture becomes more brittle, once that in smaller grains dislocations have less space to move before they hit a grain boundary. [2]

In welding of high alloy steels, the δ ferrite content is normally estimated from the constitution diagrams such as the Schaeffler [3], DeLong [4] and Kotechi [5].

In these diagrams, the δ ferrite contents of various welds had been measured experimentally by either metallography (Schaeffler) or magnetic methods (DeLong and WRC-92). [6]

The WRC-92 diagram estimates the ferrite content to reasonably good accuracy, providing additional information about the solidification mode as shown on figure 2.

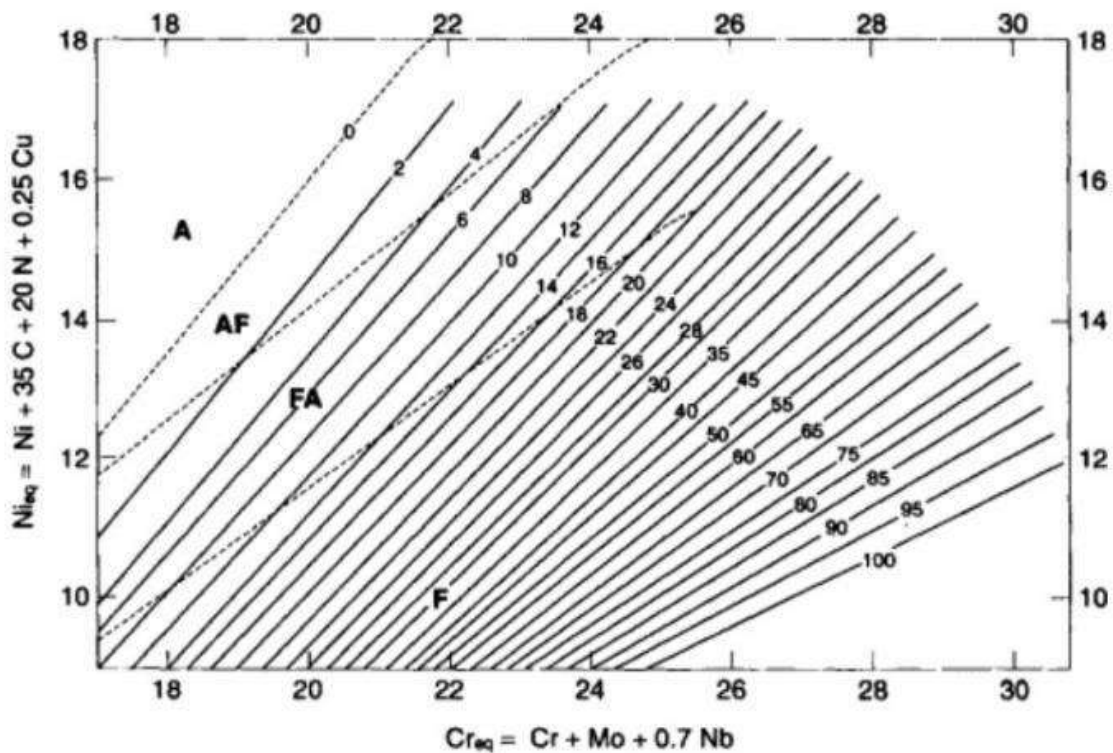


Fig.2: WRC-92 Diagram.[5]

Kotechi [5] has pointed out that there are number of alloying elements that have not been considered in the most accurate diagram to date, the WRC – 92 Diagram. Chemical elements like silicon, titanium and tungsten are not given due considerations though they are known to influence the ferrite content. He also stressed the point that cooling rate effects need to be considered more thoroughly in these constitution diagrams. [6]

Table 1 shows the expressions of chromium and nickel equivalents proposed by Schaeffler [3], DeLong [4] and Kotechi [5].

Table 1 - Cr_{eq} and Ni_{eq} formulae used for estimating the delta-ferrite content from constitution diagrams[6-8]

Constitution Diagram	
Schaeffler Diagram (1949)	$Cr_{eq} = Cr + Mo + 1.5xSi + 0.5xNb$
	$Ni_{eq} = Ni + 30xC + 0.5xMn$
DeLong Diagram (1973)	$Cr_{eq} = Cr + Mo + 1.5xSi + 0.5xNb$
	$Ni_{eq} = Ni + 30xC + 30xN + 0.5xMn$
WRC-92 Diagram (1992)	$Cr_{eq} = Cr + Mo + 0.7xNb$
	$Ni_{eq} = Ni + 35xC + 20xN + 0.25xCu$

When the Cr_{eq}/Ni_{eq} ratio < 1.5 , the solidification may be austenitic (mode I) or austenitic-ferritic (mode II). When the ratio $1.5 < Cr_{eq}/Ni_{eq} < 2.0$ the solidification will be ferritic-austenitic (mode III). And finally, when Cr_{eq}/Ni_{eq} ratio > 2.0 the solidification will be ferritic (mode IV). [7-11]

The possible solidification modes in the Fe-Cr-Ni system are:

- I) **Austenitic solidification ($L \rightarrow L+\gamma \rightarrow \gamma$):**
The only solid phase to form is austenite. In austenitic solidification, called solidification

mode I, there is no other phase transformation at high temperature. [7-8]

II) **Austenitic-ferritic solidification ($L \rightarrow L+\gamma \rightarrow L+\gamma+\delta \rightarrow \gamma+\delta$):**

Austenite solidifies as a primary phase in a dendritic or cellular way. As the temperature decreases, ferrite δ is formed from the remaining liquid. Solidification occurs through a peritectic reaction ($L+\delta \rightarrow \gamma$). This is called solidification mode II. [7-11]

III) **Ferritic-austenitic solidification ($L \rightarrow L+\delta \rightarrow L+\delta+\gamma \rightarrow \delta+\gamma$):**

The duplex stainless steels solidify according to ferritic-austenitic solidification ($L \rightarrow L+\delta \rightarrow L+\delta+\gamma \rightarrow \delta+\gamma$). δ ferrite solidifies as the primary phase in dendritic or cellular fashion. As temperature decreases, austenite is formed by a peritectic ($L+\delta \rightarrow \gamma$) or eutectic ($L \rightarrow \delta+\gamma$) reaction. In the case of a peritectic reaction, the initially formed austenite completely surrounds the ferrite and subsequently grows into ferrite and liquid. Depending on the rate of diffusion through the austenite, the reaction may or may not be complete, and at the end of the solidification ferrite may be involved in austenite. Between the two reactions - peritectic and eutectic - the transition takes place where, during the initial formation of austenite by peritectic reaction, ferritizing elements secrete to the liquid, provoking their enrichment in these elements and consequently the simultaneous formation of ferrite and austenite by means of a eutectic reaction. This is called solidification mode III. [7-17]

IV) **Ferritic solidification ($L \rightarrow L+\delta \rightarrow \delta$):**

The only solid phase to form is ferrite. In ferritic solidification, called solidification mode IV, ferrite is the only phase to form during solidification and, depending on the chemical composition, austenite can precipitate only in the solid state in the ferritic grain boundaries. [7,8]

The solidifications of austenitic stainless steels can occur according to the first three solidification modes. All ferrous alloys, except the austenitic grades, exhibit a transition from ductile to brittle temperature.

Unlike the austenite matrix, the δ ferrite presents a DBTT. This phase will be brittle at cryogenic temperatures and, depending on the volume fraction, will

lead to embrittlement of the grain boundaries of the austenitic matrix.

As discussed before, it is reasonable to conclude that the volume fraction of δ ferrite is of paramount importance in the impact toughness of austenitic stainless steels at cryogenic temperatures.

II. EXPERIMENTAL

Two welded joints of austenitic stainless steel produced by the SAW process with different welding were studied. The groove welds were produced using welding electrodes and flux of the same specification, ER 316L 3.2 mm according to AWS 5.9, and a fluoride basic flux ($\text{CaF}_2\text{-Al}_2\text{O}_3\text{-SiO}_2$). The filler metals used are from different heats with different chemical compositions resulting in different ferrite numbers. The base metal used is AISI 316L TYPE plates of 25 mm thickness. The welding parameters used were the same in order to guarantee similar heat inputs for both joints. Afterwards, the samples were cut using a cut-off. Chemical analyzes were carried out in both samples at the face, middle and root of the all weld metals, by means of an optical emission spectrometer, according to ASTM E 1086-08. [18]

Transversal and longitudinal samples were embedded in hot-cure resin (bakelite). The conventional manual polishing was applied using water sandpapers (100, 240, 320, 400, 600 and 1000 mesh) in order to standardize the surface finish of the samples. A cloth polishing with 9, 3 and 1 μm diamond abrasive paste was carried out in this sequence. The samples were electrolytically attacked in 20% NaOH solution, 6V, for 90 seconds. This allowed the microstructural characterization of the samples through optical microscopy. The quantitative metallographic analysis for the determination of volumetric fractions of δ ferrite and austenite were performed according to ASTM E 562 ed. 08, [19] using a 4X5 grid (20 points) with a magnification of 400X in 30 different regions per test piece. Finally, impact toughness tests were performed on welded joints at -196 °C using Charpy impact testing per ASTM E23-18. [20].

III. RESULTS AND DISCUSSION

Table 2 presents the welding parameters used to weld the samples. It is important to emphasize that the welding wires used to produce samples 1 and 2 were both the ER316L according to AWS 5.9, 3.2 mm diameter, from different heats.

Table 2–Welding parameters.

	Flux	Current (A)	Tension (V)	Driving Speed (mm/min)	Heat Input (kJ/mm)
Sample 1	CaF ₂ -Al ₂ O ₃ -SiO ₂	400	27	400	1,62
Sample 2	CaF ₂ -Al ₂ O ₃ -SiO ₂	400	27	400	1,62

Table 3 presents the chemical compositions and the calculations of C_{eq}, according to O. Hammar and U. Svensson [7-8, 21], of the base metal, filler metals and the all weld metals of the two joints.

Table 3– Chemical compositions and the calculations of C_{eq}.

	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N	Ceq
AISI 316L (BM)	0.024	0.42	1.62	0.040	0.010	18,00	12.05	2.67	0.06	0.060	0.063
ER316L (FM1)	0.011	0.40	1.60	0.020	0.013	18.60	12.20	2.50	0.17	0.046	0.041
ER316L (FM2)	0.012	0.48	1.84	0.015	0.010	18.20	11.60	2.60	0.05	0.046	0.042
Sample1 (AW)	0.018	0.41	1.76	0.022	0.008	18,00	11.50	2.30	0.09	0.053	0.052
Sample2 (AW)	0.020	0.49	2,00	0.017	0.006	17.90	10.93	2.39	0.03	0.050	0.053

The results presented on table 3, show that the welded joints present less Cr, Mo and Ni and more C, Si and Mn than the filler metals.

Figure 3 shows the contents of C, Si, Mn, Cr, Ni and Mo (% by weight) of the base metal, filler metals ER 316L and all weld metals.

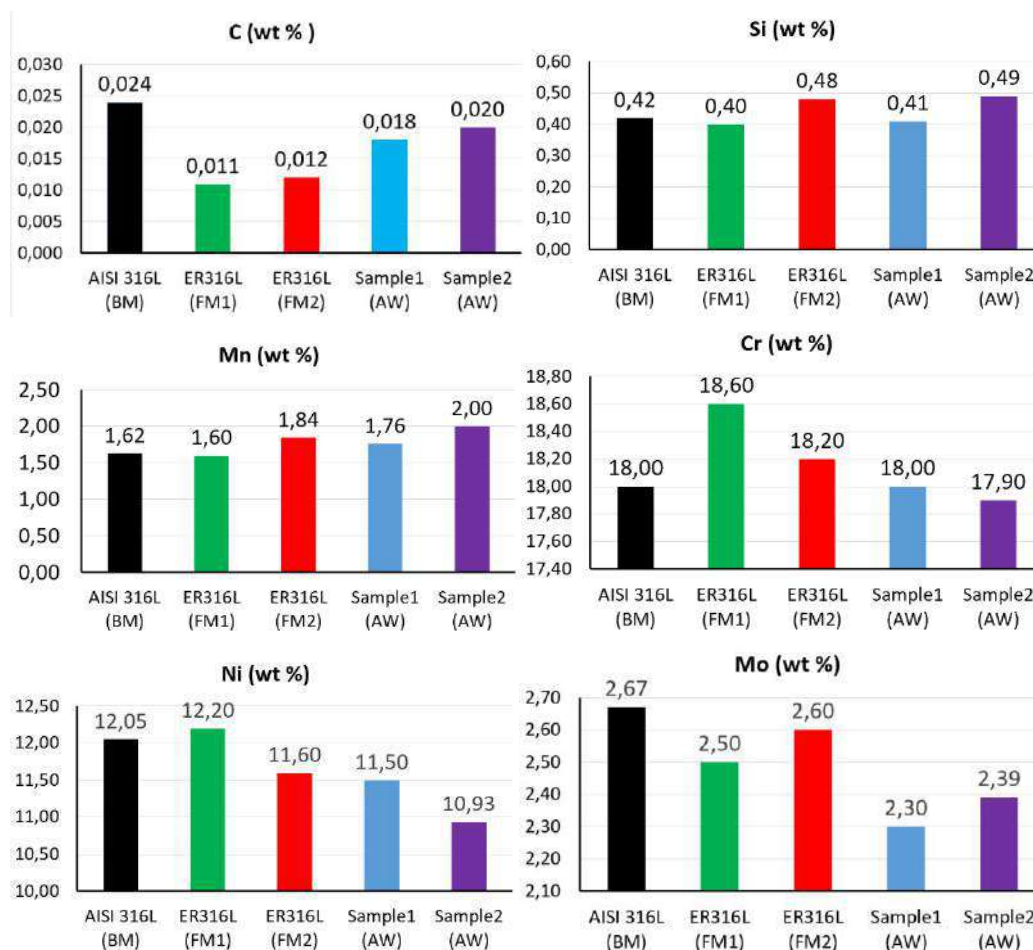


Fig.3: Contents of C, Si, Mn, Cr, Ni and Mo (% by weight) of the base metal, filler metals ER 316L and all weld metals.

Table 4 presents calculated values of Cr_{eq} , Ni_{eq} and Cr_{eq}/Ni_{eq} ratio according to the expressions of chromium and nickel equivalents proposed by Schaeffler[3], DeLong [4] and Kotechi [5]. The calculations of Cr_{eq} , Ni_{eq} and Cr_{eq}/Ni_{eq} ratio were done using formulas taken from Table 1.

Table 4– Cr_{eq} , Ni_{eq} and Cr_{eq}/Ni_{eq} ratio according to the expressions of chromium and nickel equivalents proposed by Schaeffler, DeLong and Kotechi.

	Schaeffler Diagram (1949)			DeLong Diagram (1973)			WRC-92 Diagram (1992)		
	Cr_{eq}	Ni_{eq}	Cr_{eq}/Ni_{eq}	Cr_{eq}	Ni_{eq}	Cr_{eq}/Ni_{eq}	Cr_{eq}	Ni_{eq}	Cr_{eq}/Ni_{eq}
AISI 316L (BM)	21.30	13.58	1.57	21.30	15.38	1.38	20.67	14.11	1.46
ER316L (FM1)	21.70	13.33	1.63	21.70	14.71	1.48	21.1	13.55	1.56
ER316L (FM2)	21.52	12.88	1.67	21.52	14.26	1.51	20.8	12.95	1.61
Sample1 (AW)	20.92	12.92	1.62	20.92	14.51	1.44	20.3	13.21	1.54
Sample2 (AW)	21.03	12.53	1.68	21.03	14.03	1.50	20.29	12.64	1.61

Figure 4 shows the variations of the Cr_{eq} and Ni_{eq} values (% by weight) of the base metal, filler metals ER 316L and all weld metals.

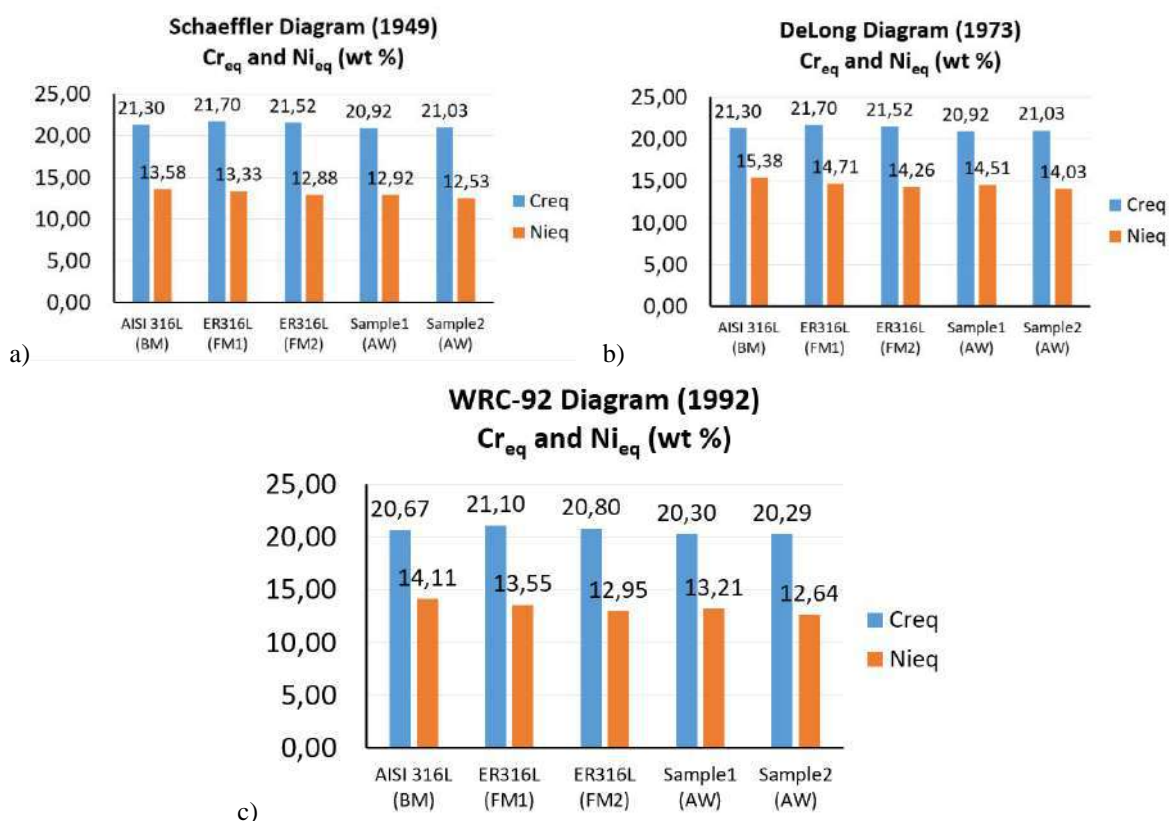


Fig.4: Cr_{eq} and Ni_{eq} values (% by weight) of the base metal, filler metals ER 316L and all weld metals, according to the expressions of chromium and nickel equivalents proposed by: a) Schaeffler, b) DeLong and c) Kotechi.

Figure 5 shows the variations of the Cr_{eq}/Ni_{eq} ratio of the base metal, filler metals ER 316L and all weld metals.

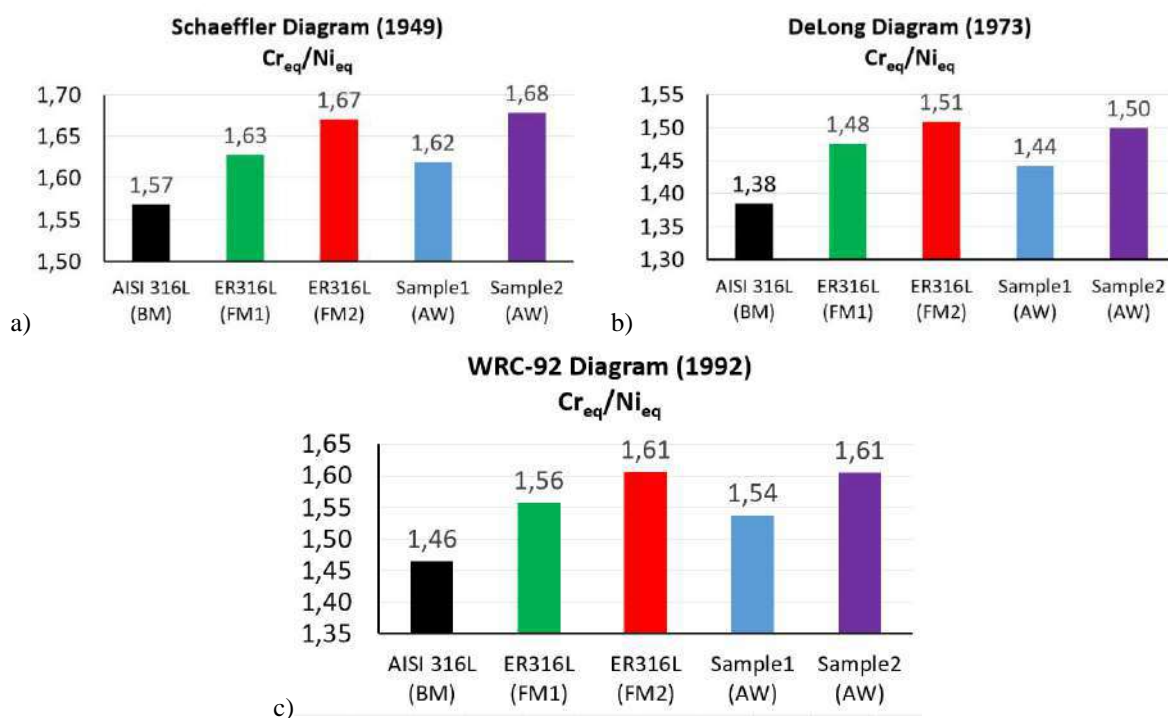


Fig.5: Cr_{eq}/Ni_{eq} ratio of the base metal, filler metals ER 316L and all weld metals, according to the expressions of chromium and nickel equivalents proposed by: a) Schaeffler, b) DeLong and c) Kotechi.

Table 5 presents the volume fractions of δ ferrite measured through metallographic analysis in 30 different regions per test piece.

Table 5– Volume fractions of δ ferrite measured through optical microscopy.

Volume fraction of δ ferrite	Mean	95%CI	%RA
AISI 316L (BM) Transversal	6.1	1.7	11.2
AISI 316L (BM) Longitudinal	3.7	1.9	14.1
AISI 316L (BM)- Average	4.6	2.0	9.6
Sample 1 (AW) Transversal	7.3	1.5	12.1
Sample 1 (AW) Longitudinal	4.3	1.7	9.6
Sample 1 (AW)- Average	5.4	1.9	10.1
Sample 2 (AW) Transversal	9.0	1.7	14.2
Sample 2 (AW) Longitudinal	6.3	1.7	10.1
Sample 2 (AW)- Average	7.3	1.8	11.1

Metallographic analysis revealed a solid austenitic-ferritic microstructure of solidification for all welded specimens, with austenite being the light phase and ferrite being the dark phase in the grain boundaries. The volumetric fractions of δ ferrite verified in the longitudinal direction

are smaller than those verified for the transversal direction in the four welded specimens.

Figure 6 shows the plots of the chemical compositions of the base metal, filler metals ER 316L and all weld metals, on the constitution diagrams proposed by Schaeffler [3], DeLong [4] and Kotechi [5].

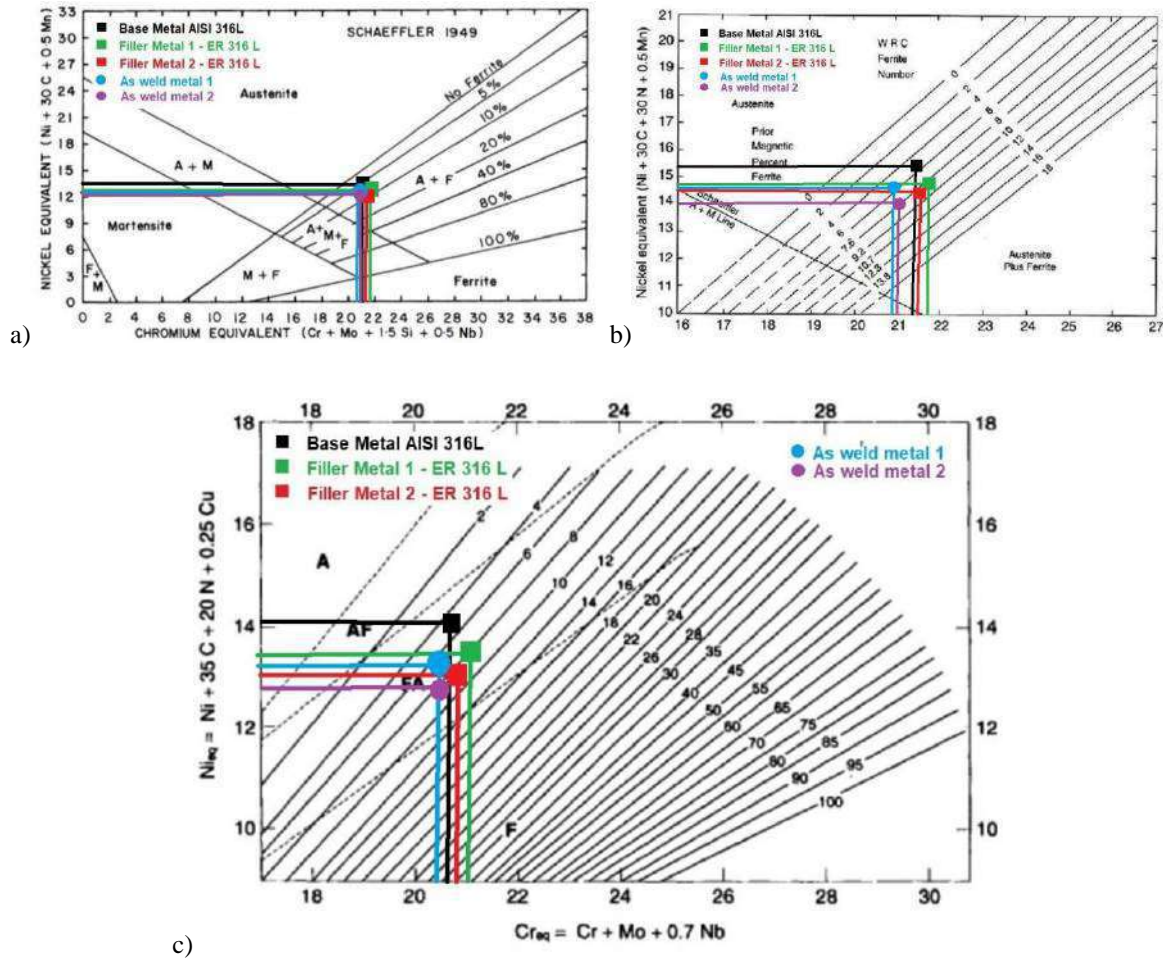


Fig.6: Plots of the chemical compositions of the base metal, filler metals ER 316L and all weld metals, on the constitution diagrams proposed by:a) Schaeffler, b) DeLong and c) Kotechi.

Table 6 presents the results of the impact toughness tests performed on welded joints at -196 °C using Charpy impacttesting.

Table 6– Impact toughness tests performed on welded joints at -196 °C using Charpy impact testing.

	Energy Absorbed (J)					Mean
	CVN1	CVN2	CVN3	CVN4	CVN5	
Sample1 (AW)	42	47	40	47	41	43
Sample2 (AW)	24	24	22	24	22	23
	Lateral Expansion (mm)					Mean
	CVN1	CVN2	CVN3	CVN4	CVN5	
Sample1 (AW)	0.62	0.61	0.56	0.51	0.55	0.57
Sample2 (AW)	0.45	0.48	0.41	0.39	0.38	0.42

As discussed earlier, the results confirm that the volume fraction of δ ferrite is of paramount importance in the impact toughness of austenitic stainless steels at cryogenic temperatures.

IV. CONCLUSIONS

The ferrite number of the joint is directly linked to the ferrite number of the filler metal. The welded joints produced using

the filler metal with higher ferrite number, presented higher ferrite number and vice versa.

Although the variations of Cr_{eq} and Ni_{eq} , both welded joints presented the same ferritic-austenitic solidification mode (mode III).

The chemical results of the welded joints suggest that the welding of austenitic stainless steels using SAW process is very sensitive to the flux. Using a flux of the type $CaF_2-Al_2O_3-SiO_2$ resulted in decrease of Cr, Mo and Ni and increase of C, Si and Mn contents in the all weld metal when compared with the chemical compositions of the filler metals.

The results obtained confirm that the volume fraction of δ ferrite is of paramount importance in the impact toughness of austenitic stainless steels at cryogenic temperatures.

The joint that presented lower ferrite number, presented better performance in the impact toughness of austenitic stainless steels at cryogenic temperatures.

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Green and brown propolis as antioxidant, antimicrobial and inhibitors of matrix metalloproteinases in endodontics

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Abstract—The purpose of this *in vitro* study was to identify the secondary metabolites and to evaluate the antimicrobial activity, cytotoxicity, antioxidant capacity, and effect on metalloproteinases (MMPs) activity of two Brazilian propolis samples. The extracts of brown (BP) and green (GP) propolis were obtained by rotoevaporation. Phenolic compounds, flavonoids and coumarins were identified by colorimetric methods and determined by spectrophotometry. The minimum inhibitory concentration (MIC) of BP and GP against *Candida albicans* and *Enterococcus faecalis* was determined by broth microdilution. Cytotoxicity was assessed by MTT assay using L929 mice fibroblast cell line and supplemented DMEM culture medium. The antioxidant capacity was evaluated by DPPH test. The zymography assay was performed to evaluate the activity of BP and GP against MMP-2 and MMP-9. GP had a higher rate of coumarins and flavonoids, whereas BP had a higher content of phenolic compounds. GP and BP extracts showed antimicrobial activity against *C. albicans* and *E. faecalis* regardless of concentration, and presented low toxicity, except GP at 2.5 mg/mL, which reduced 40% of fibroblast cell metabolism. GP and PB extracts showed antioxidant capacity against the DPPH free radical at a concentration of $55.489 \pm 1.512 \mu\text{g/mL}$ and $38.378 \pm 0.735 \mu\text{g/mL}$, respectively. Also, BP and GP showed an inhibitory effect against MMP-2 and MMP-9 from 1 to 5 mg/mL. The green and brown Brazilian propolis showed antimicrobial effect, low cytotoxicity, antioxidant capacity, and ability to inhibit the activity of MMP-2 and MMP-9, having potential to be used in endodontics as root canal irrigant.

Keywords—Anti-infective agents, Cytotoxicity, Propolis, Root canal irrigants, Tissue Inhibitor of Metalloproteinases.

I. INTRODUCTION

The success of endodontic therapy is directly related to the elimination of microorganisms and their toxins from the root canal system.¹For this purpose, a wide variety of antibacterial agents have been developed and tested as endodontic irrigants.^{2,3} Sodium hypochlorite (NaOCl) is still the endodontic irrigant of choice, since it has good tissue dissolution capacity, antimicrobial activity and acceptable biocompatibility at low concentrations.⁴However, during contact of NaOCl with the pulp and dentin tissues, organochlorine compounds (chloroform, hexachloroethane, dichloromethylbenzene

and benzaldehyde) are formed⁵, which are neurotoxic, highly lipophilic and chemically stable and permanent in nature. Chlorhexidine (CHX) has also been recommended as an endodontic irrigant for its strong disinfectant action, and is related to a broad antimicrobial activity.² However, there is great concern about the use of CHX alone or in combination with calcium hydroxide paste due to its decomposition into a reactive oxygen species (ROS), pCA (4-chloroaniline), human carcinogens.⁶

The known limitations of conventional endodontic irrigants have led to the search for alternative solutions, with increasing interest in agents derived from

natural products and plant extracts.⁷⁻¹¹ Propolis is a resinous substance produced by bees (*Apis mellifera*), which is in general composed of 30% wax, 50% resin and vegetable balsam, 10% essential and aromatic oils, 5% pollen, and other substances with the aroma of poplar, honey and vanilla.^{12,13} Flavonoids and phenolic acids present in propolis are among the main responsible for the therapeutic biological properties¹³, such as anti-inflammatory, immunomodulatory, osteoinductive capacity^{12,14}, antioxidant activity^{10,11,14} and antimicrobial potential.^{9,11,15}

In endodontics, propolis has already been used as a storage medium for avulsed teeth⁷, pulp capping material¹⁶, intracanal paste⁹ and irrigating solutions.^{8,17} When investigating propolis samples as root canal disinfectant, Kayaoglu et al. (2011)⁸, in a dentin block model, observed the effectiveness of two propolis samples against *E. faecalis*; however, only one of the propolis samples with the highest level of flavonoids showed efficacy similar to CHX after a period of 7 days. Also, Awadeh et al. (2018)¹⁷ observed similar efficacy levels between propolis, CHX and NaOCl against *C. albicans* in root canals, and this result was not affected by the presence or absence of the smear layer, suggesting that it could be used as an alternative irrigating solution.

Different types of propolis are characterized and classified according to their chemical composition, whose biological properties are in conformity with their extraction method, as well as with type and botanical origin of the sample samples.^{13,18} The Brazilian green propolis (GP), whose most important botanical source is *Baccharis dracunculifolia* DC (*Asteraceae*), has already showed antimicrobial activity, anti-inflammatory and antioxidant capacity.^{11,12,18} On the other hand, few studies were found with Brazilian brown propolis (BP)^{9,11,12,18}, being only one investigation with the BP from Cerrado region, of botanical origin *Pterodon marginatus* and *Calophyllum brasiliense*⁹, in which, the effectiveness of BP-based intracanal paste, associated or not with calcium hydroxide, was observed against *E. faecalis*.

Few investigations about the effect of propolis samples on matrix metalloproteinase activity (MMPs) have been found. A previous study showed an inhibition of the activity of MMP-2 and MMP-9¹⁹ by propolis samples. However, no studies were found with Brazilian propolis extracts. MMPs are a family of zinc-dependent proteolytic activity enzymes that are involved in type IV collagen degradation, which are present in large quantities in human dentin²⁰, and may also compromise the integrity of the tooth-restoration interface, especially in the contact regions between resinous materials and dentin.²¹

The aim of this study was to identify secondary metabolites and to investigate crucial properties for endodontic irrigants, such as the antimicrobial activity, cytotoxicity, antioxidant capacity and effect on metalloproteinases of two Brazilian propolis samples. The null hypothesis tested was that the type and concentration of propolis samples do not affect the biological activities of interest.

II. METHOD

Ethanolic extracts from propolis samples

For obtaining the crude brown propolis (BP) and green propolis (GP) extracts, BP was collected in the Cerrado region of the state of Mato Grosso, and GP from the state of Minas Gerais state was obtained commercially (Biomendes Cosméticos e Produtos Naturais, Várzea Grande, MT, Brazil). The GP and BP ethanolic extracts were obtained by extraction in 80% cereal alcohol at 60°C and subsequent concentration in a rotaevaporator (Rotary evaporator 802, Fisatom, São Paulo, SP, Brazil).⁹

Quantification of secondary metabolites

To quantify the secondary metabolites (phenolic compounds, coumarin and flavonoids) of BP and GP extracts, the assays were performed according to the procedures previously described.²²⁻²⁴ To determine the amount of phenolic compounds (milligrams of tannic acid per gram of the extract), the Folin-Ciocalteu colorimetric method²² was used, using tannic acid as a reference standard, which oxidizes phenolic compounds (phenolates), reducing acids to a blue colored complex. The tannic acid calibration equation was $y = 0.005x + 0.0012$ ($R^2 = 0.9946$). The absorbance reading was performed by spectrophotometry at a wavelength of 760 nm (Spectrophotometer 800XI, Femto, São Paulo, SP, Brazil). The flavonoid content determination of the brown and green propolis extracts was performed using a spectrophotometer at 415 nm. The solution was prepared using aluminum chloride at 2.0% in methanol in a 1:1 solution.²³ The same procedure was performed using known solutions of quercetin standard to elaborate a standard curve. Furthermore, a blank sample was prepared under the same conditions and the quantity of flavonoid content was expressed as quercetin equivalents (EQ) (mg EQ/g). The amount of coumarin (milligrams of coumarin per gram of the extract) was based on its solubility in polar organic solvents and on the ionization of phenolic hydroxyls in alkaline medium, which causes a chromatic effect at 320 nm, proportional to the coumarin concentration.²⁴ The calibration equation of coumarin was $y = 0.007x + 0.0019$ ($R^2 = 0.9997$). In all tests, reagents

with no samples were used as negative control. The experiments were performed in triplicate.

Free radical-scavenger activity

Antioxidant capacity was determined by the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, as previously described¹⁰, with some modifications. The BP and GP crude extracts were diluted in methanol at a concentration of 10 mg/mL (stock solution). The antiradical activity of the extracts was evaluated using a dilution series, which involved the mixing of 1.8 mL of DPPH solution (0.208 mM DPPH in 80% methanol) with 0.2 mL of BP and GP extracts (3.125–400 µg/mL). After 30 min, the remaining DPPH radicals were quantified by absorption at 492 nm. The absorbance of each concentration of the BP and GP extracts (only sample with 80% methanol) was subtracted from absorbance of the samples with DPPH solution. Ascorbic acid (0.625–40 µg/mL) was used as reference antioxidant. The tests were performed in duplicate in three independent experiments. DPPH solution without the tested sample was used as a control. The percentage inhibition was calculated from the control with the following equation: $Scavenging\ activity\ (\%) = 100 - [Abs\ sample / Abs\ control] \times 100$

Minimum inhibitory concentration (MIC)

To determine the MIC of the BP and GP extracts, a broth microdilution was performed.⁹ The extracts were serially solubilized in dimethyl sulfoxide (DMSO). Four to five 24-hour colonies of *Enterococcus faecalis* were selected (ATCC 29212) and grown in Muller-Hinton Broth (Difco Laboratories, Mogi das Cruzes, SP, Brazil). Chloramphenicol (64 mg/mL) was used as a standard. *Candida albicans* (ATCC 90028) were seeded in Sabouraud's medium (Difco® Laboratories, Detroit, MI, USA) and liquid RPMI-1640 (bicarbonate-free, glutamine-phenol red indicator; Cultilab®, Campinas, SP, Brazil) buffered with MOPS buffer [3-9 N-morpholine propanesulfonic acid], at a final concentration of 0.165 mol / L, pH 7.0. Amphotericin B (16mg/mL; Difco® Laboratories, Detroit, MI, USA) was used as standard. Muller-Hinton (MH) broth was used as negative control for both strains. The resazurin technique was performed to assess cell viability.⁹ The tests were performed in duplicate in three independent experiments. The data were analyzed descriptively.

Cytotoxicity evaluation

To evaluate the cytotoxic effects, BP and GP ethanolic extracts were tested at 2.5 mg/mL, 1 mg/mL, 0.5 mg/mL and 0.1 mg/mL, which were solubilized in DMSO 1%¹¹ and, filtered with 0.22 µm diameter filter (KASVI, São José dos Pinhais, PR, Brazil). Cells of the mouse fibroblast L929 cell line were plated at an initial density of 20,000

cells in each well of a 96-well dishes (Costar Corp., Cambridge, MA, USA), containing 200 µL of complete DMEM with 10% FBS, supplemented with 100 IU/mL penicillin, 100 µg/mL streptomycin and 2 mmol/L glutamine (GIBCO, Grand Island, NY, USA). The cells were allowed to grow for 24h at 37°C with 5% CO₂ and 95% air. Then, the complete culture medium was replaced by 200 µL of different concentrations of BP and GP extracts. DMEM medium was used as negative control, while DMEM + 1% DMSO medium was used as control of propolis extracts. The L-929 cells were kept in contact with the extracts for an additional 24 h in an incubator. The cell metabolic activity was evaluated by succinic dehydrogenase (SDH) activity, which is a measure of the mitochondrial respiration of the cells, using the methyltetrazolium (MTT) assay.²⁵ The scores obtained from the MTT assay were submitted to the statistical analysis of Kruskal–Wallis complemented by Tukey's post hoc multiple comparison test, considering the significance level of 5%.

Zimography

To evaluate the effect of BP and GP extracts on metalloproteinases (MMPs), MMP-2 and MMP-9, zymography assay was performed as previously described²⁶, with some modifications. MMP-2 and MMP-9 were obtained from stimulated human saliva samples, which were centrifuged for 3 minutes at 1000 RPM, and the supernatant removed to obtain MMPs. Samples were stored at -20°C for later use. This study was approved by the Research Ethical Committee and was carried out in accordance with the principles of the Declaration of Helsinki (CAAE/UFPEL n° 64527316.4.0000.5318). In order to examine the effect of different concentrations of BP and GP extracts on MMPs activity, propolis extracts were solubilized in 2% DMSO at concentrations of 5 mg/mL, 2.5 mg/mL, 1 mg/mL and 0.5 mg/mL. A conditioned medium containing MMP-2 and MMP-9 was loaded onto preparative 0.05% gelatin- containing 10% polyacrylamide gels, mixed with an equal volume of non-reducing sample buffer [2% sodium dodecyl sulfate (SDS); 125 mM Tris–HCl (pH 6.8), 10% glycerol, and 0.001% Bromophenol Blue], and then electrophoresed. After electrophoresis, the gels were washed twice in 2% Triton X-100 for 60 min at room temperature, cut into strips of approximately 1 cm, and then each strip was incubated at 37°C for 24 h in Tris–CaCl₂ buffer containing the different concentrations of BP and GP extracts. EDTA (positive control; Reagen, São Paulo, SP, Brazil) was used to inhibit lytic activities caused by MMP-2 and MMP-9, while 0.5 mM N-ethyl-maleimide (NEM; negative control) was used to inhibit activities caused by serine

proteinases. Following incubation, the gels were stained with 0.05% Coomassie Brilliant Blue G-250. The gelatinolytic activity was detected as unstained bands. To quantify the relative inhibition of MMPs by different concentrations of BP and GP extracts, electrophoretic bands were scanned and the transmittance values thus obtained (note that the transmittance values of the zymogen, intermediate and active forms were added) were analyzed using the imagej software (NIH, Bethesda, MD, USA). Inhibition of the enzyme activity was plotted against the BP and GP extracts. Each assay was performed in triplicate and was repeated at least twice. Data were plotted and submitted to linear regression to investigate

MMP-2 and MMP-9 inhibition as a function of BP and GP extracts in different concentrations.

III. RESULTS

The results of the secondary metabolites content in BP and GP extracts and their antioxidant capacity against the DPPH free radical are presented in Table 1. GP presented higher levels of coumarins and flavonoids, while BP, higher levels of phenolic compounds. BP and GP extracts were able to inhibit 50% of free radicals (IC₅₀) at a concentration of 55.4 µg/mL and 38.3 µg/mL, respectively.

Table 1. Quantification of total phenols, flavonoids and coumarins, and the antioxidant capacity against the DPPH free radical (EC₅₀ ± SD) 50% of ethanolic extracts of green and brown propolis.

Ethanolic extracts	Quantification of secondary metabolites *			DPPH
	Total phenols (mg EAT/g) ± SD	Flavonoids (mg EQ/g) ± SD	Coumarins (mg EC/g) ± SD	EC ₅₀ (µg/mL) ± SD
Green propolis	19.6 ± 0.17	190.5 ± 0.21	238.7 ± 0.11	38.378 ± 0.735
Brown propolis	41.6 ± 0.12	70.5 ± 0.06	103.0 ± 0.26	55.489 ± 1.512
Standard substances **	885.6 ± 0.25	365.5 ± 0.21	137.3 ± 0.44	4.140 ± 0.613

*EAT / g = milligram equivalent of tannic acid per gram of sample; mg EQ/g = milligram equivalent of quercetin per gram of sample; mg EC/g = equivalent milligram of coumarin per gram of sample.

** Total phenols: Tannic acid; Flavonoids: Quercetin; Coumarins: Coumarin; DPPH: Ascorbic acid.

Table 2 shows the analysis of the antimicrobial activity of GP and BP extracts. The BP and GP extracts showed inhibitory activity against *C. albicans* and *E. faecalis*; however GP showed strong inhibition against *E. faecalis*.

Table 2. Minimum Inhibitory Concentration (MIC; mg/mL) of GP and BP extracts against *E. faecalis* and *C. albicans*.

Ethanolic extracts	<i>C. albicans</i> (mg/mL ± SD)	<i>E. faecalis</i> (mg/mL ± SD)
Green propolis	5.00 ± 0.17	2.50 ± 0.11
Brown propolis	5.00 ± 0.12	5.00 ± 0.12
Standard substances*	2.0 ± 0.06	0.25 ± 0.11

* *C. albicans*: Amphotericin B; *E. faecalis*: Chloramphenicol.

The cytotoxicity of BP and GP extracts, regardless of concentration, was statistically equal to the control group (DMEM), except for GP at the 2.5 mg/mL, which caused about 40% reduction in fibroblast cell metabolism (Fig. 1).

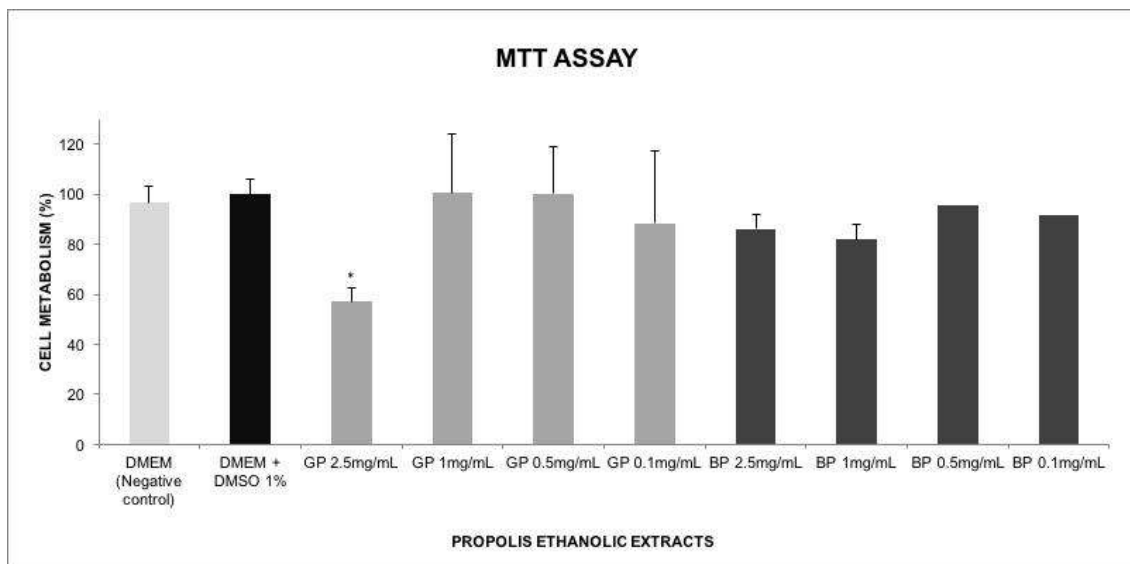


Fig. 1. Graphical representation of the cytotoxicity assessment (MTT test) of BP and GP extracts at different concentrations (Kruskal Wallis/Tukey test; $p < 0.05$).

*Statistically different group ($p = 0.006$).

** GP-Green Propolis; BP-Brown Propolis.

The evaluation of the effect of BP and GP extracts on MMP-2 and MMP-9 was showed in Fig. 2. Four major bands were detected in the zymographic assays. The strongest intensity ranges corresponded to an approximate molecular mass of 66 kDa (Act-MMP-2) and 72 kDa (pro-MMP-2). Two other bands of weaker

intensity corresponded to approximate values molecularde mass 77 kDa (Act-MMP-9) and 92 kDa (pro-MMP-9). Both BP and GP extracts, after 24 h of incubation, showed inhibitory effect against MMP-2 and MMP-9 from 1 to 5 mg/mL, being equivalent to the positive control (0.5% EDTA).

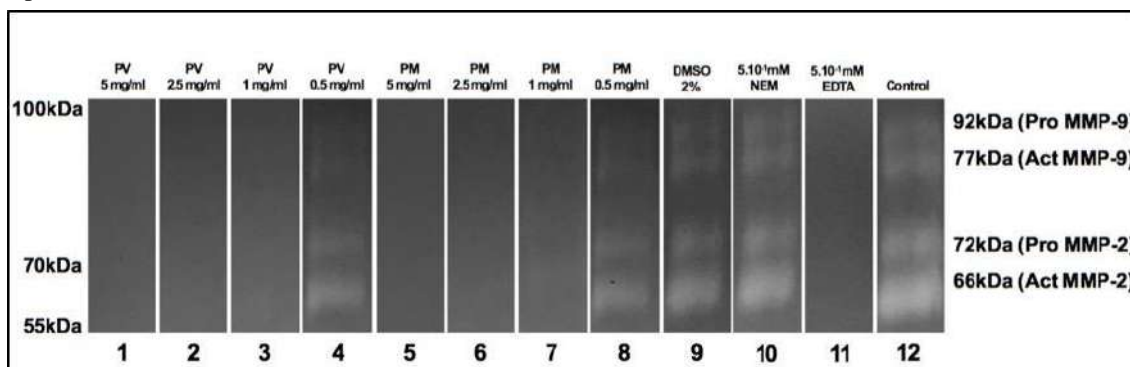


Fig. 2. Zymography for evaluation of the effect of BP and GP extracts at different concentrations against matrix metalloproteinase- 2 (MMP-2) and -9 (MMP-9) expression.

Control: Tris-CaCl₂ buffer only; EDTA (positive control); N-ethyl-maleimide (NEM/negative controle).

IV. DISCUSSION

The use of propolis extracts as endodontic irrigants might be of interest to patients and endodontists as part of the growing trend to seek natural medications as part of dental treatment.²⁷ The null hypothesis tested in this study was rejected, since the quantification of the secondary metabolites and the biological characteristics

investigated were affected by both the type and concentration of propolis samples.

Propolis samples have been classified and characterized according to it chemical composition, which depends on the extraction methods^{11,12} and phytogeographic characteristics, such as the climate of the region, the type of vegetation, the season and the existing

environmental conditions near the hive, or even the genetic variability of queen bees.^{13,18} In this study, ethanolic extracts of propolis samples were used, since the extraction method that uses alcohol as solvent has shown superior therapeutic results than the supercritical extraction method, as well as greater release and better purification of flavonoids, active components²⁸, which may be justified by the high solubility of propolis in ethyl alcohol.^{11,12} Also, the rotary evaporation method for obtaining the BP and GP ethanolic extracts used in the present is a simple and fast technique that allows a high yield of propolis extracts.⁹

The brown propolis investigated in this study originates from the Cerrado of the Pantanal Mato-Grossense, an area rich in guanandi trees (*Calophyllum brasiliense*), whose stem and leaf extracts have been shown to be active against Gram-positive bacteria and some types of fungi.²⁹ However, studies with Brazilian brown propolis from different regions have shown less biological activity.^{10,11,18} Zaccaria et al. (2017)³⁰ observed that a sample of European brown propolis was more active against oxidative stress and inflammation than a Brazilian green propolis, which reinforces the importance of the chemical composition of the samples that determines their biological functions through different mechanisms of action.

In this study, BP showed a higher level of phenolic compounds when compared to GP, which is in agreement with a previous study;¹⁰ while GP had higher levels of coumarins and flavonoids, which is consistent with an earlier study.¹² Phenolic compounds, especially flavonoids, have been reported to be responsible for the antimicrobial activity of propolis.¹²

Residual microorganisms may lead to treatment failure in endodontic therapy. *E. faecalis* and *C. albicans* have been selected due to their presence in persistent endodontic infections and their use in previous studies examining the effectiveness of disinfecting agents in endodontics.³¹ In this investigation, BP and GP showed activity against *E. faecalis* and *C. albicans*, in agreement with previous findings.^{8,9,15,17} However, twice the dose of BP (5mg/mL) in relation to GP (2,5mg/mL) was necessary to inhibit *E. faecalis*, which is consistent with previous investigations that found that antimicrobial activity is chemical composition and dose dependent.^{9,11,12,15,24} Pimenta et al. (2015)⁹ observed MIC for BP of 10 mg/mL, which was 2 times higher than our results, although the methodology was the same. Also, the authors investigating different intracanal pastes with BP samples, showed that 40% BP paste and 20% BP associated with calcium hydroxide paste were more

effective than calcium hydroxide paste against *E. faecalis* in an *in vitro* dentin model. The antibacterial and fungicidal activity of coumarin was previously observed,³² which could be a possible explanation for the action of BP and GP in this study against *E. faecalis* and *C. albicans*.

Although the chemical composition of propolis samples is extremely important for its standardization, its distinct pharmacological activities may also stem from the synergism that occurs between the many components, since the biological potential of propolis does not occur solely by the presence of a particular substance, but is resulting from a complex action of various compounds.^{8,9,11}

It has been claimed that biocompatibility assessment through primary cell culture are appealing, because these extracts as endodontic irrigants or any endodontic biomaterials could interact with such kind of cells after *in vivo* contact.³³ However, in the present study, the biological properties of propolis extracts were evaluated in L929 mice fibroblast cells. Fibroblasts are the major constituents of connective tissue, the predominant cell type of periodontal ligament and are the most important collagen producers in this tissue.³⁴ Moreover, fibroblasts secrete MMPs that are capable of initiating the degradation of extracellular matrix macromolecules, and this seems to be a key event for the progression of the inflammatory process.³⁵ In this study, both BP and GP extracts, after 24 h of incubation, showed inhibitory effect against MMP-2 and MMP-9 whose expression may induce an extracellular matrix proteolysis, and it seems to be a key initiating event for the progression of the inflammatory process.³⁶

Although the root canal irrigant should be contained within the root canal space during irrigation procedures, unintentional extrusion through the apical constriction may occur. This might cause irritation, inflammation, and possible delay in wound healing after endodontic procedures.³⁷ Matrix metalloproteinases (MMPs) play an important role in physiological and pathological matrix degradation. Flavonoids, at physiologically relevant concentrations, inhibit MMP-2 and -9. Flavonoids with increasing number of hydroxy groups and other modifications were compared for their capacity to inhibit recombinant catalytic domains of MMP-2 and -9.³⁸ Furthermore, particular plants are an excellent yielder of the flavonoids luteolin, apigenin, and their respective glycoside derivatives (7-O-rutinoside, 7-O-glucoside, and 7-O-glucuronide). The inhibitory activity of these flavonoids and their respective glycoside derivatives on the metalloproteases MMP-1, MMP-3, MMP-13, MMP-8, and MMP-9 was assessed and

rationalized correlating *in vitro* target-oriented screening and *in silico* docking.³⁹ Additionally, coumarins are heterocyclic organic compounds widely distributed in the plant kingdom and they exhibit important biological properties including antioxidant, anticancer, vasorelaxant, antiviral and anti-inflammatory activities. They have also been shown to exhibit an inhibitory effect on the activity of matrix metalloproteinases.⁴⁰ In our study, the GP ethanolic extract presented higher levels coumarins and flavonoids, which may justify the better inhibitory effect of MMPs and dose-dependent (Table 2).

Therefore, GB and BP ethanolic extracts are promising irrigant solutions that promote significant bacterial and confirm the optimal cycompatibility and antienzymatic potential. However, to establish protocols for their clinical application, further studies are necessary to evaluate their antimicrobial potential against other bacteria, animal models as well as to assess the possibility of dentin staining when using these ethanolic extracts.

V. CONCLUSION

The results of the present study demonstrated the antimicrobial and anti-enzimatic activities as well as the optimal biocompatibility potential of both Brazilian propolis extracts.

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Adsorption Properties of Activated Biochars Produced from Agro-industrial Residual Biomass

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Abstract— The use of organic wastes (residual biomasses) is a subject of great importance due to the enormous quantities generated around the world and the undesirable environmental impact caused by the incorrect disposal of this material. In this paper, it will be discussed the use of pyrolysis for some of these residual biomasses (coconut fiber, coffee silver skin and sugarcane bagasse and straw), reducing the volume and producing activated carbon for use in adsorption processes. The produced biochar was chemically activated by using potassium carbonate (K_2CO_3) and applied in the adsorption of copper (II) from aqueous samples. Batch experiments were done to evaluate the influence of contact time and initial metal concentration. The activated carbon produced proved to be an excellent adsorbent for metallic ions (Cu^{2+}) from aqueous solution, mainly due to its superficial area. Using an initial concentration of 500 mg L^{-1} of $Cu(II)$, the uptake of the activated carbon obtained from sugarcane straw was 135.7 mg g^{-1} , which is an excellent value for metal ions removal from water.

Short conclusion: The produced biochars, after the activation showed a very large surface area that confirms the potential use as a powerful adsorbent to recover polluted waters.

Keywords— Coconut fiber, silver skin, sugarcane; activated carbon; adsorption; copper.

I. INTRODUCTION

Biomass is an abundant source of energy and biomaterials and can be originated from agricultural wastes. [1,2]The use of these organic wastes is a subject of great importance due to the enormous quantities generated around the world and their undesirable environmental impact caused by the incorrect disposal. This topic assumes a great importance in Brazil [3,4]due to its intense agricultural activity generating a large amount of agro-industrial residues. The solution of this environmental problem is a challenge for researchers and the aim of the proposed processes must be not only to reduce the amount of residues but also to aggregate value to these materials.

Thermo-degradation is an important tool for reducing waste biomass volumes associated with agro-industrial activities and avoiding their inappropriate discard. In this

paper, it will be discussed the use of pyrolysis for some of these residual biomasses (coconut, coffee and sugarcane), reducing the volume and producing activated biochar for use in adsorption processes. The importance of these residues in the Brazilian economy and environment has been discussed in previous papers of our research group.[5-8]

These residual biomasses can be used in the pyrolysis process to obtain solid (biochar), liquid (bio-oil and water) and gaseous products. Biochar is the solid residue from the pyrolysis of biomass and are normally formed by organic residual carbon and inorganic oxides produced from the original biomass. Some of its uses is in soil management, waste management and water purification in sanitation stations.[9]

The properties of biochar can vary depending on the original biomass and the pyrolytic conditions. These properties are highly influenced by the temperature of pyrolysis, on the extent of carbonization increases with increasing pyrolysis temperature, increasing the carbon content, and decreasing the hydrogen and oxygen content in the resulting biochar. [6]

In general, biochar has low surface area, [10] consequently, it needs to be activated for increasing its surface area, porosity and change the volume and diameter of the pores. Activated carbon is one of the most effective adsorbents for removing a wide range of contaminants from industrial and municipal landfill leachate and contaminated groundwater. [11,12]

Metal ion salts are important contaminants from natural waters [13,14] and one of the ways to reduce this impact, besides the reduction or elimination of the source, is the use of efficient removal techniques, such as adsorption on porous solids. [13,14] The behavior of the metal salts against adsorption on activated carbon can be exemplified with the use of copper salts, since they have a behavior that is already well studied, although they are not among the most toxic in the environment. [15-20] Thus, with relatively simple techniques such as batch adsorption and measurement of residual ions by molecular spectroscopy in the visible region, it is possible to determine the adsorbent quality.

From the above information, the goal of this paper was to produce biochar from the pyrolysis of agro-industrial residues such as coconut fiber, coffee silver skin, bagasse and sugarcane straw. After the production of biochar, it was activated, characterized and tested in the adsorption of copper (II) in aqueous phase. Batch experiments were done to evaluate the influence of contact time and initial metal concentration.

II. MATERIAL AND METHODS

2.1. Biomasses

Coconut Fiber (CF) was provided by the Brazilian Agricultural Research Corporation (EMBRAPA) from Sergipe, Brazil. Coffee Silverskin (SS) was provided by a coffee processing company also from Sergipe (Brazil) and were collected directly from the industry production line. Sugarcane (straw and bagasse – SCS and SCB, respectively) were collected in the Taquari Plant, Capela, Brazil.

The ash content of the biomasses was determined according to the procedure adapted from Spanish Standard UNE 32 111 of October 1995. (UNE 1995) The tests were

carried out in a Nabertherm muffle furnace (model L 5/11) with air circulation.

2.2. Pyrolysis of Biomasses

The pyrolytic system used for the four biomasses was detailed reported in a previous work. [6] The conditions for the experimental process of the pyrolysis were as follows: 150 g of each biomass, heating rate of 20 °C min⁻¹ until 700 °C and residence time of about 35 min. The yield of the products obtained was calculated based on the total raw material fed into the reactor and the mass of products obtained (biochar and bio oil). The possible losses of the process were included in the calculation of the non-condensable gases, which were not the object of study of this work. All the experiments were conducted in triplicate. The biochar produced in this step were named as CFB - coconut fiber biochar; SSB - Silverskin biochar; SCSB - sugarcane straw biochar and SCBB - sugarcane bagasse biochar.

2.3. Activated Carbon production

The activated carbon were prepared by physical mixture of biochar (particle size below 0.297 mm) with ground potassium carbonate (K₂CO₃, Aldrich, 99%) in 1:3 weight ratio of biochar/K₂CO₃. The mixtures were activated in a horizontal furnace (Thermolyne mod. 21100) equipped with a ceramic tube, adapted with a stainless steel tube (15 cm in length and 2 cm in diameter) under N₂ flow (5 cm³ s⁻¹). The temperature was raised up to the activation temperature (800 °C) using a heating rate of 10 °C min⁻¹, and kept for 1 h. After cooling, under N₂ flow, the samples were thoroughly washed with distilled water up to pH 7 and dried at 100 °C. The activated carbons were named by adding the term AC (activated carbon) to the corresponding biochar name: CFAC, SSAC, SCSAC and SCBAC. The yield of the activation process was calculated by the difference of biochar mass used in relation to the activated carbon final mass.

2.4. Characterization of the biochar and activated carbon

2.4.1. Ultimate and proximate analyses

The proximate analysis was conducted according to ASTM D 3172-3175 standards, (ASTM 1999) and the results were expressed in terms of volatile matter, ash and fixed carbon contents. CHN analysis was performed in an elemental analyzer (Flash mod. EA 1112).

2.4.2. Nanotextural and Chemical Characterization

The textural characterization of the samples was made by N₂ adsorption isotherms at -196 °C measured in an automatic apparatus Micromeritics ASAP 2010. Before the isotherms acquisition, approximately 50 mg of the samples were out gassed overnight at 120 °C, under vacuum (P

$<10^{-2}$ Pa). From N_2 adsorption data, the apparent surface area, A_{BET} , and micro porosity were evaluated through, respectively, BET equation ($0.05 < p/p^0 < 0.15$) [21] and α_s method, taking as reference the isotherm reported by Rodriguez-Reinoso [22]. The pH at the point of zero charge (pH_{PZC}) was determined (Symphony SP70P pH Meter) by reverse mass titration, as proposed by Noh and Schwarz [23].

2.5. Batch adsorption experiments

The adsorption of copper onto different types of activated carbons was tested using standard metal solutions prepared from copper sulfate ($CuSO_4 \cdot 5H_2O$; CAS: 7758-99-8). An aqueous metal stock solution at 5000 mg L^{-1} were prepared by adding a metal salt to Milli-Q water and work solutions were obtained by diluted to obtain lower concentration solutions. All reagents used were of analytical reagent grade from Merck®. Prior to each experiment, the metal solution (25 mL) and adsorbent material (0.125 g) were mixed together in a specific flask with the initial pH of ~ 5.0 . The effects of the concentration of metal and adsorption time on the adsorption efficiency of copper ions over activated carbon were studied. The experiments were controlled through blank tests in the same conditions developed for the samples. For the study of the initial metal concentration solution at 500, 750 and 1000 mg L^{-1} of copper in water were tested with contact time of 24 h.

Adsorption kinetic studies were performed in a 750 mL erlenmeyer flask, using 500 mL of the aqueous metal solution and 2.5 g of the adsorbent. Aliquots (5 mL) were taken after 1 min, 2 min, 5 min, 30 min, 2 h, 8 h and 24 h of reaction. (Runtti et al. 2014) The experiments were done in triplicate and the relative standard deviations were calculated. All samples including the initial samples were filtered through $0.45 \mu\text{m}$ filter paper (Sartorius Stedim Biotech). The stirring was carried out in a chilled incubator

Marconi model MA830/A (at 100 rpm). The amount of copper was determined in the filtrate by UV-Vis in a Spectrophotometer Hach, model DL at 810 nm (maximum absorption wavelength found). The percentage removal of metal (%) from the solution was calculated by the equations follows: [24]

$$\text{Metal removal (\%)} = \frac{C_0 - C_e}{C_0} \times 100 \quad (1)$$

where C_0 and C_e are the initial and equilibrium concentrations in solution (mg L^{-1}).

The uptake q_e (mg g^{-1}) after equilibrium was calculated by using equation 2:

$$q_e = \frac{C_0 - C_e}{m} \times V \quad (2)$$

Where V is the volume of the solution (L) and m is the mass of the adsorbent (g).

III. RESULTS AND DISCUSSION

3.1. Yield of Pyrolysis Products

The results of the experiments are summarized in the **Table 1**. The mass yields varied from 22.1% (SCB sample) to 29.9% (CF sample), and presented coefficient of variation (CV%) of up to 2.7% (for SCB sample). For the liquid fraction (bio-oil + water), the mass yield varied from 31.8% (SCS sample) to 45.4% (SCB sample). Non-condensable gases (NCG) were not measured and were considered as all the produced gases (such as H_2 , CO_2 , CO , CH_4) expelled at the end of the process, in addition to other possible losses generated during the procedure, once they were estimated by difference. The NCG had the lowest value in the coconut fiber sample (CF sample 28.8%) and the highest value for the sugarcane straw sample (CS sample 40.7%).

Table 1: Mass yield of the pyrolytic process and for the activation for the biomasses studied.

Biomass	Yield in the pyrolysis					
	Biochar		Crude Bio-oil(*)		NCG(**)	
	Yield (%)	STD% (***)	Yield (%)	STD%	Yield (%)	STD%
CF	29.9	2.4	41.3	3.2	28.8	4.6
SS	29.4	1.7	35.6	2.7	35.0	1.4
SCS	27.5	1.3	31.8	2.7	40.7	1.4
SCB	22.1	2.7	45.4	3.8	32.5	7.1

(*) Crude Bio-Oil = bio-oil composed by organic and aqueous phase;

(**) NCG = non-condensable gases

(***) STD% = standard deviation

CF= coconut fiber; SS= Silverskin; SCS= sugarcane straw; SCB= sugarcane bagasse.

The mass yield of pyrolysis products are similar to others researches for coconut fiber,[25,26]sugarcane straw [27]and sugarcane bagasse.[25,28]The higher amount of biochar was found in the pyrolysis of silverskin (29.4%) and coconut fiber (29.9%). There are not registers in the literature about pyrolysis of silverskin, the main researches in this area were related to coffee bean pyrolysis, and the result are similar to found in this search.[29]

3.2. Biochar Characterization

In **Table 2** it is presented the results of proximate and elemental analysis of the biochar. These parameters could define the main characteristics of the fuel, and includes the moisture content, volatile matter, ash and fixed carbon, beside the elemental analysis namely the contents of C, H, O and N (wt.%).

Table 2: Proximate and elemental analysis of biomasses, biochar and activated carbons.

Sample	(wt. %)									
	Moisture	VM(*)	ASH	FC(**)	C	H	N	O(***)	H/C(****)	
Biomass	CF	-	-	3.9±0.03	-	49.6	5.9	0.5	44.0	1.4
	SS	-	-	4.8±0.02	-	44.7	5.4	2.1	47.8	1.5
	SCS	-	-	4.8±0.02	-	46.6	6.5	1.2	45.7	1.7
	SCB	-	-	1.4±0.02	-	43.2	7.3	0.9	48.6	2.0
Biochar	CFB	1.1±0.01	19.3±0.02	5.3±0.01	75.4±0.04	76.4	0.4	1.0	22.2	0.1
	SSB	1.2±0.01	21.9±0.04	11.4±0.02	66.7±0.03	80.4	2.3	1.0	16.3	0.3
	SCSB	2.6±0.01	29.9±0.03	6.9±0.01	63.2±0.04	69.5	3.6	0.4	26.5	0.6
	SCBB	1.4±0.01	29.2±0.03	4.4±0.01	66.4±0.03	71.7	3.6	0.5	24.2	0.6
Activated carbon	CFAC	3.6±0.02	14.1±0.04	8.5±0.02	77.4±0.05	62.8	3.2	0.9	33.1	0.6
	SSAC	3.4±0.01	16.3±0.02	16.1±0.04	67.6±0.06	73.7	1.9	1.7	22.7	0.3
	SCSAC	4.2±0.01	11.7±0.02	11.2±0.03	77.1±0.04	68.4	2.1	0.8	28.7	0.4
	SCBAC	6.0±0.01	8.5±0.02	6.5±0.03	85.0±0.06	74.8	3.0	0.7	21.5	0.5

(*)VM=Volatile matter; (**)FC= Fixed carbon; (***)By difference; (****)Atomic ratio between hydrogen and carbon.

Samples = CF= coconut fiber; SS= silverskin; SCS= sugarcane straw; SCB= sugarcane bagasse; CFB= coconut fiber biochar; SSB= silverskin biochar; SCSB= sugarcane straw biochar; SCBB= sugarcane bagasse biochar; CFCA= coconut fiber activated carbon; SSCA= silverskin activated carbon; SCSCA= sugarcane straw activated carbon; SCBCA= sugarcane bagasse activated carbon;

Based on these data, the nature of biomass have pronounced effects on the development of the volatile matter, ash and fixed carbon, as shown in **Table 2**. The biomass elemental composition reveals that they are composed mainly by carbon, oxygen and hydrogen, as can be expected in most lignocellulosic materials.[30]

The biomasses present low ash content and showed to be suitable for pyrolysis. The ash content and its composition

are important factors for biomass use in thermochemical processing due to its catalytic activity. [31] This biochar could be utilized as a cheap absorbent, carbon coating, solid fuel, direct fuel, household briquette, carbon sequestration and soil improvement. [32]

Elemental analysis results revealed that the carbon content is increased after pyrolysis in all the samples, as it was expected. The values are similar to those previously

reported for coconut fiber [33,34], silverskin [35], sugarcane straw [27] and sugarcane bagasse. [36,37] The high nitrogen content of the silverskin sample was already expected due to the origin of the biomass, which has a high content of this element, mainly due to the presence of caffeine and its homologues.

During the activation step, the action of the oxidant agents produce an increase in oxygen content and a decrease in carbon content as can be observed in **Table 2**, but chemically activated carbons still presented a carbon content (62.8% - 74.8%). The change in the elemental content is in agreement with the concentration of oxygenated functional groups on the surface of the activated biochar.

The H/C ratio gives an idea of the aromaticity of the sample and, as a consequence, their energy power. Very

Table 3: Mass yield, surface area (BET), volume of micro and mesoporous, pH_{PZC} and uptake of activated carbons.

Activated carbon	BET Area ($m^2 g^{-1}$)	VT ($cm^3 g^{-1}$)	Vme ($cm^3 g^{-1}$)	Vmi ($cm^3 g^{-1}$)	Vul ($cm^3 g^{-1}$)	Vsu ($cm^3 g^{-1}$)	pH_{PZC}	q_{max} ($mg g^{-1}$)
CFAC	1130	0.55	0.05	0.50	0.25	0.25	6.3	28.6
SSAC	1308	0.66	0.07	0.59	0.18	0.41	7.6	93.3
SCSAC	1185	0.58	0.08	0.50	0.27	0.23	5.9	135.7
SCBAC	791	0.37	0.03	0.34	0.11	0.23	6.6	16.7

BET Area: total surface area; VT: total volume; Vme: mesoporous volume; Vmi: microporous volume; Vul: ultra-microporous volume; Vsu: super-microporous volume; q_{max} : uptake.

Samples: CFAC= coconut fiber activated carbon; SSAC= silverskin activated carbon; SCSAC= sugarcane straw activated carbon; SCBAC= sugarcane bagasse activated carbon.

During chemical activation by K_2CO_3 , the chemical agent is introduced into the precursor, producing physical and chemical changes and modifying the thermal degradation process. The textural parameters reveal that the chemically activated carbons prepared have a well-developed porous structure, enhancing the porosity. The isotherms configuration reveals that the samples have a well-developed microporous structure associated with some mesoporosity, detected by an upward deviation of the curves for higher p/p_0 values. Pore characteristics of all activated carbons are given in **Table 3**. Specific surface areas obtained after activation steps are similar, or slightly superior, to those of activated carbons produced in laboratory scale, ranging between 800 and 1300 $m^2 g^{-1}$. [39]

It may be noted that activated carbons produced from silverskin, coconut fiber and sugarcane straw have a higher specific surface area than those produced from sugarcane bagasse. This may be due to the lignocellulosic composition of the precursors, which influences in the

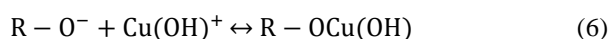
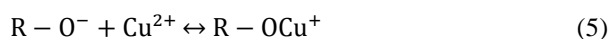
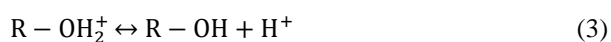
high values indicate low aromaticity, that is, high number of hydrogen atoms related to the carbon ones and lower energy power. The H/C atomic ratios obtained for the bagasse samples were higher than the other biomasses, indicating a lower proportion of condensed structures, besides tending to have a greater energy potential. Studies with lignocellulosic biomass demonstrate similar results both in relation to the elemental analysis and in relation to the atomic fraction H/C. [36,38] In the production of activated carbon, a relatively high yields was obtained for the four samples. The mass yields of activated carbon obtained in this work was 65.3, 44.2, 57.5 and 72.5% for CFAC, SSAC, SCSAC and SCBAC samples respectively, that can be considered satisfactory if the porosity are adequate.

biochar yield and porosity due to the differences in thermal stability of the major components (lignin, cellulose, hemicellulose). [40] All samples generated activated carbons with a high percentage of microporosity (approximately 90%) and a lower mesopores concentration (**Table 3**).

Concerning the surface chemistry, the pH_{PZC} values (**Table 3**) of the materials activated at 800 °C revealed that the chemistry activation produces a material with slightly acidic surface for the coconut fiber, sugarcane straw and bagasse (pH_{PZC} 6.3, 5.9 and 6.6, respectively). However, the activated carbon derived from silverskin presents a basic surface chemistry (pH_{PZC} 7.6). This difference of acidity in the surface indicates different uses for the activated carbons, and for the biochar itself, if it would be applied as a soil corrective.

3.3. Adsorption studies

The pH of the aqueous solution is an important parameter in the adsorption process because it affects the aqueous solution chemistry and the adsorbent surface binding sites. The relation between pH and the efficiency of the adsorption of copper could be interpreted by the pH effects on: (1) the association/dissociation of surface functional groups from the activated carbon; (2) the surface charges; (3) the formation of ion species, and (4) the interactions between functional group and metal ions. Below pH 5, the main species involved in the adsorption process is free ions Cu (II) [41], while at low pHs, the electrical repulsion between Cu (II) ions and positively charged functional groups on the carbon surface are responsible for low Cu adsorption. In addition, at low pHs, the overall surface of the carbon becomes positive and hinders the binding of positively charged metal ions. At pH values higher than 5.0, precipitation of insoluble metal hydroxides occurs which restricts the adsorption studies. This effect can be explained by the interaction and equilibrium of the Cu (II), Cu (OH)⁺ and Cu (OH)₂ species with the surface functional groups on the activated carbon, according to the equations below [42]:



Where:

R represents the active sites on the surface of activated carbon;

R - OH₂⁺, R - OH, R - O⁻ are protonated, neutral, and ionized surface hydroxyl functional groups; and

R - OCu⁺ and R - OCu(OH) are complexes species involving the copper.

From this and considering the literature for copper (II) adsorption, the pH selected for all experiments was 5. [43-45]

3.4. Effect of contact time

The adsorption of Cu (II) on four activated carbon produced was studied as a function of adsorption time from 1 min to 24 h. Corresponding results are showed in **Figure 1**. In all cases, the rate of percent metal removal was rapid during the initial stage. This is due to the high concentration gradient in the beginning, which exhibited a high driving force for the migration of copper ions from solution to the surface of activated carbons; in addition, there was a larger surface area of the adsorbent being available for the adsorption of Cu (II) in the process beginning. Thereafter the rate of adsorption was lower and finally approached equilibrium, reaching a plateau (mainly for the SSAC and SCSAC activated carbons) after 480 min of contact time between the two phases. For the all activated carbons, the maximum uptake is not achieved during adsorption experiment (24 h). SCSAC was the sample that most approached the maximum adsorption reaching, in 24 hours, 76% of removal (**Figure 1**).

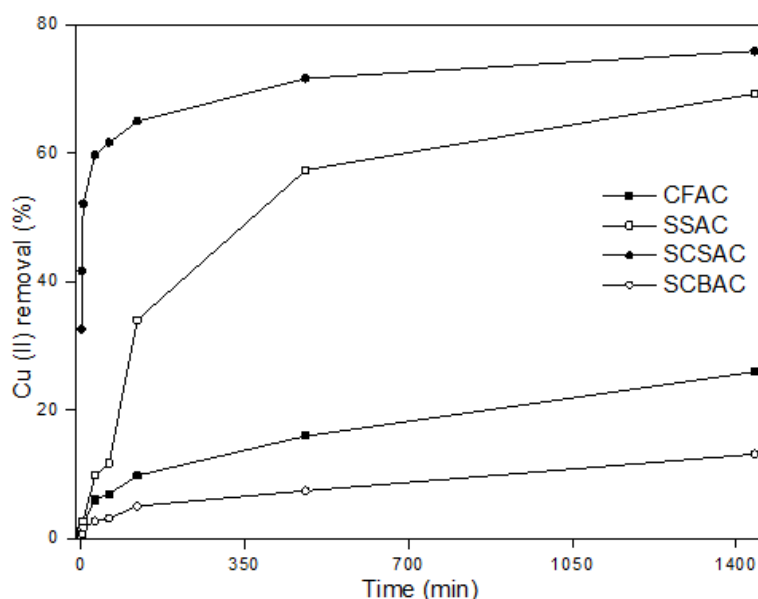


Fig.1: Effect of contact time on the removal efficiency (%) on the different samples.

Legend: CFAC= coconut fiber activated carbon; SSAC= silverskin activated carbon; SCSAC= sugarcane straw activated carbon; SCBAC= sugarcane bagasse activated carbon;

3.5. Effect of initial metal ion concentration

Experimental results for the removal of copper on the four tested activated carbon in the metal concentration range from 500 to 1000 mg L⁻¹ using 0.125 g/ 25 mL activated carbon are shown in **Table 03**. Different Cu (II) concentration resulted in different uptake. The amount of metal ions adsorbed on the activated carbon varied from 20.0 to 28.6 mg g⁻¹ (for CFAC); 64.8 to 93.3 mg g⁻¹ (for SSAC); 76.7 to 135.7 mg g⁻¹ (for SCSAC); 13.3 to 16.7 mg g⁻¹ (for SCBAC) (**Figure 2a**). In all of the samples (except CFAC), the q value increased with increase of the concentration, that is, the maximum sorption capacities of

SSAC, SCSAC and SCBAC was get in the concentration 1000 mg L⁻¹. The increase in uptake may be because the high concentration of metal ions provides greater driving force for the transfer process to overcome the mass transfer resistance. Thus, the driving force to overcome all the mass transfer resistances of the metal ions from the aqueous phase to the solid phase provided higher probability of collision between metallic ions and the active sites of the activated carbon. [46] Considering the percentage of copper adsorbed, the optimum initial metal concentration for all the samples was 500 mg L⁻¹ (**Figure 2b**).

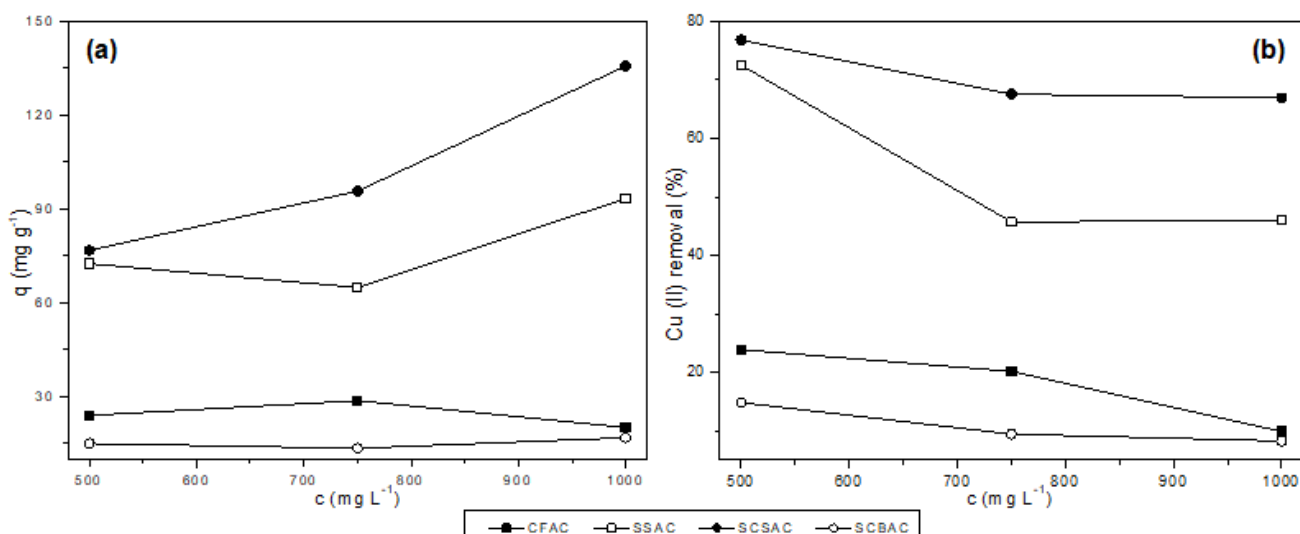


Fig.2: Effect of initial metal ion concentration on the efficiency of the processes: (a) amount of copper adsorbed per gram of adsorbent (q) and (b) percentage of removal of the copper ions by the different sorbents

Legend: CFAC= coconut fiber activated carbon; SSAC= silverskin activated carbon; SCSAC= sugarcane straw activated carbon; SCBAC= sugarcane bagasse activated carbon;

The uptake of SSAC (93.3 mg g⁻¹) and SCSAC (135.7 mg g⁻¹) indicate that the activated carbons, derived from silverskin and sugarcane straw, have extraordinary uptake for Cu (II). These values are almost an order of magnitude higher compared to adsorption capacities of activated carbon obtained from other biomass. [43,44,47]

This can be explained by the surface chemistry of the studied materials in addition to their microporosity characteristics. These data show the importance of the type of the starting material on the efficiency of adsorption of metallic ions. These both samples (SSAC and SCSAC samples) are those that presented greater superficial areas in relation to the others activated carbons studied (**Table 2**).

IV. CONCLUSIONS

These results showed that it is possible to produce high quality activated carbon from agro-industrial residues as those studied here. The advantage is not only in the cost of the raw material, adding value to an environmental waste not adequately used, but also in the quality of the product, that achieves similar surface areas and, sometimes superior, to activated carbons produced in laboratory scale.

The activated carbon produced proves to be an excellent adsorbent for metallic ions (Cu²⁺) from aqueous solution, mainly due to the surface chemistry and their microporosity characteristics. Using an initial concentration of 500 mg L⁻¹ of Cu(II), the uptake of the activated carbon obtained from sugarcane straw was 135.7 mg g⁻¹, which is an excellent value for metal ions removal from water. Beside this, the sample achieved a maximum

adsorption in 24 hours, with 76% of removal of Cu(II) from the aqueous matrix.

In previous works, we have already demonstrated that another important product from pyrolysis of agro-industrial residues (bio-oil) can be obtained.[7,48-50]The results achieved in this paper demonstrated that is possible to propose a total exploitation of these residual materials, including the use of biochar beside bio-oil. In that sense, it is possible to think in a bio-refinery based on these wastes.

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Design of Men's Casual Bags with Tumpar Embroidery Motif using the Kansei Engineering Method and the Ergonomic Model

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Abstract—This study aims to determine product attributes of men's casual bags using embroidery tumpar motif from the design and product specifications according to user needs. Tumpar is embroidery from the Dayak tribe in East Kalimantan, Indonesia and has a unique motif. This study uses the Kansei Engineering method. The purpose of the Kansei Engineering method is to translate the image of consumers or consumer feelings into real design components in order to obtain flexible bag product specifications according to consumer desires. The objects observed were 55 men respondents who were given an online questionnaire due to the Covid 19 pandemic situation. From the the result of SPSS 25 abaout analysis factors that influence the design of men's casual bags, it is concluded that ergonomic factors and innovative factors greatly influence the design of the bag. The specification of ergonomics are small size, sling bag mode, light weight, netral color and need space to put personal items. The specification of innovative are simple but unique design, material from a combination of leather and natural materials, and regional cultural elements.

Keywords—Casual Bags, Tumpar Embroidery, Kansei Engineering, Ergonomic, innovative.

I. INTRODUCTION

Bags have become a necessity that can facilitate our daily activities. A bag is a closed container that can be carried around. The materials for making bags include paper, plastic, and others. A bag that can be carried on your back is called a backpack, while a large bag to hold clothes is called a suitcase.

Bag users are from children to adults. The development of fashion is currently very fast, one of them is bag design. In the past, bags only functioned to carry goods, but now their function is more to enhance your appearance or for mere fashion purposes. Advertising is a medium that can accelerate the development of bag designs. These advertisements have succeeded in making the bag one of the best-selling fashion products to date. This makes people's mindset and behavior change, from seeing only a bag as a tool to lift objects to a part of fashion that can beautify and elevate the wearer's degree.

Design cannot be separated from the development of ideas, technical development, production processes and market enhancement. Trends will be formed from users, so that many models come and go. Based on its function,

most of the bag users are women, but with the development of bag models that are universally designed, many men also complement their fashion styles by using bags.

Bags that have elements of good health are those that have good ergonomic value. One of the ergonomic factors is the anthropometric dimension [1]. Bags that have elements of good health are those that have good ergonomic value. One of the ergonomic factors is the anthropometric dimension [2][3].

The most popular men's bag is the backpack, but nowadays men use a casual bag for their fashion i.e. sling bag, brief case, messenger bag, waist bag.

Sulam tumpar is the same embroidery in general, what distinguishes it is the embroidery motif [4]. Sulam tumpar is embroidery from the Dayak tribe in East Kalimantan, Indonesia. This embroidery motif is very unique when applied to fashion products such as men's casual bags.



Fig 1. Tumpar embroidery motif

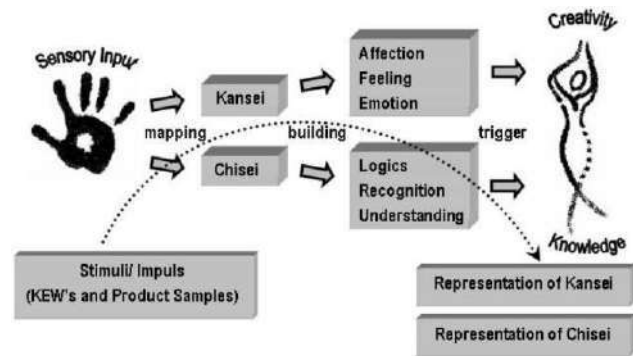


Fig 2. The working principle of Kansei Engineering

Lifestyle is a feature of a modern world, or what is commonly called modernity lifestyle and fashion have become a part inseparable from modern society in this era of globalization. The current design direction is towards personal identification, where the design adapts to the user's desires, character and lifestyle apart from design, shape and model, a design cannot be separated from ergonomic factors.

Kansei Engineering is a type of technology that translates customer feelings into design specifications [5]. In the Kansei method, emotional research requires all sensory input from the user.

This research is written to describe aspects of men's casual bags design that prioritize the emotional aspects (Kansei Engineering) and the Ergonomic aspects of users. If the Kansei Engineering method is carried out in a manner right, it will produce a product that is not only efficient but has aesthetic and ergonomic value.

II. LITERATURE REVIEW

2.1. Kansei Engineering

Kansei comes from Japanese to describe the expression of one's impression of, situations, artifacts and surroundings. The Kansei process begins with gathering functions related to feelings, emotions and intuition, through the five senses (namely sight, hearing, smell, taste and skin sensation). Figure 2 shows the Kansei and five sensory processes in the brain structure [6].

In general the working principle from kansei engineering seen in figure 2 [7]. Discussions related to experiences that occur within the design team prior to the idea creation activity are another step in the design development process. [8].

Kansei design, inspired by Japanese philosophy and culture, is founded on a non-reductionist point of view. By focusing on the central relationship between humans and the world or the environment around them, it is hoped that it can generate dynamism, and more opportunities for creativity [9][10].

Kansei engineering (KE) is known as a user-oriented technology investigate the emotional needs of users and determine the relationship between emotions and the design features of a product [11]. Kansei can be used for developing strategies, new products, marketing campaigns and market segmentation projects at the near future [12].

Customer input in product development can be done through direct customer feelings. The role of the customer can provide a clear problem allocation to the emotional design orientation of the product. This can significantly enhance the customer's emotional experience [13].

Kansei refers to sensitivity, feelings and emotions [14][15][16]. Kansei is defined as a high function of the brain associated with emotions, sensitivity, feelings, experiences [17]. Research using Kansei involves sensitivity, precision, feelings and emotions that are aligned through the 5 (five) sense; sight, hearing, smell, taste as well skin sensation. The term Kansei was then translated into an engineering method called Kansei Engineering.

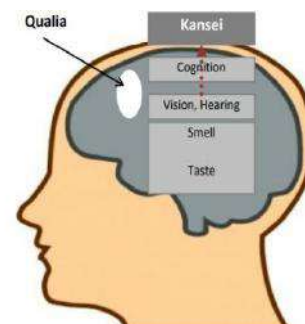


Fig. 3. The Process of Kansei

2.2. Kansei Engineering Techniques

In using the Kansei engineering method, input from respondents are required. respondents play an important role as input in the next process to analyze product design characteristics [18]. Consumer kansei measurement techniques depending on the methodology of the type KE will be used. There are at least 8 types of KE namely as follows [19][20].

- a) Type 1 is Category Classification : In Kansei Type-I, the first step is to determine the product strategy and create a concept in its design. Then collect the Kansei words related to the concept.
- b) Type 2 is the Kansei Engineering System : In Kansei Type II, it has a mathematical and statistical system for connects Kansei with the nature of a product. Kansei Engineering consists of a database that combines a number of Kansei words, images, knowledge, design, and color about the relationship between data.
- c) Type 3 is the Hybrid Engineering System : Kansei Type III is almost similar to Kansei Type II. The difference between the two types is that Kansei Type II can only change the consumer into a Kansei design parameters while Kansei Type III can predict the nature of a a product that is better known as a hybrid system.
- d) Type 4 is Kansei Engineering Modeling : This type of Kansei Modeling implements a mathematical model that aims to predict consumer feelings into words.
- e) Type 5 is Virtual Kansei Engineering : This type of Kansei Engineering is an extension of the KES technique that uses virtual reality (VR), a powerful technology for placing consumers in 3D virtual environment
- f) Type 6 is Collaborative KE Design : Collaborative Kansei Engineering Designing is a type of Kansei that is supported by the system Internet.
- g) Type 7 is Concurrent KE : Concurrent engineering methods are used for integrating the design department with the production department. Design stage divided into 2 stages, namely the project planning stage and the conceptual design stage.
- h) Type 8 is Rough Set KE : A way to use rough set theory in Kansei Engineering considering multiple users and/or multiple Kanseis.

III. METHOD

1. Initial research design : at this stage the target group, market and specifications of new products
2. Collect Kansei word gathering: Kansei words can be adjectives, nouns, verbs and sometimes sentences. This stage is part of the Category Classification method is a structural tree of events main to other parts of the incident
3. Preparation of the Differential Semantic (SD) questionnaire: Differential Semantics (SD) is a measure psychological. At this stage, kansei words that have been collected previously paired with the opponent of kansei words
4. Distributing questionnaires SD I : This stage is carried out by distributing questionnaires to customers and batik sellers for evaluate each pair of words that kansei has designed.
5. Statistical analysis I : Kansei I word selection is done with several statistical methods such as validity test, test reliability and factor analysis.
6. Design : The statistical analysis results above are a number design categories and elements to suit kansei men's casual bag customer.

IV. FINDINGS AND DISCUSSION

4.1. Target Group, Gap, and New Product Spesification

The object of the study was men aged over 20 years. The questionnaire was distributed online due to the Covid 19 pandemic conditions towards 55 respondents who live in the East Kalimantan region. Gap in this research focused on customers who want a casual bag for men who have a new look according to the customer's emotions.

At the end of the research, product specifications are wanted to be achieved in the form of a new motif Bag for men with characteristics a design adapted to the male character, also according to the principles of ergonomics.

4.2. Collect Kansei Word

Kansei word collection is obtained from distributing questionnaires to users. From the results of the collection of kansei words, 46 kansei words are obtained which will then be classified based on 10 categories and finally will be used as the basis for making semantic differential I questionnaires. Category Classification of Kansei Word shown in Table 1. Category Classification is a method for reduce data by creating levels (levels) from main concept to sub-level concept.

Table 1 Category Classification

Exclusive	Cool	Formal	Contemporer	characterized
elegant	Fashionable	traditional	Mix	typify
Deluxe	Modern	old fashion	up to date	designed
elite		out of date	present	indicate
classy		Classic		Specify
luxurious				
Ergonomics	Identity	Awesome	accessory	innovative
comfort	alignment	eye catching	detail	futuristic
functional	closeness	amazing	specific	new
aesthetic	uniformity		attribute	unique
Efficient	similaarity		point	
			feature	

$R_{table} < R_{count}$ means the data is valid and can be used for further testing (Table.3).

Table 3 Validity Score

	Rcount	R table	Ket
Exclusive (X1)	0.773	0.266	Valid
Cool (X2)	0.592	1.266	Valid
Formal (X3)	0.846	2.266	Valid
Contemporer (X4)	0.856	3.266	Valid
Characterized (X5)	0.672	4.266	Valid
Ergonomics (X6)	0.884	5.266	Valid
Identity (X7)	0.813	6.266	Valid
Awesome (X8)	0.843	7.266	Valid
eature (X9)	0.952	8.266	Valid
Innovative (X10)	0.909	9.266	Valid

4.3. Semantic Differential I Questionare

Table 2 Semantic Differential I Questionare

Exclusive	5	4	3	2	1	Non exclusive
Cool	5	4	3	2	1	Unfashionable
Formal	5	4	3	2	1	Unformal
Contemporer	5	4	3	2	1	Classic
characterized	5	4	3	2	1	Uncharacterized
Ergonomics	5	4	3	2	1	Not ergonomic
Identity	5	4	3	2	1	unidentity
awesone	5	4	3	2	1	awful
feature	5	4	3	2	1	entity
innovative	5	4	3	2	1	uninnovatif

4.4. Statistical Analysis

- Validity test

Validity test is to determine validity whether or not a questionnaire. if the question is able to reveal something which you want to measure in a study, the questionnaire is valid.

Validity test using SPSS 25 with 10 variables from the classification of kansei word categories, obtained valid results for each variable. he value of

- Reliable Test

Reliability test shows consistency and stability of a score (measurement scale). Reliability is different with validity because it focuses on consistency issues and more attention to accuracy problem. To find out the reliability value of the 10 measured variables is from the cronbach alpha value. The data is reliable because Cronbach alpha 0. 941 (Table 5). If Cronbach alpha value \geq 0.6 then the variable is reliable.

Table 4 Reliability Score

Reliability Statistics	
Cronbach's Alpha	N of Items
.941	10

4.5. Factor Analysis

Factor analysis is a reduction procedure data in multivariate statistical techniques. With the correlation between variables will be formed a new variable (variable latent) which is less number than the variable initial (manifest variable).

In the Kansei concept Engineering System, the results of this factor analysis will be focus space in determining

the items and product design categories based on image or feeling customers in the word kansei.

From the results of this factor analysis (Fig. 5) it is known that in choosing the casual men's bag based on feelings or images the product is influenced by 2 factors. That factors are grouping 10 existing variables into ergonomics factor and innovation factor (table 3 and table 4).

Component	Total Variance Explained								
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.832	68.317	68.317	6.832	68.317	68.317	5.001	50.011	50.011
2	1.353	13.534	81.851	1.353	13.534	81.851	3.184	31.839	81.851
3	.675	6.751	88.602						
4	.407	4.070	92.672						
5	.274	2.738	95.410						
6	.191	1.915	97.325						
7	.094	.938	98.264						
8	.085	.855	99.118						
9	.056	.562	99.680						
10	.032	.320	100.000						

Extraction Method: Principal Component Analysis.

Fig. 4 Total Variance Explained

	Component	
	1	2
	x1	.791
x2	.552	.774
x3	.858	.123
x4	.843	.480
x5	.702	-.579
x6	.903	-.009
x7	.815	.048
x8	.848	-.277
x9	.961	-.035
x10	.916	-.083

Extraction Method: Principal Component Analysis.
 a. 2 components extracted.

Fig. 5 Components Matrix

	Component	
	1	2
	x1	.816
x2	.003	.950
x3	.629	.596
x4	.411	.879
x5	.907	-.066
x6	.732	.530
x7	.637	.510
x8	.852	.264
x9	.804	.527
x10	.796	.462

Extraction Method: Principal Component Analysis.
 Rotation Method: Varimax with Kaiser Normalization.
 a. Rotation converged in 3 iterations.

Fig.6 Rotate Componen Matrix

Table 5 Analysis Factors

	Variable	Score	Name of factors
1	Exclusive	0.816	Ergonomics
	Formal	0.629	
	characterized	0.907	
	Ergonomics	0.732	
	Identity	0.637	
	awesone	0.852	
	feature	0.804	
	innovative	0.796	
2	Cool	0.950	Innovative
	Contemporer	0.879	

4.6. Spesification Design

From the analysis of the factors, the influence of the casual men's bag design are ergonomic factors and innovation factors. Then, a further questionnaire was distributed to find out what the ergonomics and innovation criteria are needed, and the average results were obtained :

Table 6 Specification Design

Ergonomic	Innovative
<ul style="list-style-type: none"> Bags need space to put vehicle keys, cigarettes / vape, note books, pen, 	<ul style="list-style-type: none"> Simple but unique design

wallet or handphone.	<ul style="list-style-type: none"> • Material from a combination of leather and natural materials (ulap and sulam tumpar doyo) • regional cultural elements
<ul style="list-style-type: none"> • Small Size • Sling Bag is more popular than waist bag and backpacker. • Light weight • Netral color 	

V. CONCLUSION

From the analysis and discussion, it can be concluded that :

1. The design of men's casual bags is influenced by ergonomic and innovative factors.
2. The specification of ergonomics are small size, sling bag mode, light weight, netral color and need space to put vehicle keys, cigarettes/vape, note book, wallet or handphone.

The specification of innovative are simple but unique design, material from a combination of leather and natural materials, and regional cultural elements (tumpar embroidery motif)

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Phytochemical analysis, antioxidant activity and *in vitro* ocular irritation of *Hibiscus rosa-sinensis* L. extracts

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Abstract— *Hibiscus ssp.* is a source of phytochemicals, mainly anthocyanins, widely known for its medicinal properties. The aim of this study was to develop a microwave-assisted extraction (MAE) method to extract bioactive compounds from yellow and red petals of *Hibiscus rosa-sinensis* L. (HRS) and evaluate their antioxidant and eye irritation potential. For MAE, the effect of microwave power, irradiation time, solvent concentration and solvent volume was tested. The antioxidant activity and eye irritation potential were evaluated. The extracts were analyzed by LC-DAD-ESI-IT-MS/MS. The acidified aqueous extraction was the best choice for the recovery of anthocyanins, while hydroethanolic was best extractor solvent to recovery flavonol and flavanols. MAE extracts showed efficient recovery: total phenolic content (28.4 and 23.2 mg GAE/g), total flavonoids content (44.8 and 34.5 mg RE/g), total anthocyanins content (4.1 and 16.3 mg Cy-3-glu/100 g) and extraction yields (29.5 and 23.2 %) and remarkable antioxidant activity ($IC_{50}=12.35$ and 15.76 mg L^{-1}) for yellow and red petal extracts, respectively. Main compounds were cyanidin-3-sophoroside and cyanidin-3,5-diglucoside, besides catechin, epicatechin and rutin. The extracts were classified as non-irritating ingredients. The data revealed HRS as a source of bioactive compounds and significant variations in phytochemical content among yellow and red petals of HRS.

Keywords— *Hibiscus rosa-sinensis* L.; microwave-assisted extraction; liquid chromatography; mass spectrometry; HET-CAM.

I. INTRODUCTION

Since ancient times plants have acted as therapeutic remedies, being used for the treatment of infections or degenerative diseases in humans and animals.[1,2] The effectiveness in using plants as a treatment for diseases is justified mainly, by the presence of phytochemicals originated in the secondary metabolism of several species. Secondary metabolites generated by plants have the primary function of mediating their contact with the environment, being extremely sensitive to changes or external stimuli, such as high levels of UV radiation, extreme temperatures, environmental pollution, presence of pollinating insects, or herbivorous animals.[1,3,4] Most of secondary metabolites represent an important source of

drugs due to their anti-inflammatory, anticancer, antibacterial, cardioprotective and antioxidant properties. [5]

As a result, these compounds are desired by several industry sectors, since they can be incorporated into a variety of products such as cosmetics, food, nutraceuticals, polymers, waxes, colorants, perfumes, etc.[4] In addition to this, due to the strong connection of synthetic products to toxicity and carcinogenicity, there is an emerging search for novel bioactive compounds originated from natural to replace synthetics products. [6]

Among the ‘products’ offered by nature; flowers have attracted the researcher’s attention for the fact of presenting a large amount of phytochemicals with broad

bioactive potential. [1] However, the incautious consumption of natural products or substances is not recommended. In opposition to what is often conveyed by media or popular knowledge, it is important to consider that undesirable side effects are not exclusive to synthetic drugs. Either, plants can present, in addition to beneficial compounds, some toxic substances.

Since 2009, there has been a considerable increase in the consumption of cosmetics, comprising shampoos, conditioners, moisturizers and hair colorants, which has led to a greater safety control of such products. [7] Several cosmetics have incorporated natural products in their formulations. [8] Thus, aiming at the safety and health of consumers, the chemical composition, toxicity and side effects of natural products must be elucidated. [9] The study of natural products begins with the specimen identification, followed by matrix extraction, screening (scanning) of the compounds and then, the assessment of its possible cytotoxicity. [10]

Currently, *Hibiscus sabdariffa* is the main worldwide traded specie belonging to the genus *Hibiscus* (Malvaceae). The United States and Germany are the main importers of this plant. Its dried or fresh calyces are widely consumed in culinary, in the preparation of alcoholic beverages, fermented drinks, syrups, salads, jellies, cakes and infusions. It is also used as a component in hair care and anti-ageing skin care products being considered an active oxygen scavenger cosmetic. [11-13]

Hibiscus rosa-sinensis L. (HRS) is an ornamental Chinese shrub widely cultivated in tropical and subtropical climates. In India, HRS has a great commercial appeal, being extensively used in local herbal products. [14] Its flowers and leaves are known to be emollient. [15] Studies regarding extracts from different parts of this plant have demonstrated its most popular medicinal properties such as the regulation of glycemia, and fertility. [16] have reported hair growth activity (*in vitro* and *in vivo*) by HRS extracts, suggesting its use as a constituent in hair care cosmetics.

Although, despite the promising evidences demonstrated by previous studies, only conventional methodologies for extracting bioactive compounds from HRS have been applied to the plant. In addition, it is desirable the use of advanced analytical tools in order to better identify the compounds present in the extracts, such as high-performance liquid chromatography (HPLC) coupled to mass spectrometry techniques. Furthermore, there is a lack of data concerning the assessment of the biological safety of HRS extracts.

Hence, the present study was aimed to obtain HRS extracts using microwave assisted extraction (MAE), and

investigate the chemical composition, their main biological activities and the *in vitro* potential ocular irritation of the extracts by HPLC-DAD-ESI-IT-MS and Hen's Egg Test - Chorioallantoic Membrane (HET-CAM), respectively.

II. EXPERIMENTAL

2.1 Plant material and chemicals

Fresh yellow and red flowers from *Hibiscus rosa-sinensis* were collected in June 2019 from a community garden (GPS location 10°57'56.0"S 37°03'40.9"W). The specie was identified by a taxonomist from Tiradentes University. The yellow *Hibiscus rosa-sinensis* (YHRS) (n°1142) and the red *Hibiscus rosa-sinensis* (RHRS) (n°1176) were deposited in the herbarium - UNIT, Aracaju-Sergipe/Brazil. Petals of the flowers were selected and oven dried at 50 °C for 24 h. The dried petals were grounded, sieved (8-16 Mesh) and kept in dark flasks until analysis. According to the different types of analysis, the material was subjected to different extractions. All solvents, reagents and reference standards used were chromatographic grade (JT Baker and Sigma Aldrich).

2.2. Microwave assisted extraction (MAE)

Microwave assisted extraction (MAE) was carried out using a single mode, sequential microwave system (CEM®, Discover SP). Each experiment was made with 0.5 g of powdered petals. Firstly, hydroalcoholic and acidic aqueous extraction by MAE were made with YHRS to determine the better extraction conditions. Then, these conditions were applied to RHRS.

2.2.1. Hydroalcoholic extraction by MAE.

These experiments were made to enhance the extraction of phenolic compounds from HRS. The experimental matrix was a 2⁴ factorial design with central points to measure the experimental error. The independent variables used to evaluate the efficiency of MAE were: microwave power (100 and 200 W), irradiation time (4 and 12 min), solvent concentration (25 and 75% of ethanol in water) and solvent volume (20 and 30 mL). The generated extracts were filtered and stored in dark flasks at -20 °C until the analysis. The dependent variables evaluated were: total phenolic content (TPC), total flavonoid content (TFC), % inhibition in DPPH (I%) and extract yield.

2.2.2. Acidic aqueous extraction by MAE.

These experiments were made to enhance the extraction of anthocyanins from HRS. The experimental matrix was a 2³ factorial design with central points and the independent variables were: microwave power (100 and 200W), irradiation time (4 and 12 min) and, solvent volume (20

and 30 mL). The generated extracts were filtered and stored in dark flasks at $-20\text{ }^{\circ}\text{C}$ until the analysis. The dependent variable was total anthocyanin content (TAC).

2.3. Exhaustive extraction

Exhaustive extraction was carried out in order to compare the performance of MAE. The compounds were extracted according to a method previously reported, [17] with some modifications. Briefly, 0.5g of each yellow and red powdered flowers were extracted with successive additions of 10 mL of methanol: water (8:2, v/v) acidified (1% HCl, w/v) in a Falcon tube. The tube was vortexed for 5 min and centrifuged at 4000 rpm for 5 min. The extract was filtered (filter paper) and the residue was further extracted (14 more times) until no longer reacted with the Folin-Ciocalteu reagent. The supernatants were pooled for the quantification of TPC, TFC, I%, TAC and, extract yield. The experiments were made in triplicate.

2.4. Phytochemical analysis

2.4.1. Total phenolic content (TPC)

TPC was determined using the Folin-Ciocalteu assay with some modifications. [18] An aliquot (0.5 mL) from each extract was mixed with 9 mL of distilled water, 0.5 mL of Folin-Ciocalteu reagent and 5 mL of 7% Na_2CO_3 . After 2.5 hours of incubation at $25\text{ }^{\circ}\text{C}$, the absorbance was measured at 760 nm. A standard curve was prepared using 60 to 150 mg/L of gallic acid. TPC was expressed as mg of gallic acid equivalents per 1 gram of wet weight basis (mg GAE/g).

2.4.2. Total flavonoid content (TFC)

TFC was determined using a methodology previously reported, [19] with some modifications. The extracts (0.25 μL) were diluted in distilled water (0.75 μL). The diluted extract (1 mL) was mixed with 4 mL of distilled water and 300 μL of 5% NaNO_2 was added. Five minutes later, 300 μL of 10% AlCl_3 was added in the mixture. Following that, 2 mL of 1 mol/L NaOH was added in the reaction tube and the absorbance was measured at 510 nm using a spectrophotometer. A standard curve was prepared using 20 to 200 mg/L of rutin. TFC was expressed as mg of rutin equivalents per 1 gram of wet weight basis (mg RE/g).

2.4.3. Total anthocyanin content (TAC)

TAC was determined by pH-differential method, [20] with some modifications. Each extract (400 μL) was diluted in two different buffer solutions; first in potassium chloride solution (0.025 M, buffer pH 1) (3600 μL) and second in sodium acetate solution (0.4 M, buffer pH 4.5) (3600 μL). Fifteen minutes later, the absorbance was measured at 530 and 700 nm using a spectrophotometer. The absorbance of

each sample was calculated as the difference in the absorbance between pH values and wavelengths:

$$A = (A_{530\text{ nm}} - A_{700\text{ nm}})_{\text{pH } 1.0} - (A_{530\text{ nm}} - A_{700\text{ nm}})_{\text{pH } 4.5}$$

Therefore, TAC value was obtained:

$$TMAC\text{ (mg/L)} = \frac{A \times MW \times DF \times 1000}{\epsilon \times l}$$

where A is the absorbance of the sample, MW is the molecular weight of cyanidin-3-glucoside (449.2 g mol^{-1}), DF is the dilution factor, ϵ is the molar absorptivity of cyanidin-3-glucoside ($26,900\text{ L cm}^{-1}\text{ mol}^{-1}$), and l is for a standard 1 cm path length. TAC was reported as milligrams anthocyanins per 100 g dry weight (mg Cy-3-glu/100 g).

2.4.4. Scavenging activity of DPPH radical

The antioxidant activity was measured using a modified DPPH (2, 2-diphenyl-1-picrylhydrazyl) radical scavenging method. [21] Solutions (100 μL) of various concentrations of the extracts in methanol (1, 2.4, 5 and, 10 % v/v) were added to 3900 μL of a methanol solution of DPPH (0.06 mM). The control solution was made of 100 μL of methanol added by DPPH solution (0.06 mM). After 45 min of incubation at $25\text{ }^{\circ}\text{C}$, the absorbance was measured at 516 nm. Free radical DPPH inhibition in percentage (I%) was calculated as follows:

$$I\% = \left(\frac{A_{\text{control}} - A_{\text{sample}}}{A_{\text{control}}} \right) \times 100$$

Where A_{control} is the absorbance of the control solution and A_{sample} is the absorbance of the tested extract. Extract concentration providing 50% inhibition (IC_{50}) was calculated from the graph plotted inhibition percentage against extract concentration. Tests were carried out using quercetin as positive control.

2.4.5. Total carotenoid contents (TCC)

Carotenoids were extracted according to a method previously reported by Rodriguez-Amaya, [22] with some modifications. Briefly, 0.5 g of each yellow and red powdered flowers were extracted with successive additions of 8 mL of acetone, using a vortex homogenizer. The extracts were filtered (filter paper) and the remaining residue was further extracted until its complete depigmentation. The organic fractions were pooled in a separatory funnel and mixed with petroleum ether (50 mL). The extract was washed with distilled water (100 mL) three times. The aqueous phase was discarded and the fraction of petroleum ether containing the carotenoids was collected and anhydrous sodium sulfate was added. The extract was transferred to a 50 mL volumetric flask and the

volume was completed with petroleum ether. The absorbance was measured at 455 nm. The carotenoid content was calculated and expressed as microgram of β -carotene per 1 gram of dried weight basis ($\mu\text{g } \beta\text{-carotene/g}$) as follows:

$$TCC = \frac{A_{\text{sample}} \times \text{volume (mL)} \times 10^4}{A_{\beta\text{-carotene}} \times M \text{ (g)}}$$

Where A_{sample} is the absorbance of the test extract, V is the total volume of the sample (mL), $A_{\beta\text{-carotene}}$ is the β -carotene extinction coefficient in petroleum ether (2592) and, M is the sample weight (g). The experiments were made in triplicate.

2.5. Extraction yield

The extraction yield was determined using 1 mL of each homogenized extract. The solvent was eliminated by vacuum evaporation and the yield was calculated as the percentage weight of crude extract over the total weight of the powdered flowers (%m/m).

2.6. In Vitro Eye Irritation Potential Assessment

For the evaluation of the irritative potential of HRS extracts, the *in vitro* HET-CAM test was used. The methodology is based on the observation of irritative reactions such as hemorrhage, lysis or coagulation in the chorioallantoic membrane of embryonic chicken eggs on the tenth day of incubation after contact with the tested substance. [23 - 26] To perform the HET-CAM test, only extracts obtained under best conditions of hydroethanolic and acid extraction by MAE (from yellow and red petals) were used. Initially, the extracts were concentrated by vacuum evaporation at 60 °C and then, the dry extract was resuspended in 0.9% NaCl. The resuspended extracts were immediately used for HET-CAM test.

The test was carried out as follows: fertilized chicken eggs (weighing between 40 and 50 g), acquired from a local farm were incubated at 37.5 °C for a period of 10 days. On the tenth day of incubation, the egg shell around the air chamber was removed with the aid of tweezers, exposing the outermost membrane. This membrane was hydrated with 0.9% saline solution. The eggshell membrane was removed to expose the innermost membrane, the chorioallantoic membrane (CAM). Each extract (300 μL) was deposited over the chorioallantoic membrane and the symptoms of irritation, such as: lysis, hemorrhage or coagulation, were observed after 300 seconds of exposure. A positive (300 μL of 1 molL^{-1} NaOH solution) and a negative control (300 μL of 0.9% NaCl solution) were also evaluated. The irritation score was calculated as follows:

$$IS = \frac{(301 - H_{\text{time}}) \times 5}{300} + \frac{(301 - L_{\text{time}}) \times 7}{300} + \frac{(301 - C_{\text{time}}) \times 9}{300}$$

Where H_{time} is the time (in sec) of the first sign of hemorrhage, L_{time} is the time (in sec) of the first lysis signal and, C_{time} is the time (in sec) of the first coagulation signal. The positive and negative control and the extracts were evaluated according to the irritation classification designated by Luepke, [23] where 0.0 - 0.9 is nonirritant, 1.0 - 4.9 is slightly irritant, 5.0 - 8.9 is moderately irritant and 9.0 - 21.0 is severely irritant. The experiments were made in triplicate.

Due to its high degree of pigments, the CAM exposed to aqueous acid extracts was rinsed with 0.9% NaCl prior to the observing the vascularization.

2.7. LC-MS/MS analysis

The extracts obtained under best conditions of hydroethanolic and acid extraction by MAE (from yellow and red petals) were analyzed by HPLC-DAD-ESI-MS/MS. Prior to the injection, in order to remove unwanted compounds, the extracts were subjected to solid phase extraction (SPE). Thus, each extract generated two fractions: F_1 (non-anthocyanin compounds) and F_2 (anthocyanin compounds). The procedure used was as follows: SPE cartridges of C_{18} were activated with methanol and conditioned with water acidified (0.01% HCl). Then, the sample was applied to the cartridge. The unwanted compounds were eluted with water acidified (0.01% HCl) and discarded. After that, F_1 fraction (non-anthocyanin compounds) was eluted with ethyl acetate and recovered in dark flask. After that, F_2 fraction (anthocyanins) was eluted with methanol acidified (0.01% HCl). The fractions were concentrated by vacuum evaporation at 40 °C until 1 mL and transferred to dark flasks.

The HPLC system consist of a high-performance liquid chromatograph (Shimadzu, SPD-M20A, Japan) with a Diode Array Detector (DAD) connected in series to an ion trap mass spectrometer, model Esquire 6000 (Bruker Daltonics, USA), with an electrospray ionization (ESI) source. The separation of the compounds was performed using a C_{18} column (4.0 $\mu\text{m} \times 150 \text{ cm} \times 4.6 \text{ mm}$, Phenomenex, USA) the compounds were separated at flow rate at 0.7 mL min^{-1} at 29 °C. Mobile phase were solvent A: water/formic acid (99.5:0.5, v/v) and solvent B: acetonitrile/formic acid (99.5:0.5, v/v). The used elution gradient was beginning with A/B 99:1 (v/v) to 50:50 (v/v) in 50 min, then 50:50 (v/v) to 1:99 (v/v) in 5 min, at the end the ratio (1:99, v/v) was maintained for another 5 min. Ultraviolet-visible spectra were obtained between 200 and 800 nm and the chromatograms processed at 278, 354, and 515 nm. The column eluate was reduced to only 0.35 mL min^{-1} before enter the ESI interface. The mass

spectrometer was operated under the following conditions: mass range from 100 to 800 Daltons, source in the positive and negative ionization modes, capillary voltage of 3000 V, nebulizer gas 30 psi, skimmer 72 V, temperature and drying nitrogen flow at 310 °C and 11 L min⁻¹ and fragmentation energy of 1.6 V.

The extracts were diluted with solvent A and filtered (Millipore, 0.22 µm) prior to analysis.

The identification of phenolic compounds was based on:

- (1) retention time and elution order in the chromatographic column;
- (2) UV-Vis and MS spectra, compared to analytical standards analyzed under the same conditions; and
- (3) data from the literature.

The identification was made by injection of external standard solution of gallic acid, chlorogenic acid, catechin, epicatechin, caffeic acid, rutin, *p*-coumaric acid, *m*-coumaric acid, ferulic acid and, quercetin, (25 mg mL⁻¹).

2.8. Statistical analysis

The data obtained were subjected to analysis of variance (ANOVA) using MATLAB software version 5.3 (The Math Works Inc, USA). Significance level was set at 5%.

III. RESULTS AND DISCUSSION

3.1. Extractions

3.1.1. Hydroalcoholic extraction microwave assisted extraction (MAE)

Table 1 shows the levels attributed to each independent variable and the obtained values for the dependent variables: % inhibition in DPPH (I% - y_1), total flavonoid content (TFC - y_2), total phenolic content (TPC - y_3) and, extract yield (y_4) obtained from yellow petals of HRS (YHRS).

As it is possible to note, the variables microwave power (x_1) (increasing from 100 to 200 W), irradiation time (x_2) (varying from 4 to 12 minutes) and the solvent concentration (x_3) (with amount of ethanol ranging from 25 to 75%) did not show any significant difference in the variation of TPC, TFC, I% and, extract yield ($p > 0.05$). Thus, considering the consume of energy, the degradation of the compounds at higher irradiation time and the cost of the experiment, these variables were kept at their lower levels (100 W, 4 minutes and 25%). However, it was not possible to evaluate this variable at higher levels because 30 mL was the limit of the microwave vessel. Thus, this variable was kept at 30 mL. Therefore, hydroalcoholic extraction conditions by MAE were: microwave power (100 W), irradiation time (4 min), ethanol concentration (25 %) and, solvent volume (30 mL). This set of conditions were also used to extract bioactive compounds from red petals of HRS (RHRS). **Figure 1** (red and yellow dotted lines) summarizes the results for TPC, TFC, I%, and extract yield for the two kind of flowers obtained hydroethanolic extraction by MAE.

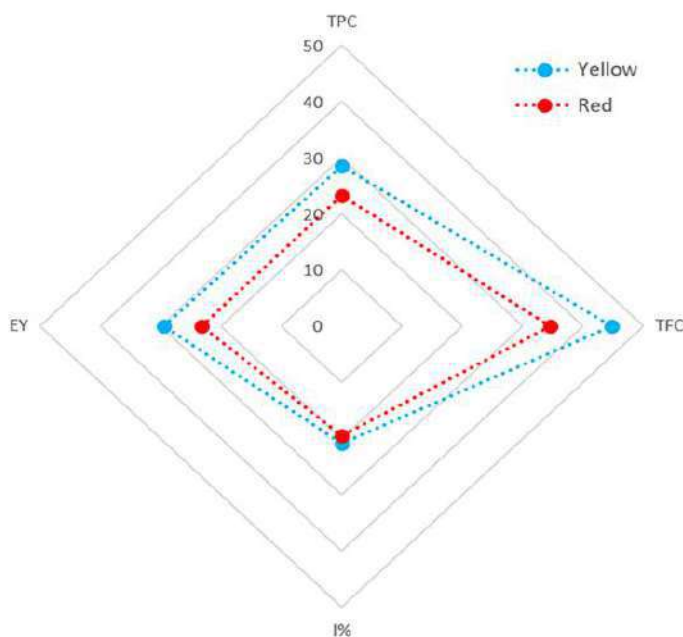


Fig.1: Total phenolic content (TPC in mg GAE/g), total flavonoid content (TFC in mg RE/g), % inhibition in DPPH (I%), extract yield (EY in %m/m) obtained by MAE from HRS petals.

Table 1: The experimental matrix of the hydroethanolic extraction with the values for the responses.

Assay	Independentvariables				Dependentvariables			
	X ₁	X ₂	X ₃	X ₄	Y ₁	Y ₂	Y ₃	Y ₄
1	-1	-1	-1	-1	27.13	76.37	23.34	28.80
2	1	-1	-1	-1	22.15	72.28	20.69	30.40
3	-1	1	-1	-1	23.76	73.53	22.92	28.80
4	1	1	-1	-1	46.07	86.51	23.85	29.60
5	-1	-1	1	-1	17.82	79.63	23.64	28.80
6	1	-1	1	-1	17.50	83.89	26.44	30.00
7	-1	1	1	-1	19.58	84.43	24.70	30.00
8	1	1	1	-1	24.40	91.09	27.85	31.80
9	-1	-1	-1	1	26.16	89.17	25.85	34.40
10	1	-1	-1	1	32.10	89.88	29.56	32.80
11	-1	1	-1	1	26.16	56.11	20.92	25.20
12	1	1	-1	1	22.63	65.35	20.63	24.00
13	-1	-1	1	1	21.83	90.83	29.88	34.80
14	1	-1	1	1	16.05	71.63	23.73	25.20
15	-1	1	1	1	20.71	91.36	28.43	32.40
16	1	1	1	1	29.05	92.16	30.02	33.60
R ₁	0	0	0	0	26.97	95.02	28.65	31.50
R ₂	0	0	0	0	27.93	101.91	28.17	31.50
R ₃	0	0	0	0	25.36	88.13	24.74	28.00

As seen in **Figure 1**, the extracts obtained by MAE (yellow and red dotted lines, respectively) were rich in TPC (28.4 and 23.2 mg GAE(Gallic Acid Equivalent) per gram (GAE g⁻¹) and in TFC (44.8 and 34.5 mg RE (Rutin Equivalent) per gram (RE g⁻¹), besides exhibited inhibition in DPPH assay (20.9 and 19.4%) and produced high extract yield (29.5 and 23.2%) for YHRS and RHRS extracts, respectively. The IC₅₀ value in DPPH of extracts were also determined (12.35 and 15.76 mg L⁻¹, respectively) and were in accordance with %I. However, the contents of all the evaluated responses were significant different among the yellow and red petals extracts ($p < 0.05$), with YHRS showing higher levels than RHRS in all parameters.

3.1.2. Acidic aqueous extraction by MAE

Acidic aqueous extraction was used to enhance the extraction of anthocyanins from HRS. **Table 2** shows the levels attributed to each independent variable and the

values of the dependent variable: total anthocyanin content (TAC – y₁) obtained from YHRS.

Table 2: The experimental matrix of the Acidic aqueous extraction with the values for the responses.

Exp.	variables			
	independents			dependents
	X ₁	X ₂	X ₃	Y ₁
1	-1	-1	-1	4.67
2	1	-1	-1	4.03
3	-1	1	-1	3.41
4	1	1	-1	4.59
5	-1	-1	1	4.07
6	1	-1	1	4.64
7	-1	1	1	4.42
8	1	1	1	4.77

R ₁	0	0	0	4.96
R ₂	0	0	0	5.20
R ₃	0	0	0	5.24

Microwave power, solvent volume and irradiation time did not show any significant difference in the variation of

TAC ($p > 0.05$). Thus, the variables were kept at the lower levels: microwave power (100 W), irradiation time (4 min), and solvent volume (20 mL). These experimental conditions were used to extract anthocyanins from RHRS. **Figure 2** (red bars) shows TAC for the two type of flowers. RHRS have four times higher level of TAC than YHRS: 4.1 and 16.3 mg Cy-3-glu/100 g.

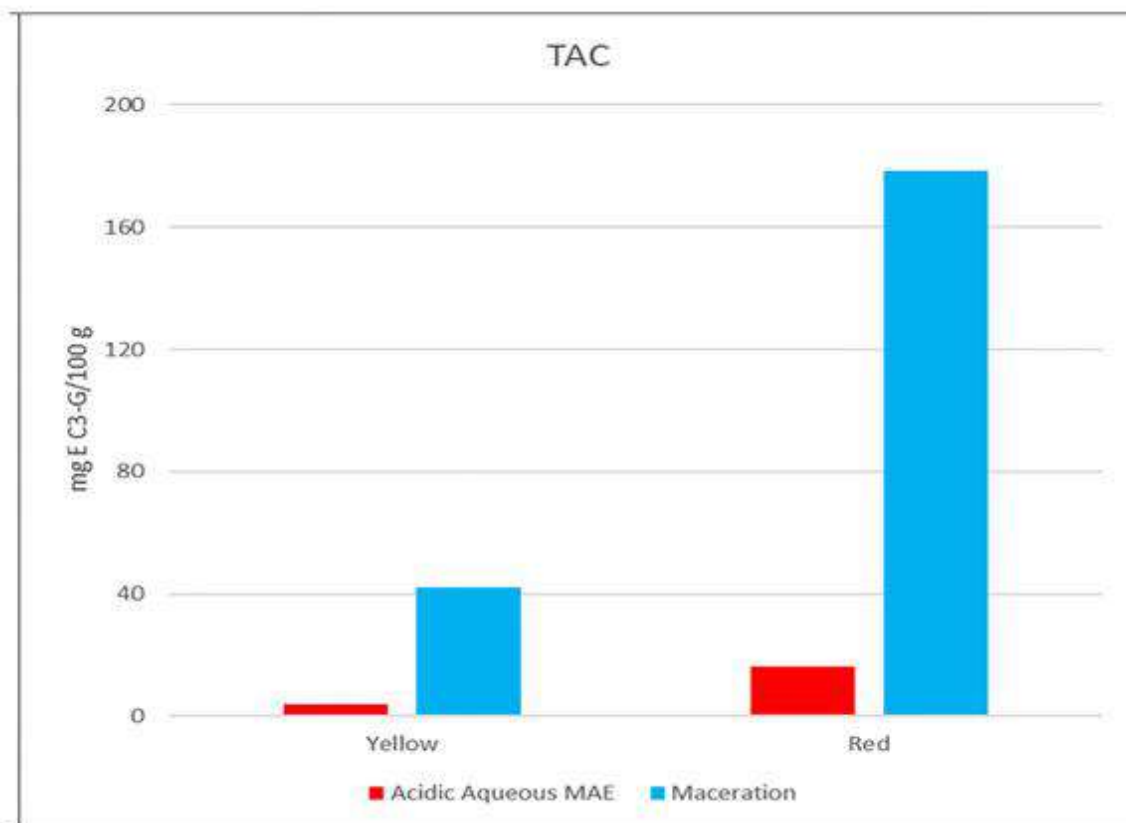


Fig.2: Total anthocyanins content (TAC in mg Cy-3-glu/100 g) obtained by MAE from HRS petals.

Microwave-assisted extraction has demonstrated advantages over conventional extraction strategies because since provides extraction yields comparable with the latter and requires less extraction time, once the microwaves rupture the plant structure to increase extraction power. In addition to similar recovery, MAE allows reduced solvent consumption, shorter extraction times and temperature control that ensuring stability of thermolabile components, among others advantages. [27]By comparing the results obtained here with those obtained by maceration, a conventional extraction technique, the proposed methodology showed similar recovery of TPC and TFC from HRS petals. [28-30] However, these values were significantly lower than those reported by Mak et al.[31]for aqueous and ethanolic extracts of *H. rosa-sinensis* petals. It's important to highlight that TPC and TFC values obtained in the present study were close to

some varieties of *Hibiscus sabdariffa*. [32] Regarding to the TAC, the MAE performance was lower than that obtained by maceration. [29,33,34]

3.2. Total carotenoid contents (TCC)

The flower extract of HRSY had significantly higher TCC value than HRSR (295.99 ± 1.69 and 78.19 ± 0.89 μg β -carotene/g, respectively - $p < 0.05$). The TCC value for YHRS was higher than that reported for *H. sabdariffa* flowers by Attaugwu and Uvere [35] but lower than that reported by Gbadamosi, Abiade and Agbatutu [36] for *H. asper* flowers. Normally, fruits, vegetables, and vegetable oils (especially olive oil) offers the most amount of carotenoid intake in the diet. [37] According to the data, the yellow and red petals of *H. rosa-sinensis* present TCC value in the same order of

magnitude of important sources of carotenoids, such as peach, watermelon, and apricot. [38]

Carotenoids are naturally occurring pigments in the chloroplasts of plants and algae, as well as, in egg yolk, fishes and crustaceans. This class of compounds plays a large role in the human diet. Studies demonstrated that the consumption of diets rich in carotenoids is associated with a lower incidence of cancer, cardiovascular diseases, age related macular degeneration and cataract formation. [39,40]

3.3. HPLC-DAD-ESI-MS/MS analysis

Flavonoids are a class of secondary metabolites of plants with powerful antioxidant and pharmacological activities. They constitute colored pigments of fruits, herbs, vegetables and medicinal plants and are divided into the

subgroup's flavanones, flavanols, flavonols, isoflavons, flavons, and anthocyanidins. [41] The HPLC analysis of hydroethanolic extracts from YHRS and RHRS obtained by MAE revealed the presence of five flavonoids. Three peaks were identification based on comparison of their retention time (RT), UV-Vis and mass spectrometric data using standards. For these compounds, MS analysis carried out in the negative-ion mode $[M - H]^-$. At retention time 22.9 min showed the presence of catechin (m/z 289, MW 290) (λ_{max} 278 nm), at 25.2 min, epicatechin (m/z 289, MW 290) (λ_{max} 278 nm) and, at 29.4 min, rutin (m/z 610, MW 609) (λ_{max} 354 nm). Catechin and epicatechin are flavanols report for the first time in HRS extracts. **Figure 3 (A and B)** present the HPLC profiles of three identified compounds in hydroethanolic extracts from YHRS.

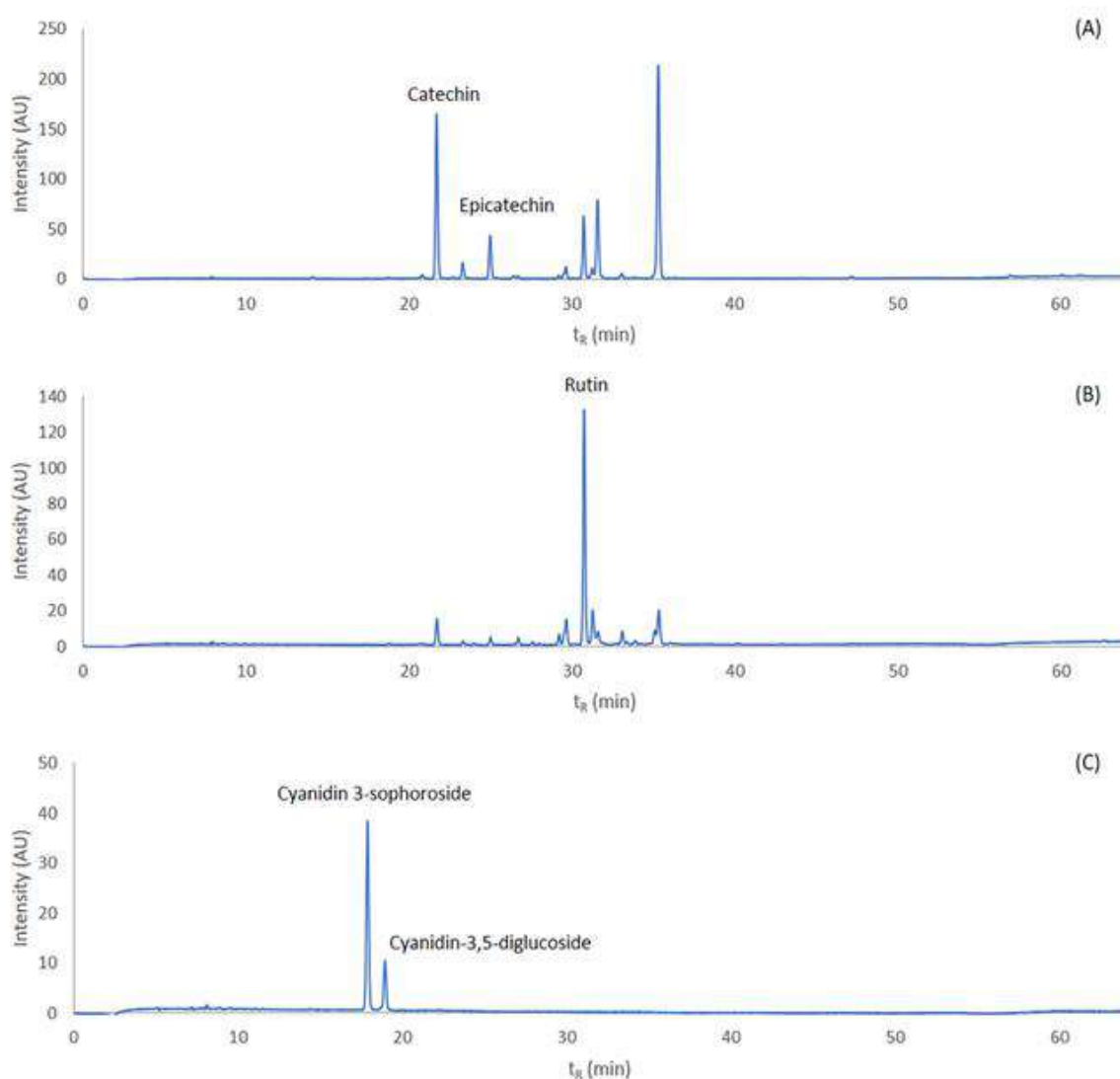


Fig.3: High-performance liquid chromatograms of the hydroalcoholic extracts from YHRS, processed in: 278 (A), 354 (B) and, 520 nm (C).

Acid extracts from red petals of HRS were found to contain catechin and epicatechin, whereas none flavonoid was identified in acid extract from yellow petals. Thus, hydroethanolic extraction enhanced the yield of flavanols and the flavonol, when compared with acidic aqueous extraction. Rutin was identified in HRS extracts in former studies. [30,42,43] Furthermore, Pillai and Min[43] identified chlorogenic acid, caffeic acid, p-coumaric acid, ferulic acid and, quercetin in the HRS extracts. These polyphenolic compounds were not identified in the present study. Rutin, catechin and epicatechin are believed to exhibit significant biological activities, including antioxidant, anti-inflammation, anti-diabetic, anti-adipogenic, neuroprotective and cardioprotective activity. [44,45]

Two anthocyanins were tentatively identified in HRS extracts, these peaks represented the first and second predominant areas in mass spectra chromatogram. The identification was based on the information obtained from UV-Vis and mass spectra data and comparison with data reported in the literature. MS analysis carried out in the positive-ion mode that affect the dissociation of glycoside bonds at positions of C₃, C₅ and/or C₇ of the anthocyanidins.[46]

Peak at RT 18.0 min, the major compound, showed m/z 611 (λ_{\max} 515 to 516 nm), which corresponded to the molecular cation tentatively identified as cyanidin-3-sophoroside. MS/MS fragmentation of m/z 611 produced a daughter ion at m/z 287, which was indicative of the cyanidin moiety, 287 [M-324].[47] While peak at RT 19.2 min was tentatively assigned as cyanidin-3,5-diglucoside. This peak showed a [M]⁺ ion at m/z 611 (λ_{\max} 515 to 518 nm) and m/z 449 - loss of glucose (162 Da) - and a predominant ion at m/z 287 in MS2, resulting from the consecutive losses of 2 glucoses. [48]

The acid solution enhanced the extraction of the anthocyanins, since acidic extracts from RHRS present the two anthocyanins, while hydroethanolic extracts from RHRS showed only cyanidin-3-sophoroside. **Figure 3C** shows the HPLC profiles of anthocyanins in hydroethanolic extracts from YHRS.

Studies concerning the composition of HRS petals identified cyanidin-3-sophoroside. [47] and cyanidin-3,5-diglucoside [48] in hydroalcoholic acid extracts. Anthocyanins are a subclass of water-soluble flavonoid

pigments, important in the plant-derived food industry. [46] These bioactive compounds are responsible for the commercial and medicinal value of genus *Hibiscus* spp.[47]The interest in anthocyanins as functional ingredients has also been generated by their potential role in preventing chronic and degenerative diseases due to their antioxidant, [49-51] anti-inflammatory,[51] antiarteriosclerosis, [52] anticancer, [53] hyperlipidemia, [54,55] and hypoglycemic activities. [56]

3.4. *In vitro* eye irritation potential assessment

After applying the extract over the CAM, the images obtained were analyzed and the irritative ocular potential was determined (**Figure 4**).

Both, YHRS and RHRS extracts, as well as, negative control, presented no irritation (IS=0.00 ± 0.00). Based on the irritation scores of the control solutions, the analyzed extracts were classified as non-irritating ingredients, since no vascular events were observed during the period of 300 s. The positive control was classified as a strong irritant (IS= 18.07 ± 0.87).

The hair care, comprising of shampoos, conditioners, styling agents and hair colorants represents around 17% of the global beauty market. In addition to the advantages of these hair care cosmetics, they present a potential risk of eye irritation due to exposure during use.^[7] Cosmetic industries are focused on explore alternative sources of raw materials, especially of plant origin, due to their content of biologically active compounds, the synergy of their action and the high degree of assimilation by the human body. [57] Leaves and flowers of *H. rosa-sinensis* exhibit hair growth *in vitro* and *in vivo*, as well as anti-greying properties,[16] suggesting that these proprieties could be used in hair growth formulations.

The HET-CAM test[17]allows the identification of irritating and non-irritating substances, which appear to be similar to those, which occur in the eye using the standard Draize rabbit eye test. It is applicable on shampoos as well as the ingredients used in their composition.

Since the HSR extracts presented here are consisted of several bioactive compounds and non-irritating ingredients were observed, this plant can be considerate as an important raw material for cosmetic formulations.

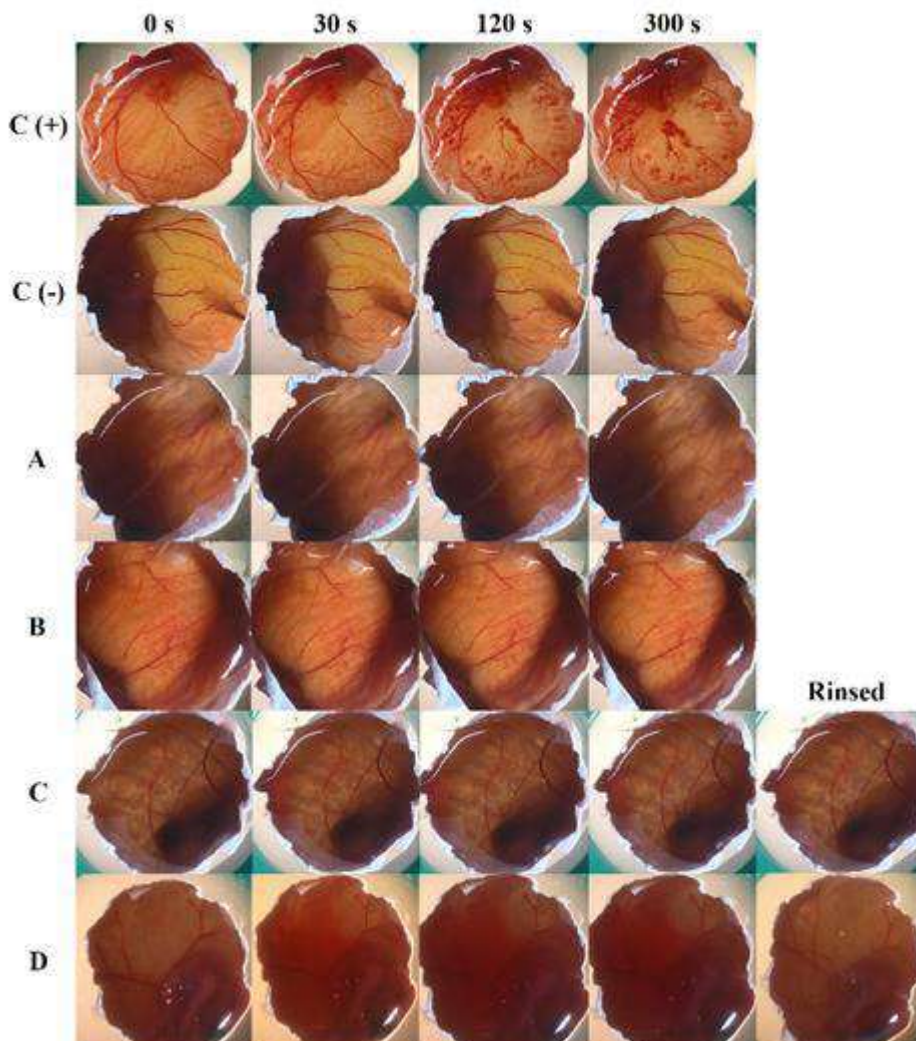


Fig.4: Representative images of the chorioallantoic membrane (CAM) after the application of: C (+) positive control; C (-) negative control; (A) hydroethanolic extract from YHRS; (B) hydroethanolic extract from RHRS; (C) acid aqueous extract from YHRS and (D) acid aqueous extract from RHRS observed during the period of 300 s.

IV. CONCLUSIONS

The two experimental designs allowed to identify which independent variables has an influence the extraction process of bioactive compounds from the petals of *H. rosa-sinensis*. In the specific experimental design for the extraction of phenolic compounds (hydroethanolic extraction), the only variable that proved to be significant was the solvent volume. The greater the amount of solvent used, the highest the amount of polyphenolic compounds extracted. Regarding acid extraction, no independent variable studied was found to be significant to the extraction process ($p > 0.05$). Then it was possible to continue the extraction under gentle conditions with no losses in its performance.

The antioxidant activity of the extracts obtained in the hydroethanolic extraction measured in terms of IC_{50} proved to be significant. The HRS extracts of both varieties showed to be a great source of carotenoids, suggesting its use as a nutraceutical, dye, or constituent of animal feed. The chromatographic analysis showed the presence of the compounds catechin, epicatechin, both for the first time in HRS, rutin, cyanidin-3-soforoside and cyanidin-3,5-diglycoside. Finally, the HET-CAM assay showed non ocular irritating potential of HRS extracts, thus being able to be safely incorporated into cosmetic formulations that may come into contact with the ophthalmic mucosa.

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Logistic Regression Models and Classification Tree for Deaths and Recovered Patients Records of Covid-19 in the State of Minas Gerais, Brazil

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Abstract— *The challenges for the construction of a pandemic confrontation agenda by COVID-19 in Brazil come up against social inequalities, as a reflection of the segregation of access to comprehensive basic sanitation services and public health assistance programs. The objective of this work is to analyze the profile of deaths and recoveries by COVID-19 in the state of Minas Gerais, based on socio-environmental predictors, using a logistic regression model and classification tree (CHAID). Data on recovered individuals and confirmed deaths for COVID-19 were obtained from the Minas Gerais State Department of Health, containing records of age, sex, race, comorbidity and municipality of residence. The data regarding municipal basic sanitation were obtained from Instituto Trata Brasil. The Minitab and SPSS software were used in the elaboration of the logistic regression models and classification tree, respectively. The probability of death from COVID-19 in the state is significantly higher in males, over the age of 60 years old, with some comorbidity, declared black and brown, living in municipalities located in the poorest macro-regions of the state, where classes prevail inadequate or inadequate basic sanitation. The classification tree for deaths by COVID-19, differentiates young blacks and browns without comorbidity, and the elderly with comorbidity not assisted by a comprehensive basic sanitation network. It is concluded that the worsening of the pandemic in the state is related to aspects of social vulnerability, and that the implementation of inclusive public policies is urgent.*

Keywords— *Pandemic, Basic sanitation, Racism, Statistical modeling.*

I. INTRODUCTION

The main discussions in the global political scenario, in view of the COVID-19 pandemic, are being directed towards the construction of an agenda capable of enabling structural and long-term solutions, and which considers equality, cohesion and social justice, through integrated and coordinated public policies. Therefore, studies on the evolution stages of the disease scenario by COVID-19, consider patterns of dissemination according to social, environmental, economic and political factors [39].

In more recent analyzes, combining data from records of those infected by severe infectious respiratory pandemics globally, they provide evidence that the increased risk in a population is largely driven by social vulnerability factors, and aggravated by disproportionate access to healthcare. health, especially basic sanitation services [21, 32]. Qualitative aspects and the recurrence of

treated water supply and sewage services in peripheral global communities are put to the test as major factors in the transmission, severity and prevalence of diseases similar to COVID-19 [8, 43-46].

The complexity of the socio-environmental impacts of COVID-19 is extensive considering the developments and social strata, including the dynamics of risk factors associated with certain population groups. According to Men over 50 and with a history of pre-existing illnesses form the most vulnerable group. For the authors, viral infection can progress rapidly to cases of fatal respiratory diseases or acute respiratory failure [8].

The unprotected health of the elderly population associated with the prevalence of severe comorbidities (such as diabetes, obesity, hypertension), which are so prevalent in urban and peripheral conglomerates in poor and developing countries, is an important condition for

deaths due to COVID-19 [16, 25]. In Brazil, hypertension and diabetes are among the prognostic comorbidities most related to deaths caused by the new coronavirus [4].

The worsening of the spread of the disease in social strata in vulnerable situations in the field of health and care, finds support in the aspects of racism and ageism present in Brazilian society. A significant part of black elderly people lives in small and medium-sized cities in houses with few rooms, with intergenerational family arrangements and lacking material resources and, in many cases, with a lack of complete information about the disease and its severity [35]. The black and elderly population with immunosuppressive and hematopoietic diseases are at additional risk to the COVID-19 pandemic [42].

Even with specific objectives that ensure the state's protective strategic actions, outlined in the National Health Policy for the Elderly, and in the National Policy for Integral Health for the Black Population, the elderly black population maintains its invisibility in facing this pandemic, due to lack of transparency in the dissemination of epidemiological bulletins, and underreporting in the incidence and mortality rates due to COVID-19 [5-6, 31, 35].

Specifically, ethnoracial aspects were not eligible for analysis of the epidemiological situation of COVID-19 in the first epidemiological bulletins and, therefore, represented little public policy strategies and formulations at the beginning of the pandemic, in the different states of the federation. There is evidence of underreporting by COVID-19 in the country, given the frequent incompleteness of the race item in the different disease notification forms. Also considering that the black population in the country as a whole, has less access to health services, and represents the largest proportion among vulnerable populations, who secularly experience the absence of public power in their territories [15, 34].

Associated with ethno racial factors, the country's socioeconomic scenario measured between the years 2012 and 2018, according to the Synthesis of Social Indicators (SIS), of the Brazilian Institute of Geography and Statistics (IBGE), further exposes the fragility of social groups and the worsening of extreme poverty in Brazil, in view of the evolution of the pandemic. The study points out that 13.5 million people in Brazil live with per capita monthly income below US\$ 1.9 per day, representing 6.5% of the country's population. Poverty mainly affects the black and brown population, who represent 72.7% of the poor (38.1 million people). And, black or brown women make up the

largest contingent, about 27.2 million people below the poverty line [17].

The same study points out that 56.2% of the total population below the poverty line (or 29.5 million people) do not have access to sanitation in their homes; 25.8% (or 13.5 million people) are not served by a water supply; and 21.1% (11.1 million people) do not have garbage collection. The proportions are higher among blacks and browns than among whites, both in relation to inadequate housing conditions and the lack of provision of sanitation services. Among blacks and browns, 42.8% (49.7 million people) are not served with sewage collection; 17.9% (20.7 million people) do not have water supply through a network; and 12.5% (14.5 million people) do not have access to garbage collection [17].

Therefore, it is very important to understand the implications of these imminent social, economic and environmental challenges in Brazil, in the context of the COVID-19 pandemic, considering the peculiarities of the states of the federation, with special attention to vulnerable populations, and for the estimation of possible impacts of the pandemic in the public health system [10]. This is a key research topic in this study. Therefore, the aim of this work is to analyze the profile of deaths and recoveries by COVID-19 in the state of Minas Gerais, based on socio-environmental predictors, using a logistic regression model and classification tree (CHAID).

II. METHODOLOGY

2.1. Database and Sociodemographic Characterization of the State of Minas Gerais

The study is supported by the survey of official notifications of cases of recovered individuals and confirmed deaths for COVID-19 at the website of the State Department of Health of Minas Gerais (SES/MG), from March 4 to September 10, 2020, and without any description that identifies the patient by name. The records of patients "In Monitoring", "Canceled" and "Ignored" were excluded (Table 1).

The secondary data considered in this research also include the records of information of individuals such as sex, age, race, comorbidity and municipality of residence. We also opted for the arbitrary exclusion of those incomplete records of any information, fields missing or not correctly described about the individuals, so that there is no incorrect or incomplete classification of the response variable in relation to the components of the model. Table 1 shows the variables used in the explanatory models, according to the type, composition and description of the

entry, paying attention to those that have undergone adaptations or some conversion.

The population and the total territorial area of the state of Minas Gerais, is 21.3 million inhabitants and

586.521,123 km² respectively, being the second most populous in Brazil, behind only the state of São Paulo [17]. The estimated rate of urbanization in the state is 85.3%, configuring a predominantly urban population [26].

Table 1. Description, types and composition of the response and predictor variables in the Logistic Regression (LR) and Decision Tree (DT) models.

Variable	Description	Type ¹	Models	Composition
'E.Covid-19'	Evolution of the COVID-19 cases	CaR	LR/DT	Death; Recovered.
'A'	Age	CoP	LR	Informed by the patient.
		CaP	DT	<1 year; 1 to 9 years old; 10 to 19 y.old; 20 to 29 y.old; 30 to 39 y.old; 40 to 49 y.old; 50 to 59 y.old; 60 to 69 y.old; 70 to 79 y.old; 80 to 89 y.old; 90 or more.
'R'	Race	CoP	LR	(1) Yellow; (2) Indigenous; (3) White; (4) Brown; (5) Black ²
		CaP	DT	Yellow; Indigenous; White; Brown; Black
'C'	Comorbidity	CoP	LR	(1) Not Informed; (2) No; (3) Yes.
		CaP	DT	Not Informed; No; Yes.
'S'	Sex	CaP	LR/DT	Women (Female). Men (Male).
'PR'	Planning Regions	CaP	LR/DT	Grouping of municipalities corresponding to the 10 (ten) regions of the state of MG. ³
'CSS'	Class of Sanitation Service	CaP	LR/DT	Inadequate (the Service Index without Collection and without Treatment prevails); Little Adequate (the Service Index with Collection and without Treatment prevails); Adequate (the Service Index with Collection and Treatment prevails).

¹CaR: Categorical Response; CoP: Continuous Predictor; CaP: Categorical Predictor. ²Based on studies [15, 36]. ³João Pinheiro Foundation, an autarchy linked to the State Secretariat of Planning and Management of the State of Minas Gerais (SEPLAG).

The municipalities were grouped according to the division into Planning Regions state of Minas Gerais adopted by the State Secretariat for Planning and Management of the State of Minas Gerais (SEPLAG), and not individualized (Fig. 1). This condition allows to classify and compare regions of the state according to parameters of the state government itself [27].

The IDHM - Municipal Human Development Index - obtained through the geometric average of 3 sub-indices (income, education and longevity), was 0.769 for the state, while in Brazil it was 0.761 in 2015 [26]. Approximately 39.7% of the population declares itself to be white in the state, while browns and blacks represent 48.2% and 11.8%, respectively [17].

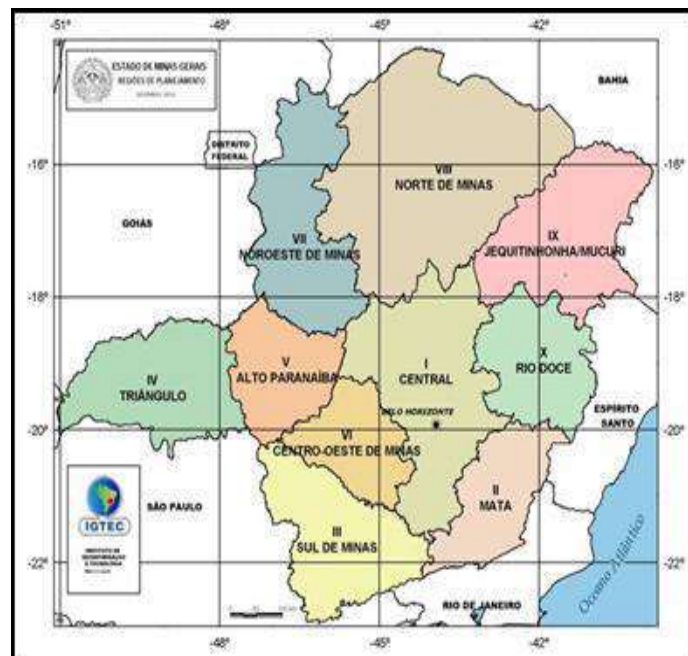


Fig. 1. Planning regions of the territory of the state of Minas Gerais adopted by the State Secretariat of Planning and Management of the State of Minas Gerais (SEPLAG).

Source: [27].

The data referring to basic sanitation in the municipalities of Minas Gerais were obtained from the Sanitation Panel Brazil, next to the website of the Instituto Trata Brasil - ITB (2020), which is based on data from the National Sanitation Information System (SNIS) - base year 2018. Minas Gerais was the second state of the federation in absolute investments in sanitation between 2014 and 2018, about R\$ 6.49 billion, but in investments per capita, the state occupies the twelfth position, with investment of R\$ 62.6 per inhabitant*year⁻¹ [19].

2.2. Statistical Models Used in Research

The study was developed using the qualitative response model (evolution of COVID-19 cases), in which the response variable is binary, i.e., it assumes two possible events, deaths and recovered. A linear probability model, using the logit link function, simplified in eq. 1, with only two parameters is given by:

$$\text{logit}_i = g(p_i) = \beta_0 + \beta_1 x_i \quad (1)$$

or, better described in eq. 2, the link function that relates the mean of the response in the ith observation to a linear predictor:

$$g(\mu_i) = X_i \beta \quad (2)$$

since, μ_i mean response of the nth line, $g(\mu_i)$, the link function, X is the vector of the predictor variables and β , the vector of the coefficients associated with the predictors of the model.

It is reasonable to implement a link function that specifies a non-linear transformation to model responses, in which the dependent variable is related to the explanatory variables in a non-linear way [1]. In these terms, the regression model that uses logistic distribution as a link function describes the response groups, as described in eq. 3, for the set of predictor variables.

$$p = \Pr[Y = 1|X = x] = \Lambda(\beta' x) = \frac{e^{\beta' x}}{1 + e^{\beta' x}} = \frac{1}{1 + e^{-\beta x}} \quad (3)$$

For the composition of the logistic regression model, continuous variables (Age, Race and Comorbidity) and categorical variables (Sex, Class of Sanitation Service and Planning Regions) were adopted. The outputs of results from the Binary Logistic Regression (LR) model were obtained using **MINITAB v. 19** [28].

Still as an analytical scope of this study, a decision tree was proposed for the evolution of COVID-19 cases, using the CHAID (*Chi-Square Automatic Interaction Detection*) method. This tree model is well used when segmentation is defined in terms of demographic characteristics or categorical variables with predictive power [24]. The CHAID method, which admits a binary

categorical dependent variable in the model composition, maximizes the significance of the chi-square statistic in each partition.

The CHAID method is described based on the maximum (chi-square statistics) using $T_{(j)}^{(*)}$ the stepwise procedure evaluating the input of each independent categorical variable in the model, and checking whether its contribution is significant or not among the predictor variables in the construction of nodes and sub-nodes [20].

The validation method was obtained from an automatic test set, with the selection of a fraction of 30% of the lines and a basis for generating random data. The simulations for the construction of the decision tree were carried out with the support of **IBM SPSS v. 25** [18].

III. RESULTS

3.1. Logit model for COVID-19 evolution data

The binary logistic regression model (Table 2) for the composition of the response variable (Y'), evaluated the coefficients of the continuous predictors (age, race and comorbidity) and the categorical groups that identify the patient's gender (male/female), the class of sanitation service (inadequate, little adequate, adequate), and the Jequitinhonha-Mucuri region as significant at 1% ($p < 0.001$). The regions of Rio Doce, Sul de Minas and Centro-Oeste of the state of Minas Gerais, which also make up the predictive variable 'Regions of Planning', were significant at 5% ($p < 0.05$) for the evolution picture of individuals diagnosed with COVID-19.

Table 2: Output of results from the Binary Logistic Regression model in the composition of the variable (Y') of evolution of COVID-19 (event: death) according to continuous and categorical predictors for the state of Minas Gerais, Brazil.

Continuous Predictors	Coef.	SE Coef.	Z	p-value	VIF
Intercept	-8,884	0,211	-42,08	0,000 ***	
'Age' – 'A'	0,0624	0,00151	41,25	0,000 ***	1,06
'Race' – 'R'	0,2290	0,0317	7,23	0,000 ***	1,07
'Comorbidity' – 'C'	1,3033	0,0372	35,00	0,000 ***	1,06
Categorical Predictors	Coef.	SE Coef.	Z	p-value	VIF
'Sex' – 'S'					
Male	0,3315	0,0456	-7,27	0,000 ***	1,02
'Class of Sanitation Service' – 'CSS'					
Inadequate	0,2842	0,0568	5,00	0,000 ***	1,57
Little Adequate	0,3186	0,0706	4,52	0,000 ***	1,20
'Planning Regions' – 'RP'					
Central	-0,120	0,130	-0,92	0,358 ns	7,89
Centro-Oeste	-0,480	0,173	-2,78	0,005 **	2,02
Jequitinhonha-Mucuri	0,780	0,183	4,27	0,000 ***	1,81
Noroeste	0,279	0,215	1,30	0,195 ns	1,51
Norte	-0,273	0,175	-1,56	0,119 ns	1,98
Rio Doce	-0,274	0,141	-1,95	0,051 **	4,20
Sul de Minas	-0,266	0,144	-1,85	0,064 **	3,61
Triângulo	-0,113	0,138	-0,82	0,410 ns	4,86
Zona da Mata	-0,231	0,146	-1,58	0,114 ns	3,73

$P(\text{death}) = \exp(Y') / (1 + \exp(Y'))$. Training Count (death; recovered): (3856; 16865). Test Count (death; recovered): (1691; 7190). Lines used (29602). Test set fraction: 30%. Area under the ROC curve (89.77%) and Test área under the ROC curve (89.71%). * significant coefficient at 10%, ** at 5% and *** at 1%.

The results of the logit model indicated that the probability of occurrence of the event (death), responds positively to the gradual increase of the patient's age, to the ethnorracial aspects and to the association with some comorbidity. The chance of death in patients with COVID-19 increases 1.06 times with the advancing age of the patient, 3.68 times in the sense of the declarants as black and brown (in relation to whites, yellow and indigenous) and, 1.25 times when associated with a pre-existing disease (in comparison with those without comorbidity or not reported), as shown in Table 3.

Individuals in the male group were more likely to compose the event profile (death), given the positive marginal effect (0.3315). The chance of deaths from COVID-19 among men is 1.39 times more likely than among women (Table 3). According to Table 4, which has chi-square statistics for the contrasts between the groups that make up the study variables, the contrast between the groups - male vs female - regarding the contribution to the occurrence of deaths by COVID-19 is quite high (94.497) and significant ($p < 0.001$).

The significant impact of the marginal effect of different classes of sanitation services on the response variable is also an important aspect of the research. The chances of obituaries in the municipalities where the basic sanitation class attendance rate is inadequate or little adequate is about 1.3 times higher than in those municipalities where the attendance rate with water and sewage collection and treatment prevails.

As for the contribution margin of effects between the sanitation classes (Table 4), from the chi-square statistic, a high amplitude was observed between the groups Adequate vs Inadequate and Adequate vs Little Adequate ($p < 0.001$), in comparison with the two classes of service Inadequate vs Little Adequate ($p = 0.05$). There is, therefore, a huge and contributory difference for the response variable [P (death)], on the order of 11 to 15 times, between the inadequate and inadequate models of basic sanitation in relation to the adequate standard of sanitation in the state of Minas Gerais.

Among the planning regions of the state of Minas Gerais, only the Jequitinhonha-Mucuri region showed a positive and significant coefficient ($p < 0.001$) for the evolution of the disease. The social vulnerability of the Jequitinhonha-Mucuri and Noroeste regions in the context of the COVID-19 pandemic in the state of Minas Gerais is evident in the results shown in Table 3, noting that the probability of death in these two regions are higher than the order of 2.0 times in relation to the other regions.

Table 3: Odds ratio of continuous and categorical predictors (for Level A in relation to Level B) in the composition of the variable (Y') of evolution of COVID-19 (event: death) for the state of Minas Gerais, Brazil.

Continuous Predictors		Odds Ratio	CI 95%
'Age' - 'A'		1,0644	(1,0612; 1,0670)
'Race' - 'R'		3,6813	(3,4222; 3,9600)
'Comorbidity' - 'C'		1,2373	(1,1816; 1,3378)
Categorical Predictors		Odds Ratio	CI 95%
Level A	Level B		
Sex - 'S'			
Male	Feminino	1,3931	(1,2739; 1,5234)
'Class of Sanitation Service' - 'CSS'			
Inadequate	Adequate	1,3287	(1,1886; 1,4853)
Little Adequate	Adequate	1,3753	(1,1976; 1,5792)
Little Adequate	Inadequate	1,0350	(0,8925; 1,2003)
'Planning Regions' - 'RP'			
Central	Alto Paranaíba	0,8872	(0,6874; 1,1451)
Centro-Oeste	Alto Paranaíba	0,6186	(0,4410; 0,8679)
Jequitinhonha-Mucuri	Alto Paranaíba	2,1822	(1,5248; 3,1251)
Noroeste	Alto Paranaíba	1,3213	(0,8668; 2,0140)
Norte	Alto Paranaíba	0,7615	(0,5407; 1,0724)
Rio Doce	Alto Paranaíba	0,7603	(0,5771; 1,0017)
Sul de Minas	Alto Paranaíba	0,7664	(0,5784; 1,0154)
Triângulo	Alto Paranaíba	0,8928	(0,6817; 1,1694)
Zona da Mata	Alto Paranaíba	0,7940	(0,5964; 1,0572)
Centro-Oeste	Central	0,6973	(0,5434; 0,8948)
Jequitinhonha-Mucuri	Central	2,4596	(1,8713; 3,2329)
Noroeste	Central	1,4892	(1,0478; 2,1166)
Norte	Central	0,8383	(0,6682; 1,023)
Rio Doce	Central	0,8570	(0,7351; 0,9991)
Sul de Minas	Central	0,8638	(0,7317; 1,0198)
Triângulo	Central	1,0063	(0,8781; 1,1532)
Zona da Mata	Central	0,8949	(0,7508; 1,0667)
Jequitinhonha-Mucuri	Centro-Oeste	3,5275	(2,4749; 5,0276)
Noroeste	Centro-Oeste	2,1358	(1,4018; 3,2541)
Norte	Centro-Oeste	1,2309	(0,8772; 1,7271)
Rio Doce	Centro-Oeste	1,2291	(0,9406; 1,6060)
Sul de Minas	Centro-Oeste	1,2388	(0,9417; 1,6297)
Triângulo	Centro-Oeste	1,4432	(1,1053; 1,8845)
Zona da Mata	Centro-Oeste	1,2835	(0,9742; 1,6910)
Noroeste	Jequitinhonha-Mucuri	0,6055	(0,3932; 0,9325)
Norte	Jequitinhonha-Mucuri	0,3489	(0,2444; 0,4982)
Rio Doce	Jequitinhonha-Mucuri	0,3484	(0,2395; 0,4678)
Sul de Minas	Jequitinhonha-Mucuri	0,3512	(0,2598; 0,4748)
Triângulo	Jequitinhonha-Mucuri	0,4091	(0,3070; 0,5452)
Zona da Mata	Jequitinhonha-Mucuri	0,3639	(0,2678; 0,4943)
Norte	Noroeste	0,5763	(0,3792; 0,8758)
Rio Doce	Noroeste	0,5755	(0,3971; 0,8338)
Sul de Minas	Noroeste	0,5800	(0,3983; 0,8446)
Triângulo	Noroeste	0,6757	(0,4714; 0,9686)
Zona da Mata	Noroeste	0,6009	(0,4098; 0,8813)
Rio Doce	Norte	0,9985	(0,7586; 1,3144)
Sul de Minas	Norte	1,0065	(0,7586; 1,3352)
Triângulo	Norte	1,1725	(0,8988; 1,5295)
Zona da Mata	Norte	1,0427	(0,7816; 1,3912)
Sul de Minas	Rio Doce	1,0079	(0,8314; 1,2220)
Triângulo	Rio Doce	1,1742	(0,9799; 1,4072)
Zona da Mata	Rio Doce	1,0443	(0,8621; 1,2649)
Triângulo	Sul de Minas	1,1650	(0,9650; 1,4065)
Zona da Mata	Sul de Minas	1,0361	(0,8448; 1,2707)
Zona da Mata	Triângulo	0,8893	(0,7268; 1,0882)

In Table 4, the high and significant contrast of the chi-square statistic comparing the regions of the state depicts the social, environmental and economic discrepancy in Minas Gerais. The Jequitinhonha-Mucuri region, in contrast to all other regions of the state, contributes significantly to the response variable [P (death)] of the model. Contrasts with less inflated chi-square values were observed between the regions of Alto Paranaíba, Central, Centro-Oeste, Triângulo, Zona da Mata and Sul de Minas.

Table 4: Chi-Square parameters (χ^2) for continuous variables (Wald's criterion) and comparison of categorical variables in the composition of the variable (Y') of COVID-19 evolution for the state of Minas Gerais, Brazil.

Contrast	Chi-Square (χ^2)	Pr > χ^2
'Age' - 'A'	2476,274	< 0,0001 ***
'Race' - 'R'	69,949	< 0,0001 ***
'Comorbidity' - 'C'	1783,299	< 0,0001 ***
'Sex' - 'S'		
Male vs Female	94,497	< 0,0001 ***
'Class of Sanitation Service' - 'CSS'		
Adequate vs Inadequate	40,303	< 0,0001 ***
Adequate vs Little Adequate	50,854	< 0,0001 ***
Inadequate vs Little Adequate	3,664	0,056 **
'Planning Regions' - 'RP'		
Alto Paranaíba vs Central	0,377	0,539 ns
Alto Paranaíba vs Centro-Oeste	6,574	0,010 ***
Alto Paranaíba vs Jequitinhonha-Mucuri	34,539	< 0,0001 ***
Alto Paranaíba vs Noroeste	0,723	0,395 ns
Alto Paranaíba vs Norte	2,331	0,127 ns
Alto Paranaíba vs Rio Doce	1,755	0,185 ns
Alto Paranaíba vs Sul de Minas	4,197	0,040 **
Alto Paranaíba vs Triângulo	0,033	0,855 ns
Alto Paranaíba vs Zona da Mata	1,106	0,293 ns
Central vs Centro-Oeste	8,043	0,005 ***
Central vs Jequitinhonha-Mucuri	67,357	< 0,0001 ***
Central vs Noroeste	2,087	0,149 ns
Central vs Norte	2,126	0,145 ns
Central vs Rio Doce	1,799	0,180 ns
Central vs Sul de Minas	6,257	0,012 **
Central vs Triângulo	0,607	0,436 ns
Central vs Zona da Mata	0,661	0,416 ns
Centro-Oeste vs Jequitinhonha-Mucuri	69,727	< 0,0001 ***
Centro-Oeste vs Noroeste	8,256	0,004 ***
Centro-Oeste vs Norte	1,048	0,306 ns
Centro-Oeste vs Rio Doce	3,492	0,062 *
Centro-Oeste vs Sul de Minas	1,130	0,288 ns
Centro-Oeste vs Triângulo	9,342	0,002 ***
Centro-Oeste vs Zona da Mata	4,179	0,041 **
Jequitinhonha-Mucuri vs Noroeste	15,823	< 0,0001 ***
Jequitinhonha-Mucuri vs Norte	54,177	< 0,0001 ***
Jequitinhonha-Mucuri vs Rio Doce	69,362	< 0,0001 ***
Jequitinhonha-Mucuri vs Sul de Minas	77,951	< 0,0001 ***
Jequitinhonha-Mucuri vs Triângulo	55,663	< 0,0001 ***
Jequitinhonha-Mucuri vs Zona da Mata	60,906	< 0,0001 ***
Noroeste vs Norte	4,329	0,037 **
Noroeste vs Rio Doce	3,695	0,055 **
Noroeste vs Sul de Minas	5,977	0,014 ***
Noroeste vs Triângulo	1,257	0,262 ns
Noroeste vs Zona da Mata	2,886	0,089 *
Norte vs Rio Doce	0,321	0,571 ns
Norte vs Sul de Minas	0,037	0,848 ns
Norte vs Triângulo	3,154	0,076 *
Norte vs Zona da Mata	0,580	0,446 ns
Rio Doce vs Sul de Minas	1,169	0,280 ns
Rio Doce vs Triângulo	2,999	0,083 *
Rio Doce vs Zona da Mata	0,109	0,741 ns
Sul de Minas vs Triângulo	7,730	0,005 ***

* significant coefficient at 10%, ** at 5% and *** at 1%.

3.2. Decision Tree Model for COVID-19 evolution data

The classification tree (Fig. 2) for the binary dependent variable shows in the first node (p-value: 0.000), the classification of obituaries in the sense of the age groups between 60 and 69 years (31.1%; n = 1193); 70 and 79 years (47.4% of deaths; n = 1446), 80 and 89 years (61.2%; n = 1375) and 90 years or more (68.1%; n = 370). The classification of recovered patients is quite expressive in those nodes that comprise the age groups between 50 and 59 years (85.1%; n = 3793), 40 and 49 years (93.7%; n = 4676), 30 and 39 years (97.6%; n = 5344) and 20 to 29 years, 10 to 19 years, 1 to 9 years and less than 1 year (98.9%; n = 4947).

The comorbidity variable classifies almost all nodes in a second depth layer (p-value: 0.000), with the exception of the node aged 90 years or older. This in turn, extends to a terminal node (p-value: 0.001) for the gender variable, with a narrow propensity of deaths in men (76%; n = 171) in relation to women (62.6%; n = 199).

In all these age groups, the percentage difference is significant between deaths and recoveries, considering only the nodes with and without reports of comorbidity, ranging between 5.8%, between 70 and 79 years and 12.8%, between 40 and 49 years. Therefore, even in those

age groups that responded better to recovery, the report of pre-existing disease was significant for the classification of deaths by COVID-19 in the dependent variable. The “Not Informed” classification ends at terminal nodes for comorbidity (Fig. 2).



Fig. 2. Decision Tree Diagram (CHAID model) with 53 terminal nodes.

The third depth layer of the classification tree is quite diverse in the formation of the last nodes, the sex variable being the one that classifies most of these nodes. The proportional difference between men and women regarding recorded deaths is relevant in the five classified nodes, ranging from 7.7% (age range between 70 and 79 years, with comorbidity) and 9.9% (age range between 60 and 69 years, without comorbidity).

The ethno racial aspect (p-value: 0.003) is quite evident for the classification of deaths in the group of brown, black and indigenous individuals (4.2%; n = 22) in relation to white and yellow individuals (0.7%; n = 4), within the node of associated non-comorbidity and age groups of 20 to 29 years, 10 to 19 years, 1 to 9 years and less than 1 year (Fig. 2).

The class of basic sanitation service prevalent in the municipality of residence of the individual, classifies the age group between 60 and 69 years old, with some pre-existing disease, differentiating the appropriate, little adequate and inadequate services (p-value: 0.000). The death records in the municipalities with a prevalence of inadequate service (43.3%; n = 391) and little adequate (51.7%; n = 148) are proportionally higher than the obituaries in the municipalities classified as adequate (36.6 %; n = 354).

The variable that frames the individual's municipality of residence among the state's planning regions classifies three nodes, all of which have no associated comorbidity. In summary, the inclusion of the municipalities of Jequitinhonha-Mucuri and Noroeste in the terminal nodes greatly expands the expression of the percentage of deaths in relation to that of patients recovered by COVID-19, in the age groups between 30 and 39 years old (10.9%), 40 and 49 years old (7.8%) and 80 and 89 years old (23.2%). Similarities, were also observed in the composition of the planning regions for the nodes of the classification tree.

IV. DISCUSSION

The results of this research agree with the conclusions of recent studies on the evolution of COVID-19 in social groups in several Brazilian regions. The prevalence of death records in the population strata of adult and elderly individuals, between 60 and 69 years, 70 and 79 years, 80 and 89 years and 90 years or more, male and with some pre-existing disease, matches the profile of greater severity and susceptibility to COVID-19 [7, 30].

In this context, social distance and policies to contain the transmission of the disease must consider the age composition in the regional context, as well as intergenerational interactions. Protective public health measures against COVID-19 and with significant reach for individuals with chronic diseases such as hypertension, diabetes, obesity, cardiovascular and respiratory diseases, are becoming increasingly urgent in the state of Minas Gerais [11, 33, 37].

There is great concern in the elderly classes (aged between 60 and 69 years old) and with some comorbidity, living in regions where the basic sanitation service that is inadequate (Index of Service with Collection and without Treatment) and inadequate (Index of Service without Collection) prevails and without Treatment). The probability of occurrence of deaths by COVID-19 in these groups, to the detriment of recovery from the disease, exposes the critical and unequal socio-environmental

context of some mining regions, greatly increasing the risk and prevalence of the disease in the state.

In this sense, the results of this work reinforce the discrepancy in the quality and reach of basic sanitation services and programs of prophylactic measures by the government, as a risk factor for the disease and its spread in the poorest regions of the state and among the population. elderly, resulting from the phenomenon of internalization of the disease [2, 12]. Such social, environmental and demographic factors are challenging in the country, including the lack of knowledge about the transmission characteristics of COVID-19, in the context of historical social and racial vulnerability. And, precisely in the regions of Jequitinhonha-Mucuri and Noroeste, which comprise the poorest municipalities in the state of Minas Gerais, there was a higher odds ratio for the registration of deaths by COVID-19 [3, 13].

Younger and classified individuals without any correlated comorbidity, in general, do not correspond to the highest probability of the event 'death' due to the disease. However, there is an aggravation of deaths due to COVID-19 among the brown, black and indigenous populations classified precisely among the youngest individuals, between the age groups of 20 to 29 years old, 10 to 19 years old, 1 to 9 years old and less than 1-year-old, with no record of comorbidity.

This is also a relevant aspect in this research, which reinforces observations that the pandemic of COVID-19 exposes unsuccessful social and political fractures in the peripheries of urban centers and fragmented in small and medium-sized municipalities, with racialized and discriminatory responses, exposing the fragility of young blacks and browns facing the disease [9, 34].

In this regard, the results are in line with some research that claims about racial disparities associated with health result from a historical process of racial segregation of households and occupation of urban areas, such as inequalities in employment opportunities, income and access to health care. Education [13, 41]. The structural and institutional racism present in the country, and so well explained before the numbers and records of the COVID-19 pandemic, reinforces the distance between the Brazilian State, the unequal condition of access of the black population to basic sanitation and public health services, and finally, the significant decrease in the life expectancy of these young people, in view of the glaring conditions of vulnerability of these communities [22].

And in this sense, the character of ethno racial vulnerability takes on alarming proportions, considering that public policies for the containment of the COVID-19

pandemic do not reach historically marginalized social groups, recognizing the limited access of these communities to health care and decent conditions. work and employment [9, 15]. And even when they are able to access health service spaces, some authors question the quality of the treatment provided as a result of racial discrimination in the health context [23, 29, 38].

It is also necessary to pay attention to the circulation aspect of the youngest who make up part of the economically active population. In general, they are users of public transport and remain working outside home-office standards or are looking for a replacement in the job market. This situation imposes a practically constant condition for the circulation of the virus and the spread of the disease among these social groups and among the individuals closest to the family and the community.

In summary, the research offers important subsidies for the composition of risk factors in the pandemic scenario of COVID-19 in view of the social, environmental and demographic strata of the spread of the disease in the state of Minas Gerais. And therefore, the actions of the public authorities need to ensure that the fragile population has safe conditions for prophylaxis, access to health services and a guarantee of minimum income.

V. CONCLUSION

The probability of occurrence of deaths due to COVID-19 in the state of Minas Gerais, in the data coverage period of this research, is significantly higher in males, aged over 60 years, with some comorbidity, declared black and brown, residents in municipalities located in the poorest macro-regions of the state, where inadequate or inadequate classes of basic sanitation prevail.

The classifications in the decision tree that admit the racial profile of deaths among the younger groups without associated comorbidity, and among the elderly with comorbidity, not assisted by an adequate basic sanitation network, reiterate the historical social asymmetries experienced by marginalized populations and alert to the urgency of protective actions by the state and municipal public authorities, far beyond the COVID-19 pandemic scenario.

The study and monitoring of the evolution of COVID-19, which is still being disseminated in the country, should cover more specific data and records on the progress of the disease in social, environmental, demographic and economic strata and groups. Based on regression models and learning machine techniques, it is possible to provide the necessary depth for reflection and the formulation of

inclusive policies in the face of the worsening of the environmental crisis in the country characterized by the pandemic of COVID-19.

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Uranium exploration in Brazil and its consequences

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Abstract—In the mid-70s, the former NUCLEBRAS carried out several studies to prospect for uranium minerals in the Northeast region. However, the anomalous occurrence of uranium and thorium located in the Agreste Semiárido region of Pernambuco, in the Pernambuco municipalities of Pedra and Venturosa drew the attention of technicians. However, after detailed studies, it was found that, despite the high concentrations of uranium and thorium, the occurrences were punctual, which made its extraction economically unfeasible. Despite being considered economically unviable, the inhabitants of the municipalities of Pedra and Venturosa are subject to high levels of natural radiation, which can result in damage to health. In Brazil, the exploration of radioactive ores is the responsibility of the Federal Government, with the National Nuclear Energy Commission (NNEC) being responsible for the administration of such resources, with the Nuclear Industries of Brazil (NIB) responsible for mining activities. Considering Brazilian law, NNEC is also responsible for radioactive deposits considered economically unviable, as it is a regulatory and supervisory body for all nuclear activities in the country. Thus, and within this context, the present study aimed to research, under Brazilian law, the legal responsibility for the natural radioactive anomaly existing in the Pernambuco and Pedra de Venturosa municipalities. For this purpose, a bibliographic review search in the specialized literature was used. The results obtained showed that, legally, CNEN is responsible for the natural radioactive anomaly located between the municipalities of Pedra and Venturosa, and therefore, it must adopt mitigating measures of radiological protection in those municipalities.

Keywords—Environmental legislation, Natural Radioactivity, Nuclear Ore.

I. INTRODUCTION

Brazil has one of the largest uranium reserves in the world, which makes it possible to supply domestic needs in the long term and make the surplus available to the foreign market. In June 2001, Brazil registered the sixth largest uranium geological reserve in the world, with approximately 309,000 tons of U₃O₈ in the states of Bahia, Ceará, Paraná and Minas Gerais, among other occurrences. Prospecting studies and geological surveys were carried out in only 25% of the national territory (1). The country also has uraniferous occurrences associated with other minerals, such as those found in the Pitinga deposits in the State of Amazonas and the Carajás area, in the State of Pará, with an estimated additional potential of 150,000 tons. Brazilian geological reserves have evolved from 9,400 tonnes, known in 1975, to the current quantity,

which can be expanded with new prospecting and mineral research work (1).

Uranium is a mineral that exists in nature under different conditions (either as ore, or associated with other minerals, such as, for example, gold and phosphate), being used as the main input to produce the fuel of nuclear plants. It is worth mentioning the density of uranium compared to that of other energy sources. About 1 kg of uranium generates 50,000 kWh of electricity, while 1 kg of coal or oil generates 3 to 4 kWh (1). This makes uranium a highly valued element in the world, as an alternative source for the generation of electricity.

In Brazil, uranium reserves are 309,000 tons of uranium and comprise the deposits of Itataia, Ceará, with approximately 142,000 tons (where uranium is associated with phosphate), Lagoa Real, in Bahia, with 93,200 tons,

and other smaller deposits, such as Gandarela, in Minas Gerais (where gold is associated with uranium), Rio Cristalino, in Pará, and Figueira, in Paraná. The Lagoa Real-Mina de Caetité deposit has total reserves of 100,770 tons of uranium, a sufficient quantity to supply the Angra 1, Angra 2, Angra 3 plants and four other plants (4,000 MW) during the entire useful life of these plants. In Santa Quitéria (Ceará), with total reserves of 142,500 tons of uranium associated with phosphate, an industrial complex for the exploration of uranium phosphate will be implemented. The Caldas deposit, in Minas Gerais, has total reserves of 4,500 tons, while the Cachoeira deposit will yield 300 tons of concentrated uranium per year for 15 years (1).

In Brazil, uranium mining is done in the open. The only mine in operation is Caetité, in Bahia, which uses the leaching process, ultimately resulting in a uranium concentrate in the form of ammonia diuranate (DUA). There is a forecast for underground mining at the Cachoeira mine, due to the approval of the licensing request requested by the Nuclear Industries of Brazil (NIB), the only uranium processing company in the country (1). The exploration of the uranium associated with phosphate will be carried out at the Itataia mine, in Santa Quitéria (Ceará), by the private company Galvani, responsible for the exploration and commercialization of phosphate, the raw material for the manufacture of phosphate fertilizers and mineral salt for animal nutrition. The economic viability of Itataia's uranium depends on the exploration of the associated phosphate, that is, the extraction of uranium is conditioned to the mining and the improvement of the phosphate ore. As a by-product in this process, the uranium liquor will remain with NIB(1).

The Mineral Treatment Unit (MTU) in Caldas, in Minas Gerais, was the first mining and processing project for uranium ore to operate in Brazil. It consisted of an open pit mine, or treatment facilities and a metallurgical processing plant for the production of uranium concentrate and a sulfuric acid factory. The plant was designed for an annual production of ammonia diuranate (DUA) of 500 tonnes equivalent to U_3O_8 . The mining of uranium ore began in 1977 and the plant's operation was closed in 1995 due to economic unfeasibility. During this period, around 1,200 tons of U_3O_8 were produced (1).

Uranium exploration in Brazil was started in 1952 by the National Research Council (NRC). This led to the discovery of the first uranium deposits in Poços de Caldas and Jacobina. These activities were subsequently continued by the National Energy Commission / National Nuclear Energy Commission (NNEC), formed in 1962. The founding of NUCLEBRAS in late 1974 marked the

growing effort of the country's uranium exploration program. At that time, only the Poços de Caldas deposit was known as measurable resources (2). Due to the reorganization of the Brazilian nuclear program in 1988, all uranium exploration in the country was interrupted. Until then, eight areas with uranium reserves have been identified, namely, the Poços de Caldas plateau (Minas Gerais); Figueira (Paraná); Quadrilátero Ferrífero (Minas Gerais); Amarinópolis (Goiás); Rio Preto / Campos Belos (Goiás); Itataia (Ceará); Lagoa Real (Bahia); Espinharas (Paraná). The first uranium production in Brazil, at the Osamu Utsumi mine (Poços de Caldas deposit), started in 1982. Due to rising costs and reduced demand, this activity was put on standby between 1990 and 1992. The mine was restarted in 1993 but was stopped again in October 1995. The mine's accumulated production up to 1996 was 1241 tonnes of uranium. Currently, the Lagoa Real deposit is being prepared as a new producing mine (2).

Uranium is an element that has the peculiarity of being used to produce heat. For this reason, it has its greatest use in the nuclear industry, as fuel for thermal plants to generate electricity. Although it is not a renewable energy source, its use as an energy fuel is greatly optimized.

The Federal Constitution (3) maintained, in its art. 21, XXIII and in art. 177, the Union's monopoly for the entire uranium chain, from mining to electricity generation. In order to exercise it, there are two state-owned companies, one responsible for the research and mining of uranium, Nuclear Industries of Brazil (NIB), and the other for the generation of nuclear energy (Eletrobrás). With regard to the inspection of activities involving the mineral and the final destination of radioactive waste, this is the responsibility of the National Nuclear Energy Commission (NNEC), the federal authority that created Rule 1.13, Licensing of Mines and Mining Processing Plants Uranium and / or Thorium, grant authorization for mining. Given the magnitude of the environmental impacts of uranium mining as well as nuclear generation and, considering that it is a strategic sector for the country, both are subject to prior environmental licensing by IBAMA, according to Art. 4, IV, of the Resolution CONAMA 237/97 (4). However, other environmental agencies intervene during the process, such as state environmental agencies and the administration of the Conservation Unit, when necessary.

The Preliminary License is the first environmental license to be obtained, and for that purpose an environmental impact study must be submitted, as well as a recovery plan for the degraded area as established in art. 3 of Decree 97.632 / 89 (5). The following licenses are for

the installation of the enterprise and the last for operation. For each phase, specific studies must be submitted to the licensing body. Thus, as can be seen from the procedures briefly outlined above, due to the exploitation of nuclear mineral deposits significantly impacting the local ecosystem, national legislation imposes a careful licensing procedure, which, once completed, will require the environmental agencies to take steps to inspection of the activity, in compliance with the technical rigors imposed on its exercise.

In the case of the exploration of ores containing uranium, however, the procedure apparently extended, the current environmental legislation lacks technical specificities necessary for the safety of the environment and the health of the population, in addition to an inefficient inspection by the environmental agency, often resulting from lack of human resources, specific technical knowledge for the activity, and even technological resources. In this sense, it is important to have a specific rule regulating the licensing of uranium research and mining activities, such as CONAMA Resolution 23/94 (4) which deals with the environmental licensing of the seismic, prospecting, production and exploration phases. Oil and Gas.

Uranium ores for being radioactive must be handled with caution so as not to generate environmental damage, and in addition to all the known consequences of such damage, it will also incur huge costs for the entrepreneur himself with remedial and compensation measures. For this reason, it is increasingly necessary to reinforce internal environmental monitoring programs, which must be constant and monitor both the operation and the closure of the mine, as the main environmental problems are related to these stages. In both phases, the resources most affected are water, flora and soil.

In many cases, the recovery of areas degraded by uranium exploration consists of relocating contaminated soil, as well as preventing and controlling erosion, usually done with vegetation. However, complete recovery of the area is not always possible. Sometimes, the contamination has such a wide scope that the removal of all the contaminated soil becomes impracticable and may even impede the extraction of the mineral. Therefore, and within this context, the objective of this work was to carry out a bibliographic research, aiming to show the consequences of uranium exploration in Brazil.

II. METHODOLOGY

In the present work, the methodology of bibliographic survey in specialized literature was used, with emphasis on

the exploration of uranium and its consequences for the natural environment and for human beings, analyzing the phases of operation and decommissioning of uraniumiferous mines according to the current laws.

III. RESULTS AND DISCUSSION

3.1. Brief history of uranium exploration in Brazil

The systematic prospecting of radioactive minerals, initiated in 1952 by the National Research Council of Brazil (NRCB), led to the discovery of the first indications of uranium in Poços de Caldas (Minas Gerais) and Jacobina (Bahia). This phase of activities initially depended on foreign know-how. In 1955, technical cooperation agreements were signed with the government of the United States of America to recognize the potential of uranium in Brazil. In 1962, the recently created National Nuclear Energy Commission (NNEC) sought the collaboration of the French Center for Nuclear Studies (FCNS) in the organization of its Mineral Exploration Department (2). So, at the 1970s, more financial resources were made available for prospecting for radioactive minerals exclusively through NNEC. With the founding of NUCLEBRÁS in December 1974, the Brazilian government's efforts received a boost in the basic part of the nuclear program, namely, the development of exploration and mining of uranium deposits. When, in December 1975, Brazil and Germany signed the Cooperation Agreement in the Field of the Peaceful Uses of Nuclear Energy, the Osamu Utsumi mine, in Minas Gerais, was the only known and measured uranium deposit (2).

Due to the reorganization of the Brazilian nuclear program in 1988, all uranium exploration activities were interrupted in 1991. After a reorganization of the Brazilian nuclear program in 1988, uranium exploration activities were delegated to a special organization known as "Urânio do Brasil SA", which was organized as a subsidiary of Nuclear Industries of Brazil (NIB), a holding company responsible for planning, programming and executing the nuclear fuel cycle. Currently, only NIB is responsible for all nuclear fuel cycle management activities in Brazil. During the period from 1990 to 1992, uranium production was on standby. Production restarted at the end of 1993, and stopped again in October 1995, with the production of 211 tons of U_3O_8 (2).

The action of the former company NUCLEBRAS in the development of mining research for ores containing uranium, was of great importance for the discovery in Brazil of important deposits of natural occurrences of uranium deposits. Although there are currently other sites

for deposits of uranium ores discovered in Brazil, for historical reasons, we will highlight the main uranium occurrences discovered by NUCLEBRAS in the national territory.

-1- Deposit of Lagoa Real (Bahia)

The uranium anomalies of the uranium Province of Lagoa Real, in the Caetité municipality of Bahia, are found in an archaic basement of the zone composed of cataclastic granitoids, gneisses augens, gneisses microcline, granodiorites and albitites. Discovered in 1977, the uranium occurrence in Lagoa Real had reserves of 100,000 tons of uranium concentrate. Initially, the anomalies of Minas Cachoeira and Quebradas were explored, which together produced 300 tons of uranium annually by open pit mining (2).

Currently, uranium mining in Brazil is carried out by NIB at its Uranium Concentration Unit, located in the municipality of Caetité (Bahia). Activities include mining and mineral processing operations. The unit is located in the uranium province of Lagoa Real, where there is a resource of 99.1 thousand tons of uranium contained (U_3O_8) distributed in 17 deposits. The ore is extracted from the mine and transported by trucks to be crushed. After going through stages of primary and secondary crushing (particle size reduction operations), the material is disposed of in piles and receives a solution of sulfuric acid that extracts uranium from the rock. This process is known as leaching and it results in a liquid, uranium liquor - a solution of sulfuric acid with uranium. This uranium liquor is purified and treated with various chemical and physical separation processes, which generates the uranium concentrate, also known as yellowcake. This material is stored in special, fully sealed drums and proceeds to another stage of the nuclear fuel cycle: conversion (6). The Caetité Uranium Concentrate Unit started to be implemented in 1995, and the effective exploration of uranium was only started in 1999, on an experimental basis, when it already had all the necessary licenses to operate, having produced uranium concentrate commercially from the year 2000. This uranium reserve, known as Jazida da Cachoeira, was detected in 1977 in an area where there are about 100 thousand tons of ore (7).

-2- Deposit of Figueira (Paraná)

In the Figueira deposit, uranium mineralization is located in the sedimentary sequence between the coal seam and the limestone, associated with carbonaceous sandstones, siltstones. In sandstones, uranium mineralization is found in the form of uraninite between the interstices of quartz, grains cemented by a limestone cement. Within carbonaceous silts and coal, uranium

mineralization occurs in the form of organo-mineral complexes (2).

-3-Deposit of the Quadrilátero Ferrífero (Minas Gerais)

In the deposition of the Quadrilátero Ferrífero, the oligomitic metaconglomerates of the base section of the Moeda Formation have uranium mineralization, especially the horizons connected to a paleodrainage drainage in the direction of approximately N45 ° E. The stones of the conglomerate are almost all quartz, rarely quartzite. It is a relatively immature conglomerate with an abundant matrix of light green quartz sericite, generally quite pyritic with uraninite and pitchblende mineralization (2).

-4-Amorinópolis Deposit (Goiás)

The Iporá-Amorinópolis area, where uranium mineralization occurs, is located in the so-called Amorinópolis horst. The area was subjected to tectonic movements of a tensile nature that caused gravity failures and injection of alkaline materials. The uranium mineralization of the Amorinópolis deposit is of two types, a primary with +4 valence uranium and a secondary with +6 valence uranium. The primary mineralization is composed of dark minerals, pitchblende (uraninite) and coffinite. The secondary consists mainly of autunite and sabugalite, which are products of alteration of primary mineralizations. Uranium mineralization is essentially controlled by the physical-chemical conditions of the host sandstone and by the hydrodynamic flow of the solutions (2).

-5-Itaia Deposit (Ceará)

The uranium mineralization of the Itaia deposit is associated with apatite or colophane. Typical apatite occurs in usually millimetric idiomorphic crystals, filling fractures and pores of feldspar rocks (episiênitos), gneisses, marbles and chalcosilicate rocks or even in gaps (2).

-6-Espinharras Deposit (Paraíba)

In the Espinharras deposit, uranium mineralization occurs in dams of feldspar rocks enclosed in gneisses in an area of about 1.2 km. It is related to metasomatic phenomena of the sodium type (albitization). Mineralized rock is composed of 80 to 90% feldspar, some biotites and small amounts of apatite and carbonates. Its grain size ranges from very thick pegmatite to microcrystalline. In the vicinity of the dikes, the surrounding rock (amphibolite biotite gneiss) is infiltrated by feldspar material. Several radioactive minerals, including uraninite, have been observed. The primary radioactive minerals

were mostly totally altered, forming secondary minerals not identifiable on the surface (2).

Since the initial studies carried out by the former NUCLEBRAS, NIB has been conducting several studies on the occurrence of uranium deposits in the Brazilian territory. It was observed that in Brazil, uranium occurs in different types of deposits and mineralizations: -1- marine platform sediments; -2- sedimentary deposits; -3- metamorphic sediments; -4- deposits of the karst type; -5- mineralization in granites; -6- uranium mineralizations in pegmatites; -7- metasomatic deposits (uranium in albitites); -8- mineralization in alkaline rocks and carbonatites; and -9- uranium lineaments and metallogenesis(1). As can be seen, Brazil has a high potential for uranium deposits. However, it is not enough to just explore the ores that contain uranium, but this must be done considering the sustainability indicators that are essential for carrying out the decommissioning.

3.2. Impacts caused by uranium exploration in Brazil

Decree No. 97,632, of April 10, 1989 (5), which provides for the regulation of Article 2, item VIII, of Law No. 6,938, of August 31, 1981, legislates on the issue of impacts caused by exploration of mineral resources in the Brazilian territory:

1st. The undertakings that are destined for the exploration of mineral resources must, when presenting the Environmental Impact Study - EIS and the Environmental Impact Report - EIR, submit to the approval of the competent environmental agency, a plan for the recovery of degraded area.

Single paragraph. For existing projects, a plan to recover the degraded area must be presented to the competent environmental agency, within 180 (one hundred and eighty) days, as from the date of publication of this Decree.

2nd. For the purposes of this Decree, processes resulting from damage to the environment are considered degradation, by which some of their properties are lost or reduced, such as the quality or productive capacity of environmental resources.

3rd. The recovery should aim to return the degraded site to a form of use, in accordance with a pre-established plan for land use, with a view to achieving environmental stability.

Regarding the exploration and processing activities of uranium ores, the CNEN-NE-4.01 (8) Standard has the following dictates: (1) Establishes the safety and radiological protection requirements of mining-industrial facilities that handle, process, as well as storing ores, raw

materials, steriles, residues, slag and tailings containing radionuclides from the natural series of uranium and thorium, simultaneously or separately, which can at any time during their operation or post-operational phase cause exposures undue exposure by individuals of the public and workers to ionizing radiation; (2) Applies to activities in mining-industrial facilities in operation, suspended or that have ceased their activities before the date of issue of this Standard, intended for mining, physical, chemical and metallurgical processing and the industrialization of raw materials and wastes containing associated radionuclides from the natural series of uranium and thorium, covering the stages of installation, operation and decommissioning of the installation.

It appears that both Decree No. 97.632 / 1989 and Norm CNEN-NE-4.01 require plans to recover degraded areas resulting from mineral exploration activities. Uranium exploration in Brazil began in 1982, in the municipality of Caldas (MG). In 1995, INB found that the unit's operation was economically unfeasible and ended its activities. Ten years later, the decontamination of its facilities and land began (9). The facilities, the soil, the waters and the equipment of the old mining are permanently monitored, as well as the radioactive materials that are stored there, in order to protect the environment and ensure the health of the workers of the unit and the residents of the region.

At the Caldas Decommissioning Unit, the Environmental Laboratory for Chemical and Radiological Analysis is installed, which carries out the necessary analyzes for monitoring the environment in areas where INB units in Bahia, Ceará, Minas Gerais and São Paulo operates. In 2012, IBAMA approved the Recovery Plan for Degraded Areas, which was prepared based on studies in the areas of hydrology, geochemistry, hydrochemistry and radioprotection, carried out with the objective of defining the works to be carried out and the actions of environmental recovery that must be developed in the unit (9).

Since its decommissioning in 1995, the Poços de Caldas Minerals Treatment Unit Complex has been the target of much criticism by parts of several entities, and mainly by the local population. Until the present date, no environmental recovery works have been carried out on the site where the mine operated. There is still a radioactive waste containment dam that has been in the open for decades. This dam has high amounts of radioactive waste from uranium, thorium and their descendants, as does radio. According to Pires (1), with regard to water resources, it is observed that mining causes important changes in the hydrological system. Such

changes, neglected environmentally, can lead to contamination of water courses and reservoirs. According to Pires (1), the exploration of the uranium mining activity necessarily requires high costs with the environment heading, costs that are not always available in the Union budget. It is a fundamental role of the State to provide essential services and we do not see uranium mining as a essential service. It is rather a means activity, in order to generate electricity, which, like any other that exploits natural resources, must receive sufficient investments to operate safely and undergo all types of inspection provided by law.

As a result of the Federal Public Ministry's action, the National Nuclear Energy Commission decided to institute an action plan for the regulatory control of the tailings dam of the Mineral Processing Unit of the Brazilian Nuclear Industries (NIB), located in the municipality of Caldas, in Minas Gerais. The full document was published in the Federal Official Gazette on 05/23/2019 (10). The President of the National Nuclear Energy Commission, in the use of the powers conferred on him by article 15, items I and V, of Annex I, to Decree n° 8.886, published in the Official Gazette of October 25, 2016, resolves:

Art. 1st To institute the Action Plan related to the regulatory control over the Tailings Dam of the Mineral Treatment Unit of the Nuclear Industries of Brazil - INB in the municipality of Caldas - MG, according to Annex I to this Ordinance;

Art. 2 Attribute to the Directorate of Radioprotection and Nuclear Safety of CNEN the execution of the referred Plan;

(...)

ANNEX I

Directorate of Radioprotection and Nuclear Safety

Action plan

Regulatory control actions on the tailings dam of the Mineral Processing Unit (MPU) in Caldas

Introduction

This Action Plan aims to establish the set of actions and milestones within the regulatory scope that will guide the conduct of licensing, inspection and control activities of the tailings dam of the Mineral Processing Unit (UTM) in Caldas, owned and operated, under the responsibility of Nuclear Industries of Brazil - INB.

This Plan was prepared based on the actions recommended by the Federal Public Ministry, through the Federal Attorney's Office in the Municipality of Pouso

Alegre. The deadlines were established taking into account a feasible timetable for compliance.

Actions and Deadlines

1. CNEN shall, within 360 (sixty) days, within its sphere of competence, update the regulations relating to the Safety of Tailings Dam Systems containing Radionuclides, in order to adapt it to the National Policy on Dam Safety (PNSB) provided for in Law No. 12,334, of September 20, 2010.

The regulations must contain, at a minimum:

I - The registration system for dams inspected by CNEN, under construction, in operation and deactivated, as well as the periodicity of data update;

II - system of classification of tailings dams containing radionuclides, by risk category and by associated potential damage;

III - the establishment of minimum requirements for the implementation, by the entrepreneur, of a dam safety monitoring system, the level of complexity of which will depend on the classification of the structure by associated potential damage;

IV - the frequency, the qualification of the responsible team, the minimum content and the level of detail of the following inspections for Tailings Dams containing Radionuclides: (i) Regular Safety Inspection; (ii) Special Security Inspection; (iii) Periodic Dam Safety Review, in proportion to the dam's complexity and the needs to guarantee adequate safety conditions;

V - the qualification of the responsible team, the minimum content, the level of detail and periodicity of updating and revision of the Emergency Action Plan for Tailings Dams containing Radionuclides, proportionally to the complexity of the dam and the needs to guarantee adequate conditions of security;

VI - the requirement for the entrepreneur to submit to CNEN, at a periodicity to be fixed, a Declaration of the Stability Condition of the structure, to be mandatorily prepared by an external team, hired exclusively for this purpose;

VII - the requirement that the Safety Plan of every dam that is to be built after the enactment of Law No. 12,334 / 2010 has the "as built" project (as built);

VIII - the requirement that the Safety Plan of any dam that was built before the enactment of Law No. 12.334 / 2010 and that does not have the "as built" project (as built), contains the "as is" project (as it is), within a period to be fixed in the regulations.

IX - the establishment of deadlines, requirements and conditions for the decommissioning of nuclear mining dams that are in an abandoned situation, deactivated or with no expected return from operations;

X - the definition of the nominal value considered minimum for the Safety Factor of the dams, in compliance with the best national and international practices.

2. NNEC shall, within 90 (ninety) days, collect data on all tailings dams subject to its supervisory power, pursuant to art. 5 of Law 12.334 / 2010. The survey referred to in the caput must comprise, at least:

I - the identification of the entrepreneur;

II - identification of the person responsible for the design and execution of the construction;

III - identification of the existence of a "as built" or "as is" project, as appropriate.

3. NNEC shall, within 60 days, adopt all necessary measures so that the identified structures are registered in the National Dam Safety Information System (SNISB), established by Law 12.334 / 2010, if they have not yet been included by the entrepreneur.

4. NNEC shall adopt, within 180 days, the necessary measures to increase the inspection activities of the dams, either by requesting the assignment of servers from other bodies, entering into agreements or cooperation agreements, or even the emergency hiring of private agents. specialized.

5. Regarding specifically the UTM-Caldas Tailings Dam, NNEC must present a conclusive opinion, considering DNPM Ordinance No. 70.389 / 17, on the Emergency Action Plan submitted by NIB to MPF, within 45 days, from receipt of the document by NNEC, as well as verifying the effective implementation of the PSB, especially the PAEMB, by INB, monitoring the execution of the plans within 06 months, from the receipt of the complete PSB, when it will then report to the MPF, informing compliance or not by the company.

6. NNEC must monitor the measures to be implemented by NIB related to the restructuring of the tailings dam monitoring system, concurrently with the deadlines given to INB, analyzing the projects in a timely manner (before the respective execution), as well as monitoring the execution of the work.

The non-observances of the environmental legislation result from the lack of transparency and the fact that the State itself, through NNEC and IBAMA, inspecting itself, that is, inspecting the state-owned companies INB and Eletrobrás. In this context, the monopoly on activities

involving uranium has been discussed in Congress (JORGE, 2014). As a result, Jorge (2014) suggests the creation of a Nuclear Energy regulatory agency, since NNEC cannot regulate itself, nor legislate in its own cause.

The exploitation of uranium carried out by the Minerals Treatment Unit in Poços de Caldas left a great heritage of environmental liability of social responsibility of INB. The MTU Complex is formed by the Osamu Utsumi mine, in "open skies", with a "lake" of radioactive acid effluents from acid mine drainage (DAM). In December 2004, NIB signed a term of reference for the preparation and presentation of the closure plan requested jointly by IBAMA and NNEC. Several studies have been carried out to support the preparation of the closure plan. Since then, INB has, as its main liability, for closure purposes, the acid drainage generated in the pit ("lake"), in the waste dumps and on the tailings beach (11).

Acid mine drainage (DAM) at Osamu Utsumi Mine is relevant, both from an environmental point of view, and for the costs involved in neutralizing it. DAM is caused, basically, by the natural oxidation of metal sulfides (exposed in the pit, waste dump and tailings dam) in the presence of water and oxygen. As a result, there is formation of sulfuric acid, reduction of pH and dissolution of heavy metals associated with rocky matrices with serious environmental impacts. However, the water courses close to the mine pit, and used for public supply, showed high concentrations of natural radionuclides, mainly uranium-238 (238U) and radio-226 (226Ra) (11).

Currently, legal procedures for remediation of the site and decommissioning of this area are in progress, and NIB must comply with the requirements and standards established by the National Nuclear Energy Commission and the Brazilian Environment Institute (IBAMA). Figure 1 shows the spatial view of the Osamu Utsumi Mine in Poços de Caldas, with the mine pit ("lake"), with the environmental liabilities generated by the mineral exploration of uranium.



Fig.1: Spatial view of the Osamu Utsumi Mine in Poços de Caldas.

Source: Google (2020).

After the deactivation of the Osamu Utsumi Mine in Poços de Caldas, INB started to explore uranium in Lagoa Real, in the municipality of Caetité, in Bahia. Currently, the Lagoa Real Uranífera Province is the most important occurrence of uranium currently in Brazilian territory. Figure 2 shows the spatial view of the Lagoa Real Mine. According to Chaves (2005), the area is inserted in the so-called quadrilateral formed by the cities of Caetité, Lagoa Real, Maniaçu, and São Timóteo, near the border with Minas Gerais. After its discovery, several works were carried out with a view to mapping the bodies mineralized in uranium and its enclosures, characterizing its structural framework, dating and understanding the genesis of uranium mineralization and its spatial distribution. Chaves (12) also clarified that:

Mineral paragenesis and the distribution of uranium mineralization and its formation conditions make Lagoa Real Province an example of economic uranium concentration, occurring primarily in the form of oxide (U_3O_8), constituting the mineral ore called uraninite present in metamorphic rocks medium to high degree, associated with sodium metasomatism.



Fig.2: Spatial view of the Lagoa Real Mine in Bahia.

Source: BBC News (2020).

Porto et al. (13) presented a study on the impacts caused by uranium mining in Lagoa Real. These authors made some considerations in relation to the damage caused to the natural environment and to people:

Mineral exploration activities, in general, are known for the various impacts produced, such as: generation of effluents and toxic waste; environmental contamination of soil, air and water resources; occupational exposure to toxic substances (cyanide, sulfuric acid, etc.), among others. However, the specific case of uranium exploration has a complicating element, radioactivity. And there are many uncertainties that nurture controversies among scientists, researchers and opinion makers in the debate about the future biological

effects due to human exposure to radioactive materials, especially exposures to low doses.

Regarding the health risks and impacts of the communities that inhabit the region surrounding uranium mines, there is a lack of scientific studies. Uranium mining in Caetité has been marked by many controversies. There are several reports of administrative irregularities, operational problems, accidents at work, leaks of radioactive material into the environment and signs of environmental contamination of groundwater. Local civil society has manifested itself since the mine's first years of operation with regard to possible risks and impacts to health and the environment.

The main environmental problems and risks arising from uranium mining and processing activities in Caetité, based on reports from representatives of local social movements and people who live in the vicinity of the mine, are: (1) air pollution from rock detonations for extraction of the ore, with the release of radioactive dust, radon, and other radiotoxic substances; (2) suspicions of groundwater contamination, quite possibly as a result of the various spills of radioactive material from the basins and waste containment tanks to the environment; (3) excessive water consumption in a region where this resource is scarce; (4) the lack of transparency regarding NIB's environmental management practices; (5) withholding information and disinformation regarding the potential risks and impacts associated with uranium mining activities.

Currently, the Federal Government is studying the possibility of exploring the Itataia uranium mine, in Santa Quitéria, Ceará (Figures 3 and 4). The Santa Quitéria Consortium is a partnership between INB and Galvani, a company that produces phosphate fertilizers, for the implementation of a joint mining project. The purpose of the partnership is to explore uranium and phosphate, found in an associated way in the Itataia deposit, located in the municipality of Santa Quitéria (Ceará). Phosphate is predominant, with reserves of 8.9 million tons. The uranium reserves are 80 thousand tons (14). The forecast is that 240,000 tons of phosphate and 1,600 tons of uranium concentrate are produced annually by the Consórcio Santa Quitéria. The ore, after being extracted from the deposit, will undergo a process of separation of elements. The phosphate will remain with Galvani, which will use it in the manufacture of fertilizers and animal feed, and the uranium will be delivered to NIB for the production of the uranium concentrate. INB owns the mining rights to the deposit, located in the domains of Fazenda Itataia, which has 4,042 hectares. The operation of the Santa Quitéria Consortium will quadruple the production of uranium

concentrate, used by NIB in the production of nuclear fuel, and will increase Brazilian production of phosphate fertilizers by 10%. The mine is expected to generate around 800 direct jobs and contribute to the development of the region (14).

The Itataia uranium deposit is located in the central part of the State of Ceará, about 45 km southeast of the city of Santa Quitéria. It is the largest uranium reserve in the country and its economic viability is dependent on the exploration of the associated phosphate (15). This means that the extraction of uranium is conditioned to the production of phosphoric acid, which is the input used in the production of fertilizers. Thus, it is necessary to analyze the benefits, costs and damages, mainly for the population in the immediate vicinity of the mine, formed by about six thousand families, distributed in twenty-seven communities in the municipality of Santa Quitéria and fifteen in the municipality of Itatira(15).



Fig.3: Main entrance to the Itataia mine.

Source: Diário do Nordeste (2020).

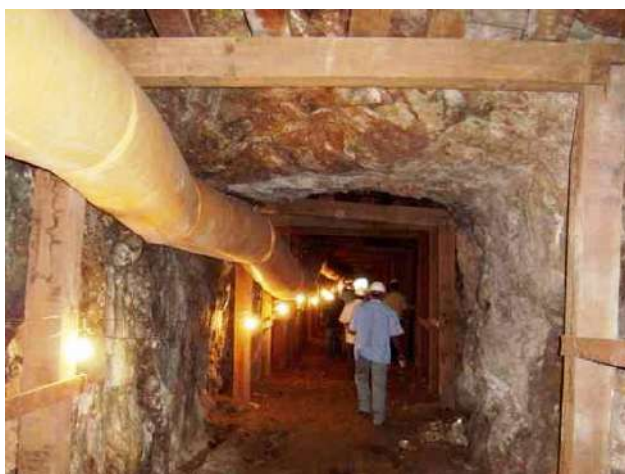


Fig.4: Interior of the Itataia mine.

Source: The voice of Santa Quitéria (2020).

However, for uranium ores to be exploited in Itataia, licensing by IBAMA is required. A report from the newspaper O POVO, in February 2019, showed that IBAMA denied the license for the mine to operate:

IBAMA considers that the installation of a uranium and phosphate extraction plant in Ceará is not feasible for the environment. In the wake of the Brumadinho (MG) tragedy, the Environment and Renewable Resources Institute (IBAMA) decided to discard the environmental licensing process for the Santa Quitéria / Itataia uranium plant in Ceará. According to an e-mail sent to O POVO by the agency's communications department, the "phosphate and uranium mining project was shelved due to the environmental infeasibility of the study presented".

The newspaper O POVO had requested information from the national superintendence of IBAMA about the result of the analysis of the Environmental Impact Study and the licensing of the enterprise that would benefit radioactive material. Since 2014, environmentalists opposed to the implantation of the plant and the Consórcio Santa Quitéria, formed by mining company Galvani and Indústrias Nucleares do Brasil, awaited the decision of the licensing agency.

One of the points most criticized by environmentalists and communities that would be impacted by the plant is the construction of the dam for the disposal of waste. According to data from the Santa Quitéria Consortium, the projection is that the uranium waste would reach 90 meters in height. Phosphogypsum (deposit of phosphoric acid production) would reach 70 meters in height.

According to data from process 02001.005454 / 2004-24 / IBAMA, the Sertão Ceará plant would annually produce 1,600 tons of uranium concentrate and 1,050,000 tons of phosphate derivatives.

In 2014, the Center for Work, Environment and Health at the Federal University of Ceará (Tramas-UFC) filed for representation at the Federal Public Ministry asking for the annulment of the EIA-Rima presented by the companies. And it filed with Ibama civil society demonstrations against the enterprise. According to Tramas-UFC lawyer Talita Furtado Montezuma, several irregularities were pointed out to the two federal agencies. IBAMA even issued a provisional technical opinion and asked for complementations to the environmental study.

In August last year, there were meetings between IBAMA and the entrepreneurs in Fortaleza and the last opinion of the agency pointed to the lack of water viability of the project, which intended to consume, with the plant,

911 m³ of new water per hour. Entrepreneurs even asked for a review of the opinion.

IBAMA has not yet detailed what it called the filing of the lawsuit due to the "environmental infeasibility of the study presented" by Consórcio Santa Quitéria. However, he ended up agreeing with points of the representation that point, for example, to the "lack of data on radiation" in the management of uranium, "undersizing risks", "lack of effectiveness of mitigating measures", "absence of communities in the social diagnosis" and the "lack of computer simulation on the dispersion of radioactive pollutants".

The extraction of uranium and phosphate from the Santa Quitéria Plant, in Ceará, according to the project, would be used to manufacture fertilizers, fertilizers and other chemical products. 92.6 million reais is the estimated ICMS and ISS collection for Ceará with the uranium plant. In November 2015, the expectation of the president of Indústrias Nucleares do Brasil, Aquilino Senra, was that the previous license from IBAMA would be issued and would allow the operation of the Santa Quitéria Plant in 2019. The phosphate production would be for Ceará, Piauí, Tocantins, Maranhão and Bahia.

One of the concerns of residents of Santa Quitéria and surrounding municipalities is that the dam contaminates the Quixadá weir with radioactive material.

A report by Samuel Quintela published in Diário do Nordeste in October 2019, shows the disadvantages in relation to the opening of the Itataia mine:

After changes in the direction of Ibama, a project that will have an investment of US \$ 350 million may be resumed. Operations are expected to begin by 2025, but experts point to a risk of contamination by radioactivity. Previously impossible for environmental reasons, the Itataia uranium and phosphate mine, in Santa Quitéria, already has new plans for the start of extraction operations.

The potential of the new venture is already beginning to be compared with the impact generated by Companhia Siderúrgica do Pecém, considering the economic activity of the region. However, the enterprise's socio-environmental viability is questioned because of the environmental risks of the business.

The exploration project for the Itataia deposit was initially prepared in 2009 by the Santa Quitéria Consortium. The partnership is formed by Galvani (a private company) and the state-owned Indústrias Nucleares do Brasil (NIB). However, the business ended up being left

out after companies failed to obtain an environmental license for the exploration of the deposit.

Although NIB states that advances in mining techniques facilitate the application of the project, the plant would probably need a tailings dam. Despite the similarity of Vale's cases in Brumadinho and Mariana, where the dams broke, left victims and affected the environment, the state company claims that there would be no risks in Santa Quitéria.

There are risks of contamination of soil and water resources in the region. Over the years, just by checking feasibility, the part of the soil in the region around the Santa Quitéria deposit would already have uranium levels above normal. The mine exploration process, which will be based on the dynamization of rocks, may dispense dust with radioactive elements that could damage the health of the region's residents, increasing the incidence of various types of cancer, such as lung cancer.

During the twenty years of exploration, a larger volume of tailings would be generated than that of the dam in Mariana, but a rupture can cause a greater impact than there, due to the concentration of radioactive minerals. The Capital would not be free of contamination risks, in case of carelessness, since the material would be drained by CE-020 and would be sent to INB through the Port of Mucuripe. Therefore, the Santa Quitéria exploration project does not offer socioeconomic viability.

3.3. Criticisms of CNEN's inspection

Uranium exploration is an important activity for the development of Brazil, but it must be carried out respecting people's health and the natural environment. It is not enough to have a set of laws and regulations that are ingeniously written, but that work properly in practice. It is observed that, although CNEN has uranium mining management standards, whose dictates legislate from mining exploration procedures to decommissioning, its inspection in this type of undertaking is very precarious. Thus, it is important to analyze the discussion by Porto et al. (2014) on NNEC's performance in the inspection of uranium mining in the national territory:

NIB owns about 99.99% of its shares under the control of the National Nuclear Energy Commission (NNEC), which, in turn, is linked to the Ministry of Science, Technology and Innovation, and aims to plan, establish standards, inspect, license and control the activities of the nuclear sector in the country. Thus, it is observed that Brazil does not comply with article 8 of the International Nuclear Safety Convention, according to which the bodies charged with the promotion of nuclear

energy must be separated from those that carry out regulation and inspection activities.

For Brazil to be efficient in the inspection of uranium mining, it is necessary that all laws of radiological protection of people and the natural environment are respected. Therefore, it is necessary for NNEC to stop inspecting and regulating itself. This thesis is highly defended by Jorge (16). According to this author, nuclear power generation needs a regulatory agency.

The environmental liability left by uranium mining is huge, not only at the site of exploration, but also in the surrounding areas, especially in the water resources used by the population. An interesting report by André Borges in Exame Magazine (17), shows the precarious inspection of NNEC in the activities of the Lagoa Real Mine:

The Brazilian Institute of Environment and Renewable Natural Resources (Ibama) received explanations from Nuclear Industries of Brazil (NIB) about the case of uranium contamination in a well in the municipality of Lagoa Real, in southwest Bahia. The environmental agency, the only one responsible for the licensing of radioactive material in the country, should soon take a position on the case, which could result in a fine to INB for omitting information.

NIB was immediately notified by Ibama last Saturday, based on a report published by the State. The state-owned company, which has a monopoly on the exploitation of radioactive material in the country, found contaminated water with high uranium content in the well of a farm in the rural area of Lagoa Real, but did not inform Ibama, the federal government or even the government of Bahia. The first inspection, carried out by the company in October 2014, identified a quantity of the toxic ore more than four times above the limit allowed for human consumption.

None of this, however, was communicated to Organs responsible bodies, nor to the city hall. A second check was carried out by NIB in March of this year, and the company again found a uranium index more than three times above that allowed by health agencies. Again, however, there was no communication on the case. The two bulletins did not reach the city hall of Lagoa Real until the end of May, as the State revealed.

It was when the municipal management tried to go to the owner of the contaminated well and inform him that he should no longer consume that water. Still, nothing came to the attention of the federal governments and the State of Bahia. Around the contaminated well site, dozens of other properties with exactly the same wells were not

alerted to the problem and continued to use their wells regularly. "Immediately after being informed by the report, Ibama notified NIB, NNEC (National Nuclear Energy Commission) and the competent health authorities to adopt the necessary measures so that there is no risk to the local population," said Ibama in a note.

The government of Bahia, with support from Ibama agents, reported that, based on the complaint, it set up a task force in the region to collect water from all wells and check the quality of the water consumed by the local population. The rules for the environmental licensing of the uranium mine, which is located in the neighboring municipality of Caetité, require that INB forward periodic reports on the implementation of environmental programs to Ibama and, "in the event of an unusual event that may result in damage to the environment and risk to the population, immediately report the incident to Ibama, NNEC and the Bahia Environment and Water Resources Institute (EWRI).

"The eventual omission by INB characterizes noncompliance with condition 1.4 of the Caetité mine operating license, a fact that, if confirmed, will result in the imposition of a fine," informed Ibama. Rule 1.4 mentioned by the institute is part of the "general conditions" required by Ibama, so that the company can operate in the exploration of uranium. The item states that "Ibama, NNEC and ERC (Environmental Resource Center) must be notified immediately in the event of any accident that causes an environmental impact or any unusual event that may cause potential damage to the environment."

Despite the requirement, NIB claims that it did the well owner in Lagoa Real a favor and that it is located in an area outside its responsibility. The state company also says that the contamination has nothing to do with its activities in the region, which have been operating for 15 years, because it is 20 kilometers away and is part of another hydrographic sub-basin. Ibama has already assessed NIB on another occasion. In November 2009, the state company was fined R\$ 1 million for failing to comply with the environmental licensing condition that determines the immediate report to the agency of any accident that occurred in the enterprise.

On October 28 of that year, it was found that there was a leak of organic solvent with uranium. The Institute notified the company to submit a detailed report on this accident. The inspection of the area where the accident occurred was carried out on November 18, when Ibama technicians visited some points inside the project where the leak was detected.

The team found the leakage of the organic solvent containing uranium, which overflowed from the processing tanks to the crushed box of the processing unit. Due to the heavy rain, this material also overflowed into the rainwater drainage system, reaching the drainage channel, which directs the water to the Córrego do Engenho Dam. The result was the contamination of 15 cubic meters of material (earth and gravel), removed from the gravel box, and 33 cubic meters of contaminated soil from the drainage channel.

The National Nuclear Energy Commission (NNEC) informed O POVO that the Santa Quitéria Consortium, until today, had not sent enough documentation to release the operation.

When evaluating the performance of the National Nuclear Energy Commission (NNEC) in the exploration of uranium mines in Brazil, specifically analyzing the cases of the Poços de Caldas and Caetité mine, there was a lack of supervision by this body when dealing with the exploration and exploration processes. decommissioning. This puts NNEC's performance in check if the Itataia mine is to be exploited one day, as previous experiences have shown poor inspection by NIB. Possibly alerted of the inefficiency of NNEC's inspection with the INB, many civil entities mobilized to prevent the Itataia uranium mine from functioning.

In 2006, the Environment and Sustainable Development Commission of the Chamber of Deputies presented the report of the nuclear safety and inspection working group, whose rapporteur was Deputy Edson Duarte (18). In this document, in addition to other issues analyzed within the Brazilian Nuclear Program, NNEC's role as a regulator and supervisor of itself (18) was called into question:

It is no longer today that Brazilian society, especially through renowned members of the scientific community, has been questioning the independence and transparency of the inspection carried out by NNEC over the nuclear sector. Still in the 70s, the Brazilian Physics Society (SBF), after exhaustive studies of the Brazilian Nuclear Program, suggested that NNEC be split into two distinct entities - one that regulates, licenses and supervises the use of nuclear energy, and another, which manages of the Brazilian Nuclear Program. The claim was that it would be technically, politically and ethically incorrect for NNEC to self-monitor itself in various activities attributed to it within the scope of the nuclear program.

In 1985, the then President of the Republic, José Sarney, established, through Presidential Decree No.

91.606 of 02/09/85, the formation of a "Commission for the evaluation of the Brazilian nuclear program", under the presidency of the scientist José Israel Vargas (Minister of Science and Technology during the term of President Itamar Franco and held in office during the first term of President Fernando Henrique Cardoso). Formed by academics in the scientific field, engineers, economists, administrators and entrepreneurs, the commission aimed to produce recommendations for public administration action in the field of nuclear technology. Among the recommendations presented by what became known as the "Vargas Report", we highlight:

- Create, within the ambit of the Presidency of the Republic, the National Commission for Radioprotection and Nuclear Safety, which would be in charge of the normative, licensing and inspection functions exercised by NNEC, whose President would be appointed by the President of the Republic, with the approval of the Federal Senate, and with mandate not coinciding with those of the executive branch leaders;
- Create the National Nuclear Research and Development Commission, in the form of a foundation under the Ministry of Mines and Energy, which would assume the research and development activities under the responsibility of NNEC. This Commission would be chaired by a Deliberative Council composed of representatives from the Ministry of Science and Technology, Eletrobrás, Nuclebrás (currently NIB), and personalities from the technical and scientific community, appointed by the President of the Republic, following a proposal by the Minister of Mines and Energy;
- Assign the coordination of basic nuclear research activities to the Ministry of Science and Technology.

However, taking a historical overview of the Brazilian nuclear issue, the 2006 nuclear safety and inspection working group's report investigated opinions contrary to the NNEC division. Some reports of the time presented considerations by the authorities for not complying with the recommendations made by the Vargas Report, such as (18):

Paulo Richter - Secretary-General of the Ministry of Mines and Energy - *Jornal do Brasil*, 11/15/1986:

(...)

"The non-separation of NNEC is a solution that can be carried out immediately and less costly (...), however this separation is necessary at a later stage".

(...)

Rex Nazaré Alves - President of NNEC in 1986 - *The State of São Paulo* 11/06/1986:

(...)

“NNEC should not be divided now so that there is no dispersion of financial and technical resources in two other autonomous and independent bodies, since the parallel Nuclear Program is essential for the country, and this is going very well, after all, in a team that is winning doesn't move ”.

(...)

The answers to these arguments were already in the Vargas Report. But the reality would manifest itself more sharply exactly one year later, and in the worst possible way, with the Goiânia tragedy. According to the 2006 nuclear safety and inspection working group report (pages 46 and 47):

As in other countries, the National Nuclear Energy Commission was created with the dual purpose of promoting the use of nuclear energy and supervising its use, to ensure that it was used without risk to the population. This was the type of sectoral organization that predominated in the middle of the last century. Right after World War II, the main concern about the nuclear issue was related to National Defense. For this reason, several countries have adopted strict state control and a major centralization of nuclear activities. It should be noted that it was this centralization of nuclear activities that enabled the existence of a classified nuclear program in Brazil, with the objective of producing nuclear artifacts for military purposes.

Nowadays, however, the world's attention is more directed towards the safety of populations and the environment. Especially for the case of Brazil, the option for the exclusively peaceful use of nuclear energy was enshrined in its Constitution. In the United States, the risks arising from having an institution regulating the same activity that it helps to operate and develop led the country to review the sectoral legislation. The Atomic Energy Commission (AEC) was extinguished, which, like NNEC in Brazil, centralized most of the activities in the nuclear area, and the Nuclear Regulatory Commission - NRC (Nuclear Regulatory Commission) was created, as an independent regulatory agency. The operational and sectoral policy responsibilities of the former Atomic Energy Commission have been transferred to the Department of Energy. Similar cases were observed in Argentina, Spain, Canada and France, among others, as pointed out in a study by the Legislative Consultancy of the Chamber of Deputies.

In the report of the 2006 nuclear inspection and safety working group (p. 46) there is a mention of Rex Nazaré Alves:

Rex Nazareth was a collaborator of the military dictatorship, acting as administrator of the parallel nuclear program. He was responsible for the secret accounts, dubbed "delta", which were intended to finance the national war program - the construction of the bomb. The select group that took care of the "delta" also had Admiral Othon Pinheiro, now president of Eletronuclear. Rex Nazareth remains in the government today, as a "civil society representative" on the NNEC deliberative committee.

Legally, it cannot be admitted in the current Brazilian Nuclear Program that an institution like NNEC continues to operate within the framework established by military influence, whose purpose was the construction of the Brazilian atomic bomb. Currently, the scenario requires the expansion of protection to the environment and people, against the harmful effects caused by radiation. Thus, an institution like NNEC that regulates and supervises itself, has no more space within the current scientific scenario of the Brazilian Nuclear Program.

IV. CONCLUSION

At the beginning of the Nuclear Program, uranium exploration in Brazil was carried out by foreign technology, with the United States having almost absolute dominance in this activity.

The creation of the National Research Council was an important milestone for Brazil to master the technology for the exploration and processing of uranium.

The creation of NUCLEBRAS marked the growing effort of the uranium exploration program in Brazil.

With the creation of the National Nuclear Energy Commission (NNEC), CNPQ is no longer responsible for the exploration and processing of uranium.

Brazil has large uranium reserves in its territory, but due to the lack of public policies for the sector, exploration still suffers from the lack of feasibility throughout the national territory. Uranium exploration should be a state policy, not a government policy.

The monopoly of uranium exploration in Brazil is carried out exclusively by the state-owned Nuclear Industries of Brazil (NIB), which succeeded NUCLEBRÁS. NNEC is a majority shareholder of NIB, where it holds almost 100% of its shares.

The Osamu Utsumi uranium mine located in the Poços de Caldas deposit, in Minas Gerais, was the first to start operating in Brazil. After decades of operation, mine exploration has left an incalculable environmental liability. Currently, NNEC and IBAMA are studying a site recovery plan.

After the deactivation of the Osamu Utsumi mine, the Caetité Uranium Concentrate Unit was implemented in 1995, and is still operational today, despite several reports of contamination in the areas adjacent to the mine. The exploitation of uranium in Caetité, as happened in the case of the Osamu Utsumi mine, is generating a great environmental liability.

NIB has been seeking environmental licensing to explore the Santa Quitéria uranium mine in Itaia, but for operational reasons, and also due to the various complaints made by civil society, IBAMA has not authorized its operation.

NNEC cannot currently operate within the dictates that were established during its creation, when it received strong influences from the military that aimed to create an institution with the purpose of developing nuclear technology for military purposes.

Since NNEC is a majority shareholder of NIB, it should neither regulate nor supervise uranium exploration activities in Brazilian territory, since, in doing so, NNEC regulates and inspects itself, which is legally incorrect.

NNEC's inspection of the activities carried out by INB proved to be quite inefficient. It is necessary to create a Nuclear Energy Regulatory Agency in Brazil.

It is necessary to create laws that are rigorous in the establishment of new guidelines aimed at improving the technology of uranium exploration in Brazil, having as main theme the radiological protection of the natural environment and people.

NNEC's management in the exploration of uranium ores by administrative normative acts proved to be inefficient as a power of law in the inspection of NIB.

The inefficiency of NNEC's inspection was clearly shown when, by the action of the Federal Public Ministry, it was forced to build an action plan for the regulatory control of the tailings dam of the Mineral Processing Unit (UTM) of the Nuclear Industries of Brazil (NIB), located in the municipality of Caldas, in Minas Gerais.

The exploitation of uranium mines and their decommissioning procedures should be strictly discussed as a law by the National Congress that really has the power to draft laws on Brazilian nuclear policy.

It is necessary to create, within the Environmental Law, the Brazilian Nuclear Law that must contemplate the stages of the exploration and decommissioning of uranium mines existing in the national territory.

Brazilian Nuclear Law must contemplate the participation of society in debates on the exploration and operation of uranium mines.

Brazilian Nuclear Law must contemplate the possibility of popular action in the event of abnormalities in the operation of uranium mines.

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Comparative study of ideal and inadequate coarse aggregate on the mechanical properties of concrete

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Abstract— *The purpose of this study was to produce concrete with ideal coarse aggregate and compare it to concrete made with inadequate aggregate. Assess the influence of inappropriate aggregate on concrete properties. The concretes produced with Blade aggregate presented an elasticity module superior to the concrete with cubic aggregate, demonstrating greater elasticity in the concrete and, in the tensile strength, they presented better performance in the first ages. For fresh concrete and compressive strength, the cubic shape performed better. The cubical shape, considered ideal, has length/thickness <18 mm and width/thickness <18 mm; the blade shape, considered inadequate, has length/thickness >30 mm and width/thickness >30 mm. The physical properties of ideal coarse aggregate and inadequate aggregate were compared after separation and classification for concrete production and subsequent analysis of workability, compressive strength, tensile strength and modulus of elasticity of the resulting concrete. The goal was to assess the influence of ideal and inadequate coarse aggregate in different situations: dry material content, binder content, w/c ratio and concrete strength.*

Keywords— *Coarse aggregate; Ideal aggregate; Inadequate aggregate; Concrete performance.*

I. INTRODUCTION

The study of aggregate shape for concrete asphalt and concrete hydraulic is an area already explored by researchers such as [1–3], who were the first to propose an aggregate shape classification method. Currently, there is a great amount of research on the classification of coarse aggregate shape for concrete, such as [4–10], and regulatory norms such as [11–16] that refer to the ideal coarse aggregate shape for concrete.

The crushing mechanism is one of the main factors that influences the characteristics of natural stone aggregate, such as particle size distribution, shape, texture, size, specific mass and unit mass. Crushers produce aggregates of various sizes and shapes that can perform positively or negatively in the production of concrete.

Aggregate shape affects concrete behavior, both in the fresh and hardened states, because it influences workability, internal friction angle and compactability, among other factors dependent on kneading water amount[9]. Cubical

aggregate presents better performance than those with elongated, discoid and laminar shapes [17].

According to studies done by [17,18], cubical aggregates are generally preferable to flat or elongated aggregate for use in concrete, since they have lower surface area per volume unit and normally lead to better aggregate packing. Laminar aggregates produce mixtures with low workability for a given amount of water, which leads to poor compaction and high void content, resulting in low resistance and durability.

Laminar aggregates, when compared to cubical aggregates, tend to break along the particle axis due to their slenderness. Thus, aggregate shape affects concrete strength and life span [19].

According to Isabel [20], the determination of the ratio between the largest and smallest size of the aggregate in her experimental results indicate that, when most particles have a ratio lower than 3:1, aggregate shape will have little influence on the quality of concrete. However, when more

than 50% of particles have a ratio of 5:1, concrete strength will be affected.

II. METHODOLOGY

Aggregate shape refers to its three-dimensional geometry, but as it is difficult to represent irregular three-dimensional bodies, it is more convenient to define certain geometric characteristics of these bodies, such as elongation, flatness, cubicity, sphericity and angularity [6].

According to studies by [2,21–23], commonly employed methods to determine aggregate shape are based in the measuring of fragment dimensions through projection lines that define length, width and thickness.

Considering the ideal shape in the crushing process and exact dimensions (imagining a perfect shape), the shape of coarse aggregate can be classified according to its length/thickness and width/thickness ratios.

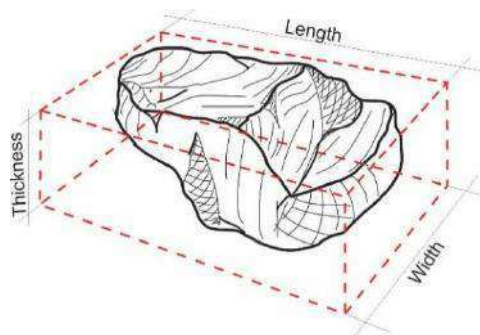


Fig.1: Projection of ideal particle shape over real particle shape

The method employed in this study was the one proposed by Silva and Geyer[10], which classifies aggregate shape in four categories (cubical, elongated, rod and blade), according to Table 1 for crushed natural coarse aggregate, having as reference the ratios of its dimensions. Aggregate shape is considered cubical for shape indices length/thickness and width/thickness < 1.8 , elongated for length/thickness > 1.8 and width/thickness < 1.8 , rod for length/thickness > 2.4 and width/thickness > 2.4 and blade for length/thickness > 3.0 and width/thickness > 3.0 .

Table 1 Shape index determination[10]

Shape	Ratio	Index
Cubical	$l/t < \text{and } w/t <$	18 mm
Elongated	$l/t > \text{and } w/t <$	18 mm
Rod	$l/t > \text{and } w/t >$	24 mm
Blade	$l/t > \text{and } w/t >$	30 mm

For the analysis of a given aggregate, its axes are defined according to [11], in which the greatest dimension obtained is referred to as length; the intermediate dimension as width, and the smallest dimension as thickness. Classification of crushed coarse aggregate is derived from the degree of particle cubicity, and, according to Silva and Geyer [10], coarse aggregate shape can be classified as cubical, elongated, rod or blade.



Fig.2: Cubical shape



Fig.3: Elongated shape



Fig.4: Rod shape



Fig.5: Blade shape

According to the analysis in [9], aggregate of cubical shape is considered ideal, aggregates of elongated and rod shape are considered acceptable and aggregate of blade shape is considered inadequate for concrete production.

Table 2 Classification of aggregate shape as ideal, acceptable or inadequate for concrete

Shape	Parameter
Cubical	Ideal aggregate
Elongated	Acceptable aggregate
Rod	
Blade	Inadequate aggregate

Source: [9]adapted

Table 3 Coarse aggregate characterization

Test	Coarse aggregate	Norm
Fineness modulus	7.48	NBR NM 248 (ABNT, 2003)
Maximum characteristic size (mm)	25	NBR NM 248 (ABNT, 2003)
Unit mass (kg/dm ³)	1.37	NBR 7251(ABNT, 1982)
Specific mass (kg/dm ³)	2.67	NBR NM 53 (ABNT, 2003)

III. EXPERIMENTAL PROGRAM

3.1 Aggregate selection

The coarse aggregate selected for the experimental program was granulite from the Anápolis – Goiás quarry, due to its crushing process, rock origin and technical specifications, in line with [24]. This rock is of metamorphic origin and presents a high degree of metamorphism, granoblastic texture and gneissic structure, resembling granite (an igneous rock rich in quartz, feldspar and mica) due to its mineralogy and texture. Aggregate within an interval between 19 mm and 25 mm was used, which best fits the experiment due to its ease of handling.

3.2 Extraction and crushing of coarse aggregate

Extraction of the rock is achieved by open pit blasting. Afterwards, it is transported by trucks over a distance of 500 m to the primary crusher (jaw crusher), and after the primary crushing, it is transported by conveyors to the secondary crusher (cone crusher). The rock is kept in the secondary crushing process until it acquires the desired particle size distribution. Then, it is transported by conveyors to the tertiary crusher (cone crusher) and, when the required grain size is obtained, it is transported by trucks to the end consumer.

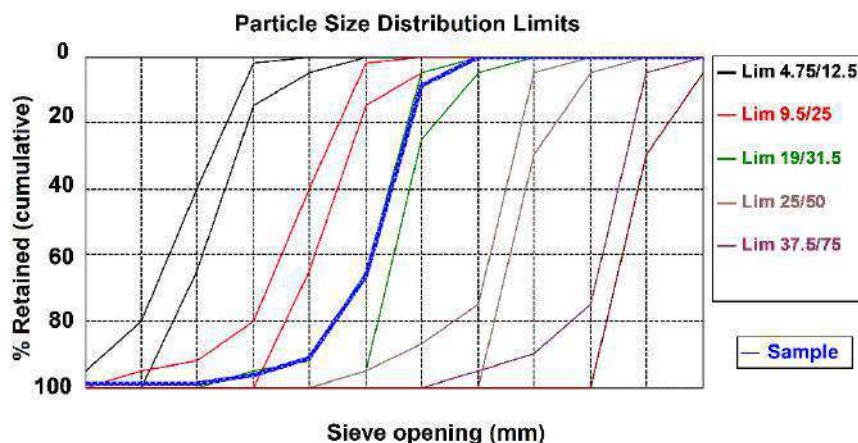
3.3 Coarse aggregate analysis

The tests for characterization of particle size distribution, specific mass, unit mass and shape index of the coarse aggregate used in the experiment were done in the Laboratório de Materiais da Escola EEC/UFG (Materials Laboratory of the Civil Engineering School of the Federal University of Goiás), with the following results in regards to particle composition [25–27].

Table 4 Coarse aggregate particle size test

Opening Mesh size (mm)	Retained weight (g)	Test	
		Simple	Cumulative
75	0	0	0
63	0	0	0
50	0	0	0
37.5	0	0	0
31.5	0	0	0
25	870	9	9
19	5750	58	66
12.5	2500	25	91
9.5	500	5	96
6.3	284	3	99
4.75	0	0	99
2.36	0	0	99
Pan	96	1	100
TOTALS	10000	100	-

The coarse aggregate presented continuous particle size distribution within the acceptable limits for concrete production in line with technical specifications as determined by norm [25].



Graph 1 Coarse aggregate particle size test

3.4 Coarse aggregate shape classification

Ten samples of 10 kg of coarse aggregate each were prepared and the following sequence was observed: characterization, cataloging and sample separation.

Sample characterization was undertaken according to Table 1, followed by cataloging and separation of the aggregate between cubical, elongated, rod and blade shapes, according to [10].

Table 5 Characterization of Sample 1 (10 Kg)

Shape	Number of aggregates	Index	Weight (kg)	%
Cubical	331	15 mm	3,35	33,50%
Elongated	363	21 mm	3,11	31,10%
Rod	204	27 mm	1,61	16,10%
Blade	365	60 mm	1,93	19,30%
TOTAL	1.263 (aggregates)	32 mm	10,00	100,00%

Table 5 presents the classification and separation of the particles between cubical, elongated, rod and blade shapes, based on their dimensions and according to Table 1.

For the first analysis, classification was done according to shape, quantification and weighing of each particle and subsequent measuring of total weight for each shape, with

the goal of determining the exact representation of each shape in a 10 kg sample. From the second analysis onward individual weighing of particles was not undertaken.

Table 6 presents the result of aggregate analyses 1 through 5, and Table 7 presents the results of analyses 6 through 10. All analyses consisted of 10 kilograms of the selected aggregate.

Table 6 Comparison of coarse aggregate samples 1 through 5 according to shape

Shape	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	Weight (kg)	Weight (kg)	Weight (kg)	Weight (kg)	Weight (kg)
Cubical	3,35	3,29	3,1	3,09	3,20
Elongated	3,11	3,19	3,21	3,19	3,21
Rod	1,61	1,70	1,95	1,79	1,65
Blade	1,93	1,81	1,72	1,93	1,94

Table 7 Comparison of coarse aggregate samples 6 through 10 according to shape

Shape	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
	Weight (kg)	Weight (kg)	Weight (kg)	Weight (kg)	Weight (kg)
Cubical	3,30	3,25	3,10	3,09	3,35
Elongated	3,12	3,03	3,25	3,50	3,14
Rod	1,80	1,76	1,69	1,55	1,80
Blade	1,78	1,96	1,96	1,86	1,71

IV. CONCRETE PRODUCTION

The chosen aggregates for concrete production were the one with cubical shape, considered ideal, with shape index length/thickness and width/thickness of 15 mm, and the one with blade shape, considered inadequate, with shape index length/thickness and width/thickness of 60 mm.

IPT's (Institute of Technological Research) dosing method was used for concrete production and subsequent analysis of mixes with respect to compressive strength of 10x20 cm specimens at 7, 14 and 28 days, diametral compressive strength of 10x20 cm specimens at 28 days, and modulus of elasticity of a 15x30 cm specimen at 28 days.

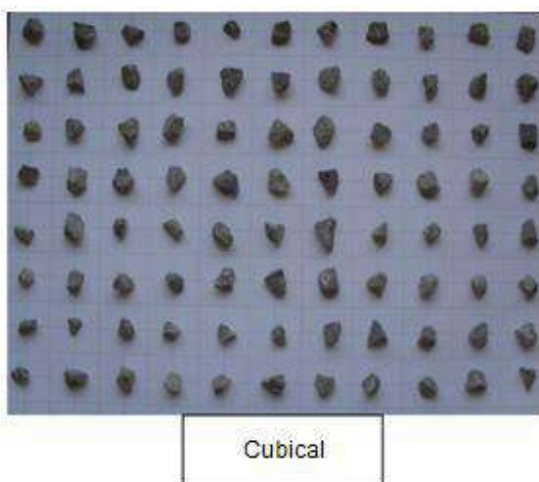


Fig.6: Images of particles according to their classification – cubical shape (Index 1,52:1)

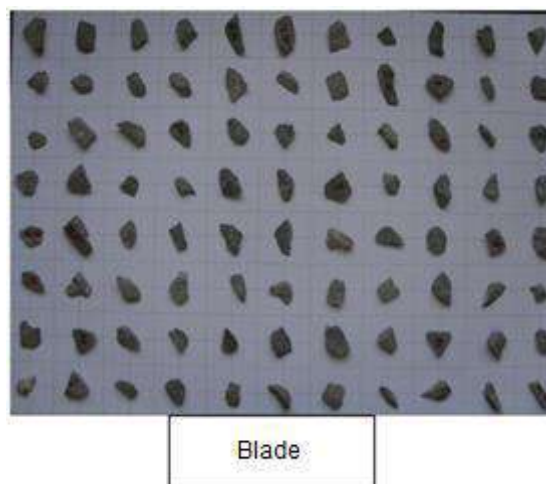


Fig.7: Images of particles according to their classification – blade shape (Index 6,7:1) 4.1 Concrete dosing

Three different concrete mixes were produced for each aggregate shape: a 1:3,5 mix with high cement consumption, a 1:5 mix with moderate cement consumption, and a 1:6,5 mix with low cement consumption. The goal was to assess the influence of aggregate in different situations: dry material content, binder content, w/c ratio and concrete strength.

Mortar content for the cubical shape aggregate was determined in laboratory (alpha at 0,52). As aggregate shape index increases, so does the irregularity of coarse aggregate; thus, the value of alpha was changed in +0,03 for the blade shape (alpha at 0,55). This procedure was necessary to maintain the same finish in concrete with different aggregate irregularity indices. Table 8 Dry material amount – Cubical aggregate *mixes* and

Table 9 Dry material amount – Blade-shaped *aggregate mixes* present the dry material amounts for the cubical and blade-shaped aggregate mixes.

Table 8 Dry material amount – Cubical aggregate mixes

Mix	cement	coarse sand	gravel 1	Cement (kg/m ³)
1:3,5	1	1,34	2,16	473,7
1:5	1	2,12	2,88	355,8
1:6,5	1	2,90	3,6	285,3

Table 9 Dry material amount – Blade-shaped aggregate mixes

Mix	cement	coarse sand	gravel 1	Cement (kg/m ³)
1:3,5	1	1,47	2,025	464,0
1:5	1	2,30	2,70	348,8
1:6,5	1	3,12	3,37	274,9

Fresh concrete tests followed the standards of [28] for determination of consistency by slump test. Results of the conic frustum slump were obtained by dosing the concrete without additives. Only water was used to adjust the workability of the concrete, until it led to a slump of the conic frustum of 10 ± 2 cm. Table 10 and Table 11 present the w/c ratio and slump test result for the cubical and blade shapes.

Table 10 w/c ratio and slump test – cubical shape

Mix	w/c	Slump test
1:3,5	0,426	10 cm
1:5	0,544	10 cm
1:6,5	0,657	9 cm

Table 11 w/c ratio and slump test – blade shape

Mix	w/c	Slump test
1:3,5	0,468	10 cm
1:5	0,598	10 cm
1:6,5	0,785	9 cm

V. COMPRESSIVE STRENGTH RESULTS

To assess the compressive strength of the concrete, compression tests were done according to [29], in order to determine concrete performance at 7, 14 e 28 days of age of 10x20 cm cylindrical specimens. A sulfur surface capping was used in order to regularize the surface of the cylindrical specimen for breaking in the press. Table 12 and

Table 13 show the result of concrete compression with cubical and blade-shaped aggregate.

Table 12 Concrete compressive strength – cubical shape

Mix	7 days	14 days	28 days
1:3,5	26.04 MPa	31.71 MPa	36.35 MPa
1:5	21.46 MPa	25.41 MPa	26.23 MPa
1:6,5	15.09 MPa	17.38 MPa	18.72 MPa

Table 13 Concrete compressive strength – blade shape

Mix	7 days	14 days	28 days
1:3,5	25 MPa	26 MPa	31.2 MPa
1:5	15.8 MPa	17.7 MPa	20.1 MPa
1:6,5	9.1 MPa	11.1 MPa	16.9 MPa

VI. TENSILE STRENGTH BY DIAMETRAL COMPRESSION RESULTS

Tensile strength by diametral compression tests of 10x20 cm cylindrical specimens at 28 days were undertaken according to the norm [30]. Table 14 Results of tensile strength by diametral compression tests at 28 days presents the response of the concrete to diametral compression at 28 days for the cubical and blade shapes.

Table 14 Results of tensile strength by diametral compression tests at 28 days

Mix	Cubical Shape	Blade Shape
1:3,5	12.5 MPa	12.9 MPa
1:5	10.9 MPa	9.5 MPa
1:6,5	8.0 MPa	5.9 MPa

VII. MODULUS OF ELASTICITY RESULTS

Modulus of elasticity tests of cylindrical specimens at 28 days were done with respect to procedures established by the norm [31]. A sulfur surface capping was used in order to regularize the surface of the cylindrical specimen for breaking in the press. Table 15 and Table 16 present the modulus of elasticity results for cubical and blade shapes.

Table 15 Modulus of elasticity results for cubical shape

Mix	MPa	GPa
1:3,5	34.6	23.3
1:5	25.3	28.4
1:6,5	18.2	37.5

Table 16 Modulus of elasticity results for blade shape

Mix	MPa	GPa
1:3,5	27.6	19.7
1:5	19.6	32.8
1:6,5	12.2	44.3

Table 17 Particle size distribution results for cubical shape

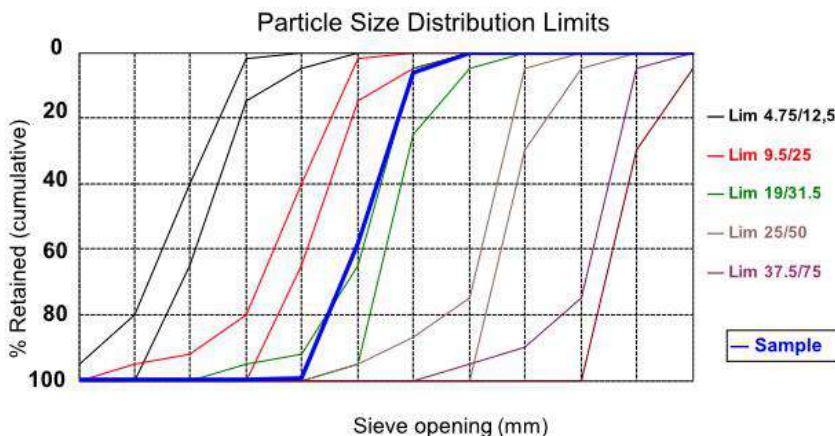
Opening Sieves (mm)	Weight retained (g)	Test	
		Simple	Cumulative
75	0	0	0
63	0	0	0
50	0	0	0
37.5	0	0	0
31.5	0	0	0
25	0	0	0
19	4456	45	45
12.5	5450	55	99
9.5	87	1	100
6.3	4	0	100
4.75	1	0	100
2.36	0	0	100
Pan	2	0	100
TOTALS	10000	100	-

VIII. ANALYSES AND DISCUSSION OF RESULTS

8.1 Analysis of cubical shape and blade shape aggregates

Based on the results, the smaller the particle size, the greater its irregularity. Therefore, for an aggregate with particle size between 19 mm and 25 mm to be classified as a good quality aggregate, with continuous and well graded particle size distribution, a certain quantity of particles of decreasing order is required in order to fit the ideal particle size distribution curve.

Table 17 and Graph 2 present the particle size distribution test results for cubical aggregate, which approached the ideal particle size distribution, with 99% of particles retained in sieves with openings of 25, 19, 12.5 and 9.5 mm.



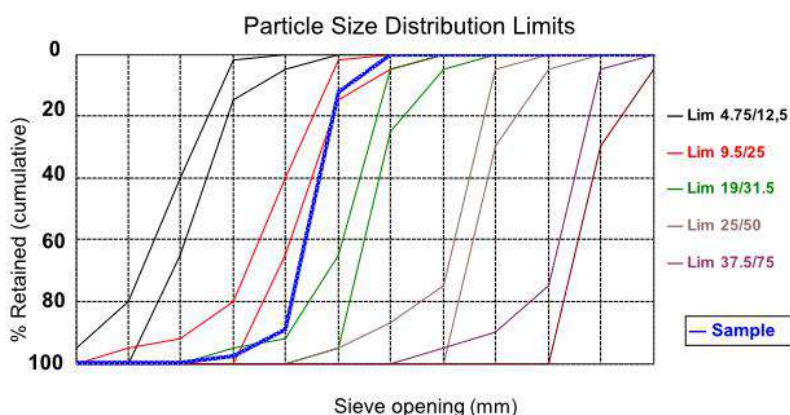
Graph 2 Cubical aggregate particle size distribution

Table 18 and Graph 3 present the particle size distribution test results for blade-shaped aggregate, which differed from the ideal particle size distribution, with 98% of

particles retained in sieves with openings of 19, 12.5 and 9.5 mm.

Table 18 Particle size distribution results for blade shape

Opening Sieves (mm)	Retained weight (g)	Test	
		Simple	Cumulative
75	0	0	0
63	0	0	0
50	0	0	0
37.5	0	0	0
31.5	0	0	0
25	0	0	0
19	1244	12	12
12.5	7654	77	89
9.5	879	9	98
6.3	200	2	100
4.75	12	0	100
2.36	3	0	100
Pan	8	0	100
TOTALS	10000	100	-



Graph 3 Blade-shaped aggregate particle size distribution

Table 19 Characterization results of cubical and blade shapes presents the test results for cubical and blade-shaped aggregates used for concrete production.

Table 19 Characterization results of cubical and blade shapes

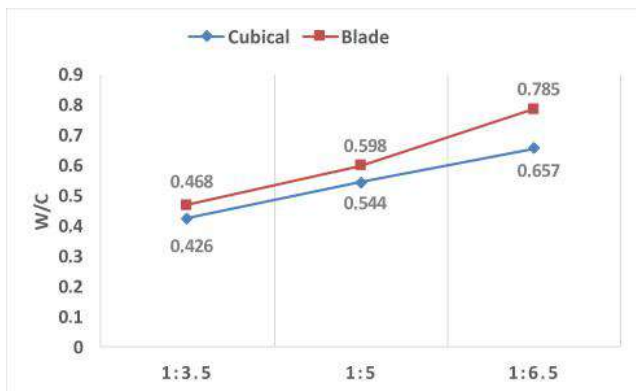
Test	Cubical	Blade	Norm
Fineness modulus	7,58	7,10	NBR NM 248 (ABNT, 2003)
Maximum characteristic size (mm)	25	25	NBR NM 248 (ABNT, 2003)
Unit mass (kg/dm ³)	1,413	1,279	NBR 7251(ABNT, 1982)
Specific mass (kg/dm ³)	2,57	2,72	NBR NM 53 (ABNT, 2003)
Aggregate shape index (mm)	15	60	NBR 7809(ABNT, 2008)

It can be observed that the crushing process significantly influences the physical properties of the crushed aggregate, such as specific mass, unit mass, fineness module and shape index.

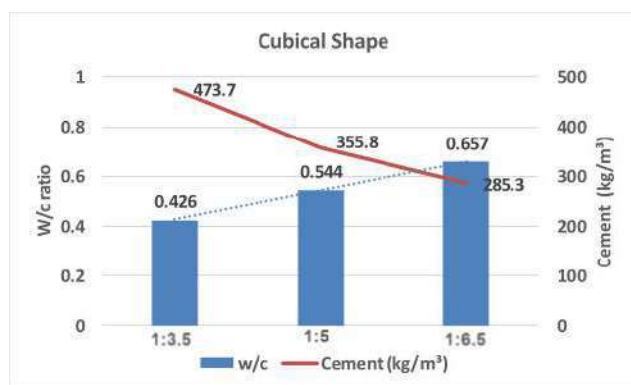
It is important to note that coarse aggregates with blade shape or inadequate particle size distribution do not fit the dosing methods, which are based, for instance, on ideal particle size distribution curves, and influence the properties of concrete and its cement consumption [7].

8.2 Fresh concrete

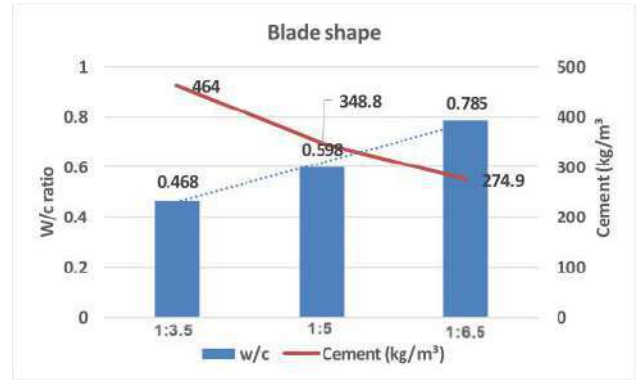
As the amount of mortar in a mix increases, it is necessary to increase the water/binder ratio in order to maintain the same workability. Concrete with blade-shaped aggregate presented higher water consumption when compared to concrete with cubical aggregate, to maintain the desired workability. Graph 4, Graph 5 and Graph 6 present the w/c ratio of concrete mixes produced with cubical and blade-shaped aggregates.



Graph 4 W/c ratios for cubical and blade shapes



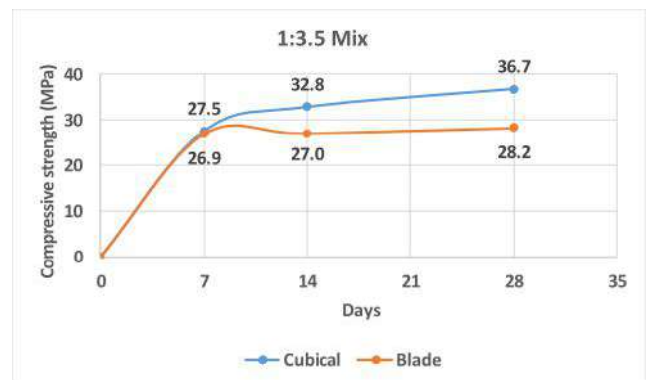
Graph 5 W/c ratios for cubical shape



Graph 6 W/c ratios for blade shape

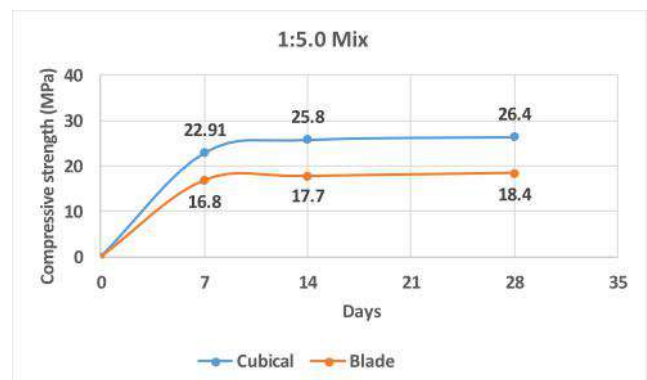
8.3 Compressive strength

Concretes with ideal (cubical) shape used for the experimental program have 100% of particles with an average ratio of 1.5:1. Concretes with inadequate (blade) shape, in contrast, have 100% of particles with an average ratio of 6:1. Graph 7, Graph 8 and Graph 9 present the compressive strength results for the 1:3.5, 1:5 and 1:6.5 mixes.

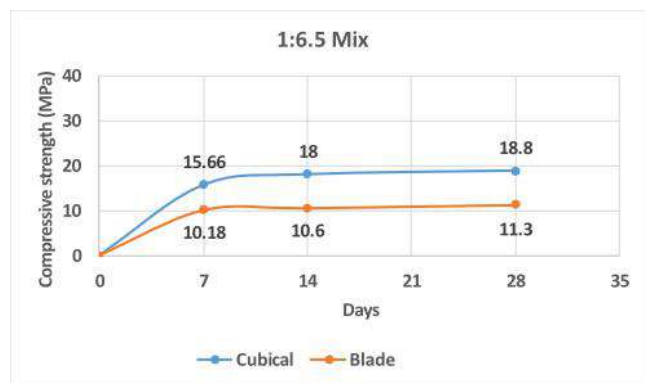


Graph 7 Compressive strength results of the 1:3.5 mixes

Compressive strength results of the 1:3.5 mix with cubical aggregate showed the best results for all ages, and a better strength projection when compared to the concrete with inadequate (blade-shaped) aggregate.



Graph 8 Compressive strength results of the 1:5 mixes



Graph 9 Compressive strength results of the 1:6,5 mixes

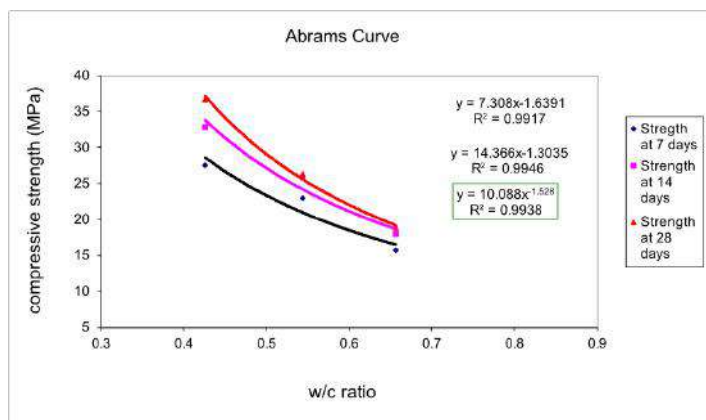
The 1:5 and 1:6,5 mixes with ideal (cubical) aggregate showed the best results for all ages. However, both aggregate shapes presented a similar strength projection.

The 1:3,5 mix with cubical aggregate presented an increase in strength, from 7 to 28 days of age, of 9.2 MPa, followed

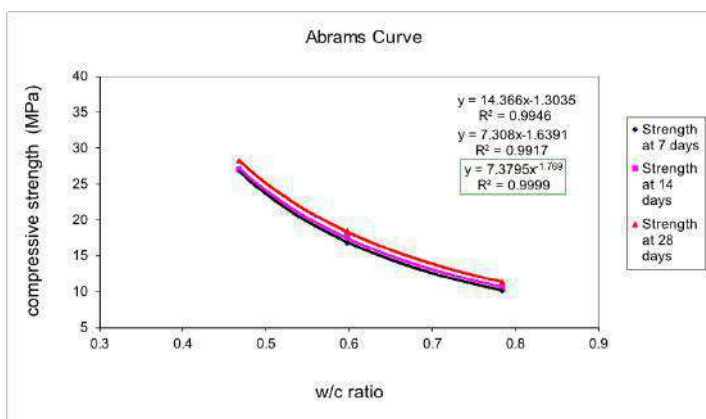
by the 1:5 mix with an increase of 3.49 MPa and the 1:6,5 mix with the smallest increase of 3.14 MPa. For the compressive strength of blade-shaped aggregate concrete, the 1:5 mix showed an increase in strength, from 7 to 28 days of age, of 1.6 MPa, followed by the 1:3,5 mix with an increase of 1.34 MPa and the 1:6,5 mix with the smallest increase of 1.12 MPa.

Compressive strength of ideally shaped (cubical) aggregate presented better performance due to the compaction index of the aggregate, which, in general, has continuous particle size distribution, thus favoring the concrete and making it denser and less porous.

Graph 10 and Graph 11 present the Abrams curve for w/c ratio of the 1:3,5, 1:5 and 1:6,5 mixes at 7, 14 and 28 days old, for cubical and blade-shaped aggregates.



Graph 10 W/c ratio and compressive strength at 3, 7 and 28 days (cubical shape)



Graph 11 W/c ratio and compressive strength at 3, 7 and 28 days (blade shape)

Cubical aggregate presents better characteristics for use in concrete when compared to blade-shaped aggregate. Cubical aggregate is denser, stronger and shows better performance than inadequate aggregates, making the mortar more fragile than the aggregate, and, due to these properties, fractures or cracks start in the transition zone between mortar and aggregate when the concrete is submitted to stress. The inadequate aggregate shape is highly flat, causing a build-up of voids in the concrete microstructure, making it fragile and brittle, ultimately weakening its microstructure.

Studies done by [32] indicate that the influence of aggregate properties on workability and mechanical strength decreases with the increase of cement amount, and according to studies proposed by [9], which consider cubical aggregate as ideal coarse aggregate and blade-shaped aggregate as inadequate for concrete production, and its influence on the mechanical properties of concrete, there is a loss of concrete properties with the increase of inadequate aggregate amount. However, some researchers

such as [20] suggest that concrete strength is affected if more than 50% of the aggregate has a 5:1 shape index (blade shape), which can lead to low compaction and high void rate, resulting in low strength and lower durability concrete. [9], in contrast, reports that a proportion higher than 20% of inadequate (blade-shaped) aggregate affects concrete performance with respect to compressive strength, tensile strength and modulus of elasticity.

8.3 Tensile strength by diametral compression

For the tensile strength by diametral compression tests, the 1:3,5 concrete mix with inadequate (blade) shape aggregate showed better performance than the concrete with ideal (cubical) aggregate. However, there was a sharper decrease in the concrete with inadequate (blade) shape for mixes with lower cement amount. Concrete with ideal (cubical) aggregate presented better performance for mixes with moderate (1:5) and low (1:3,5) cement consumption. Graph 12 and Graph 13 present the tensile strength test results for the 1:3,5, 1:5 and 1:6,5 mixes.

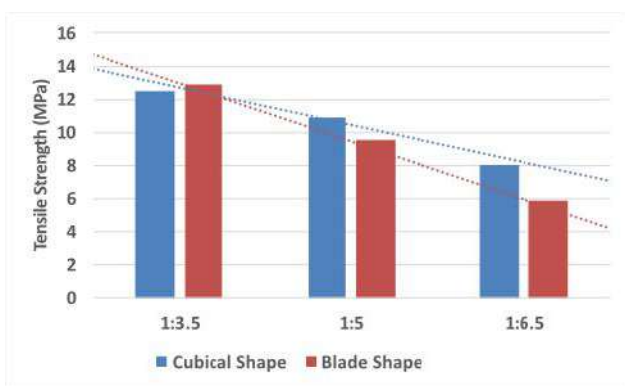
The negative influence of the physical characteristics of inadequate aggregate is greater than that of the cement. The inadequate particle's shape is fragile and when submitted to stress it tends to rupture as a fixed beam, making the coarse aggregate the weak point of the concrete microstructure.

With respect to tensile strength by diametral compression, the concrete made with inadequate aggregate showed the best performance, with an Fck of 12.86 MPa for the 1:3,5 mix. This result can be attributed to the greater surface area of inadequate aggregate, which leads to higher adherence between the aggregate and the mortar.

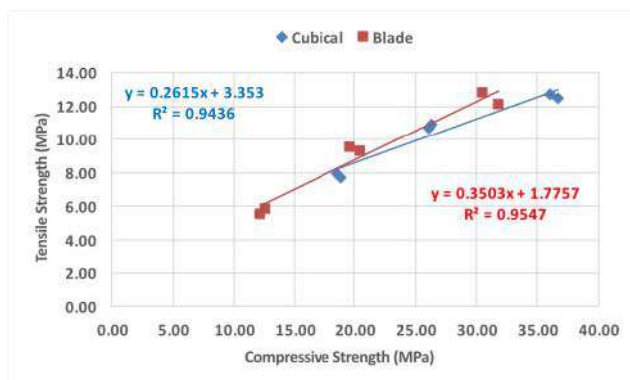
Due to the greater surface area of the inadequate (blade-shaped) aggregate, a better contact region between mortar and coarse aggregate is achieved. Inadequate aggregates, for being slimmer and flatter, function as anchoring areas in the microstructure of concrete when submitted to stress. This effect occurs in mixes with high cement consumption.

8.4 Elasticity modulus

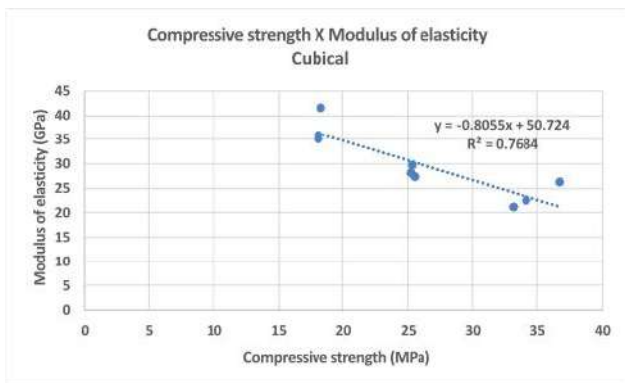
For the concrete made with cubical and blade-shaped aggregates, it was observed that with the increase of w/c ratio there was an increase in the concretes' modulus of elasticity and a decrease in the compressive strength. Graph 14 and Graph 15 show that a higher w/c ratio results in a lower compressive strength and a higher modulus of elasticity. This is attributed to the high amount of pores caused by high water consumption in the concretes.



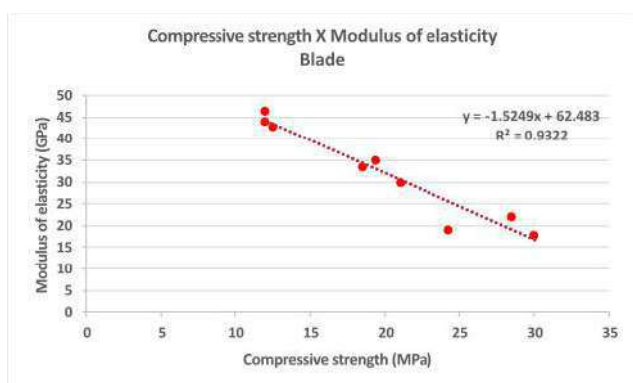
Graph 12 Tensile strength results at 28 days



Graph 13 Relationship between tensile strength and compressive strength at 28 days for cubical and blade shapes

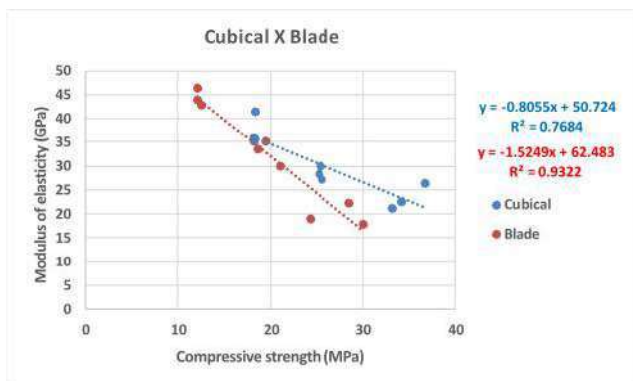


Graph 14 Relationship between compressive strength and modulus of elasticity at 28 days (cubical shape)



Graph 15 Relationship between compressive strength and modulus of elasticity at 28 days (blade shape)

Concrete with a high rate of voids in its microstructure can suffer elastic deformations, causing microdeformations in its interior. By using the pore network in the concrete microstructure, it can settle before rupturing. Graph 16 compares the modulus of elasticity of the cubical aggregate concrete and the blade-shaped aggregate concrete at 28 days.



Graph 16 Comparison of the modulus of elasticity of cubical and blade shapes at 28 days

The 1:3,5 mix with cubical aggregate was determined to have a higher modulus of elasticity than the one with blade-shaped aggregate. This result can be attributed to the high cement consumption along with the good performance of the ideal shape, which produces a denser and more compact concrete, allowing it to reach high strengths before rupturing. For the remaining mixes, with moderate and low cement consumption, the concrete with blade-shaped aggregate presented lower compressive strength and higher modulus of elasticity when compared to that with cubical aggregate. According to studies performed by [33–35], this result is due to the influence of inadequate aggregate on the mechanical properties of concrete, such as the increase of porosity that causes greater elastic deformation before the rupture of concrete at low strengths.

IX. CONCLUSION

According to analysis of the concrete, the ideal aggregate with cubical shape has better performance when compared to the blade shape in concrete production, due to aggregate shape and good particle size distribution, which allows good packing of coarse and fine aggregates, eliminating voids in the microstructure of the concrete and improving the properties of both fresh and hardened concrete.

Concrete produced with inadequate aggregate with blade shape produces higher void rates caused by the accumulation of bubbles. These voids provide elasticity to the concrete, functioning as tension concentrators and allowing the concrete to work when subjected to stress. However, it makes the concrete more fragile, causing it to rupture at low resistance.

With data from monitored tests of traction, compression and modulus of elasticity, where there is a record of the deformations presented for each trace of the elongated-lamellar shape. The behavior stops being linear just before the last load. This behavior is due to the progressive micro cracking that occurs initially at the coarse aggregate interface and the cement paste, and subsequently spreads throughout the concrete, presenting greater elastic deformations before rupture, in contrast to the cubic shape that presents few elastic deformations before rupture of concrete.

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The Cultural Landscape Formation in Piracicaba Central Sugar Mill

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Abstract— *The Piracicaba Central Sugar Mill was founded in 1881, from the acquisition and installation of French machinery from the mechanical industry 'Brissonneau Frères'. The assembly of the infrastructure was carried out by engineers André Paturau and Fernando Dumoulin with the most advanced technology in the period. It went into operation with 50 workers the following year, processing sugar cane from small and large suppliers. After going through two consecutive sales, it was acquired by French businessmen, under the new name 'Sucrerie de Piracicaba'. With French capital, investments were made in infrastructure, expansion of the manufacturing plant and acquisition of agricultural area. In 1907 the 'Société de Sucrierie Brésiliennes' - SSB was founded, which comprised six plants and until the end of the 1920s it was the largest and most important industry in the region. At the end of the 1960s, SSB was nationalized, changing its name to 'Usinas Brasileiras de Açúcar SA', operating until 1973, after two consecutive sales. The industrial plant, in line with industrial growth, received annexes and new constructions, which are constantly changing, but despite not being original, the industrial complex formed until the end of the operation of industrial activities is historically and landscapely representative. In 1989, the Central Sugar Mill remaining, including the forest, was listed as Cultural Heritage by the municipality and also expropriated to be used as a public park for cultural and leisure activities. Based on the identification and analysis of the elements through iconographic sources and remaining buildings, it is possible to see that the cultural landscape formed from a productive system is one of the most striking elements in the urban environment, already consolidated and considered an city icon in tourist and cultural character, because it combines the natural landscape formed by the Piracicaba river waterfall and the built landscape of a factory remnant.*

Keywords— *Piracicaba; Central Sugar Mill; Cultural Heritage; Cultural Landscape.*

I. INTRODUCTION

From the disciplinary field of Cultural Landscape, the present postdoctoral research at CPq-FAUUSP, analyzes the remaining buildings of the old Engenho Central de Piracicaba, opened in 1882, and a pioneer in São Paulo.

Its manufacturing plant has undergone several productive and economic processes, reflected in the factory arrangements and in its industrial buildings.

The original factory was built with a French prefabricated iron structure inspired by the Baltard Halls in Paris, which consisted of an unusual dome for its manufacturing function, justifying further studies on the buildings that have already disappeared from the old mill complex and its remaining remains, including the professional performance of its authors.

To better understand how the factory projects were carried out, a broader investigation was carried out, in which the origins of the Central Mills and Sugar and Alcohol Mills were studied in France, a pioneer in the process of mechanization of sugar production and its repercussions and in Brazil, in states like São Paulo, Rio de Janeiro, Minas Gerais and Pernambuco, in addition to other central devices that operated in the city of Piracicaba, such as the counterpart and contemporary of Monte Alegre.

The interest in the Piracicaba Central Sugar Mill lies in the urban, social and cultural impact that the central sugar and alcohol mills have produced in industrialized cities and in society since the Industrial Revolution. Despite his contribution to the formation of Brazilian industrialization, due to his identification with a less erudite architecture, he

was on the sidelines of the study of the history of Architecture and Urbanism.

Since the appreciation of industrial heritage and archeology, a significant number of researchers have sought to identify the importance of industrial architecture in historiography, highlighting its contribution to the formation of urban contexts and cultural landscapes in cities.

In addition to the buildings of the Piracicaba Central Sugar Mill, which were constituted as objects of study, a large number of counterparts in the capital and interior of São Paulo illustrates in a significant way the São Paulo industrialization process of the 20th century, whose participation was fundamental for the formation of the cultural landscape of cities and neighborhoods.

Analyze and understand the projects and typological arrangements of the buildings that made up the Piracicaba Central Sugar Mill, in the State of São Paulo, between the end of the 19th century and the middle of the 20th, a period that constitutes the first Brazilian industrial cycle.

Analyze the origins of the functional and architectural program of central sugar mills and sugar and alcohol mills in Europe, especially in France, and their insertion in Brazil, to understand how and under what influences their projects were constituted in Piracicaba.

Understand the constitution of the spaces determined by the needs program in the factory, verifying the intentionality of the project and the influence of projects carried out by equipment supply companies in the construction of buildings, mainly the companies 'Brissonneau Frères' and 'Fives-Lille', in addition to from the pioneer 'Derosne & Cail'.

Contribute to the maturing of the understanding about the origins of the manufacturing units in Brazil, related to the import of prefabricated structures in iron and also the development of the 'manchesterian' typology to replace the traditional Portuguese-Brazilian one, with characteristics of architectural eclecticism.

Identify and understand the buildings of Piracicaba Central Sugar Mill: construction system; masonry mooring; other architectural characteristics, related to the beginning of Brazilian industrialization, through the sugarcane production chain, from bibliographical research, surveys and systematization of information on: Industrial Architecture, Iron Architecture, Industrial Archeology, Industrial Heritage, and Cultural Landscape.

At least, based on the identification and analysis of the elements through iconographic sources and remaining buildings, it is possible to see that the cultural landscape

formed from a productive system is one of the most striking elements in the urban environment, already consolidated and considered an city icon in tourist and cultural character, because it combines the natural landscape formed by the Piracicaba river waterfall and the built landscape of a factory remnant.

II. MATERIAL AND METHODS

After conducting bibliographic research, surveys and systematizing the information obtained through primary, secondary and iconographic sources on the topic, in works that have already addressed related themes - mainly on industrial architecture of central sugar mills and plants - the thesis has its development in two parts: history of the origin of the Central Mills in Europe and Brazil with an emphasis on spatial arrangements and constructive characteristics of the sugar central mills and plants in order to establish comparative analyzes between the Piracicaba Central Sugar Mill and its French and Brazilian counterparts; and studies on Industrial Architecture, Iron Architecture, Industrial Archeology, Industrial Heritage and Cultural Landscape, with an in-depth study of the Piracicaba Central Sugar Mill.

III. RESULTS AND DISCUSSION

3.1 The Piracicaba Central Sugar Mill

From the 1870s, the São Paulo productive complexes began to be constituted according to the incentives from imperial policy of modernization to the sugar production in Brazil, among them the Piracicaba Central Sugar Mill, the third industrial establishment in the city. On January 19, 1881, the lawyer and businessman Estevam Ribeiro de Souza Rezende (future Baron Rezende), associated with the farmers Antonio Corrêa Pacheco and Joaquim Eugenio do Amaral Pinto, opened the Central Sugar Mill Company with an estimated operating time of 20 years. The machinery was commissioned from the mechanical industry Brissonneau Frères located in the French city of Nantes in Pays de la Loire. On May 3 of that year, the chairman of the shareholder council, Estevam de Rezende, donated part of his land at São Pedro Farm for the installation of the Sugar Mill. Four days later, on May 7, 1881, Emperor D. Pedro II signed Imperial Decree No. 8,089, granting authorization for its operation (Camargo, 1899; Guerrini, 2009).

Still in 1881, on November 18, the first shipment of machinery arrived from France, starting its assembly under the direction of industrial engineer André Paturau and engineer Fernando Dumoulin. Meira (2007) states that,

perhaps due to the concern with setting up the engine with the most advanced technology in the period, the works took a long time to be completed, and the company spent more than the guaranteed capital on the assembly. Only in October 1882 were the Central Sugar Mill machines started, starting the agro-industrial complex (Camargo, 1899; Guerrini, 2009; Meira, 2007).

The plant operated with automatic reed inlets and bagasse exiting the furnaces, with three 100-horsepower generators and three copper tanks for saturating the cane juice, in a building served by a brick chimney (Mialhe, 2012). As for the original Central Sugar Mill machinery, it consisted of an eight-cylinder Brissonneau Sugar Mill, powered by a waterfall-driven hydraulic turbine, with a regular supply capacity of 120 to 150 tons of production, with 67% extraction (Picard, 1903).

For Meira (2007), the performance of foreign companies was decisive in the assembly of the Sugar Mills, since Brazil had neither capital nor technology for the installation of factories, creating a link with foreign capital, which acted as much in the supply of new machinery, as well as the assembly of sugar central Sugar Mills by foreign companies. Among them, French companies benefited greatly from the policy of the sugar central Sugar Mills, especially selling machinery. The author stresses that in São Paulo, practically all the central Sugar Mills were assembled with French machinery.

The São Paulo pioneer experience in the Porto Feliz Sugar Central Sugar Mill, inaugurated in 1878, encouraged the opening of the central Sugar Mills in 1881 in cities like Lorena and Capivari, as well as the Piracicaba Sugar Central Sugar Mill. According to Melo (2006), the new factories enabled São Paulo a new fully mechanized technical standard, producing on a large scale and providing greater production compared to traditional Sugar Mills. The sugar produced was superior in quality and ready for direct consumption. In addition, “the municipalities where they were located became the largest provincial producers and their factories were national examples of sector modernization in the Empire” (Melo, 2006).

São Paulo, from the economic and demographic growth of the second half of the nineteenth century, with the installation of the railways and immigration policy, assumed the economic role in the country, becoming the main Brazilian consumer market of sugarcane derivatives. The central sugar Mills are responsible for the founding of the big sugar industry in São Paulo, as well as being part of the formation of the modern sugarcane agribusiness in

the country, 'which would so strongly mark our nineteenth century history' (Melo, 2006).

The São Paulo sugar Mills were created to compete with other producing provinces for the supply of the São Paulo market, and its entry into operation has already caused a decrease in the amount of sugar imported. In this case, São Paulo producers were at an advantage due to the proximity with the market, ensuring lower expenses with the transportation of goods (Melo, 2006).

Despite the increase in state production volume, in the early years of the 1880s, the Piracicaba Central Sugar Mill faced financial difficulties, aggravated by decree no. 9,253, of August 2, 1884, which declared the concession expired by the government, thus losing the right to guarantee interest (Meira, 2007). According to Terci and Peres (2010): The decree 8,089 of May 7, 1881 of the imperial government authorizing the operation of the Central Sugar Mill of Piracicaba Co. guaranteed loan for 20 years, for a daily capacity of 240 tons with a minimum production of 16,000 60 pounds bags. However, it was difficult to meet this minimum yield, considering that the viability of the central Sugar Mills lay in ensuring sufficient supply of sugarcane by the farmers, if not a huge factory structure was organized to current standards, with huge permanent capital and unsustainable idle capacity (Terci and Peres, 2010).

According to Perruci (1978), since at least 1885, the first and major problems appeared in the central Sugar Mills, whose negative results would be a consequence of technical reasons to a greater extent than structural ones. Among the main causes were: poorly chosen railroad tracks and poorly executed layout; poorly selected areas; and the fact that many concessions were given to speculators, with an interest in ensuring the high profits that the laws allowed, in addition to the numerous small central devices created indiscriminately, due to government subsidies.

Despite the promising São Paulo market, the Piracicaba Central Sugar Mill stagnated, among other reasons, due to insufficient raw materials, entering into bankruptcy on April 29, 1887, under the responsibility of the partners: Estevam Ribeiro de Souza Rezende and João Tobias de Aguiar e Castro. The significant number of sugarcane suppliers, who appeared as creditors, did not guarantee, finally, the quantity and the quality of the volume of cane necessary for production. Due to the impossibility of paying off the company's commitments regarding the payment of interest on the debt acquired from the government, with the profit from that year's harvest, the owners and creditors decided to announce the company

sale. In the following month, on March 17, 1888, Baron Rezende bought the shares of its partners and became its exclusive owner, in a period of sugar deficit in the promising São Paulo market (Guerrini, 2009; Terci and Peres, 2010).

Even in a fast expansion, the São Paulo sugar production was unable to supply the market, which complemented the demand by buying large quantities from the Sugar Mills in the Brazilian Northeast and Rio de Janeiro (Melo, 2006). This decisive moment in Brazilian history, who concerns the transition from the imperial to the republican regime, according to Terci and Peres (2010), was marked by great transformations with the end of slavery and the institution of the Republic, in addition to the virtuous cycle of coffee agro-export production. There was, therefore, a dynamism in the São Paulo internal market, with new perspectives for sugarcane production, and the local landowners did not let the opportunity pass, including the small ones that dedicated themselves to the subsistence genres and to the spirit in rudimentary contraptions, which would return faster than with coffee, with a minimum maturation time of four years (Terci and Peres, 2010).

During the First Republic, the banking network expanded in Brazil, with intense penetration of foreign capital, mainly used to finance works for the partial modernization of infrastructure, such as: railways construction, upgrading or construction of ports and urban reforms, among others. Banks, mainly foreigners, financed production and controlled all Brazilian foreign trade, acting as the true arbiter of national development, in an exporting country par excellence. This political period encouraged the sugar sector in a much more correct way from the economic point of view than the imperial regime, when the principle of division between industry and farming was exhausted, representing the end of the cycle of the central Sugar Mills and the origin of the plants (Perruci, 1978; Meira, 2007).

For Perruci (1978), from the failure of the sugar central Sugar Mills of the policy, after the short duration of approximately 15 years, the producers intended to evolve, without re-establishing the old production system based on banguês. On the contrary, the high investments and the contradiction of a possible “technological revolution” led to a new stage of the sugar “technological revolution”, represented by the plantation system. The author notes that with the Sugar Mills, the production system has returned to being similar to that of the old Sugar Mills, with the agricultural and industrial sectors of sugar production, reunited in a single company.

In view of the difficulties of solving the problems of lack of raw material, in addition to the new conditions imposed by the new political regime, coupled with the constant oscillations of the market and the need to adapt to the new plant regime, on June 22, 1891, the Piracicaba Central Sugar Mill company was sold by Baron Rezende to the newly created 'Companhia de Cultura de Cana, Manufacture and Refining of Assucar, Alcool, Cal, etc. - Niágara Paulista ', whose board was made up of the cel. João Carlos Leite Penteado (President), Victor Nothmann and com. Cícero Bastos, with a new capital injection. Under the new administration of the Niágara Paulista Co., according to the edition of *Gazeta de Piracicaba* in April 16, 1893, Central Sugar Mill manufactured 88 thousand arrobas of sugar, or 22 thousand bags, in the previous year, and expected to produce 80 thousand arrobas in that year (*Gazeta de Piracicaba*, 08/10/1893).

The improved machines introduction in sugar Mills has already led to progressive indebtedness since the second half of the 19th century. In this sense, the Porto Feliz, Rafard, Lorena and Piracicaba sugar central Sugar Mills, installed between 1878 and 1884, suffered several financial crises and ended up being sold to French investors at the 19th century end, who started to control the largest production units of sugar, brandy and alcohol from São Paulo. According to Melo (2006), even before the reorganization developed by the French, these units had already evolved into the plant structure, 'integrating agricultural and factory production, while maintaining, at least in part, the supply of third parties' cane' (Perruci, 1978; Melo, 2006).

On March 31, 1899, the Deed of Purchase of Piracicaba Central Sugar Mill was drawn up in a Parisian registry office, containing the statutes of the 'Société de la Sucrière de Piracicaba', of which industrialist Fernand Doré was founded. Two days later, on April 2, at the general shareholders' meeting, the definitive organization of the said company was decided, as recorded in the Minutes. In turn, the general shareholders' meeting of Niágara Paulista Co., held on April 17, 1899, decided to dissolve the company (Guerrini, 2009).

On April 29, 1899, the 'Société de la Sucrière de Piracicaba' acquired Niágara Paulista Co., then chaired by com. Cícero Bastos. The new company was represented by industrialist Fernand Doré, arts and manufacturing engineer Paul Henry Durocher and businessman Maurice Allain (*Gazeta de Piracicaba*, 11/05/1899).

In the new phase, with French capital injection, investments in infrastructure, expansion of the manufacturing plant and acquisition of agricultural

production area are still taking place in 1899. On October 4, 1899, a pressure and repression Sugar Mill and two multitubular boilers were opened, fed by sugarcane bagasse, capable of producing, in the incoming harvest, two thousand arrobas of sugar per day, in the harvest (Guerrini, 2009).

The sugar industry in São Paulo was, in this period, so economically advantageous that it attracted more foreign capital. On October 24, 1907, through decree no. 6,699, the limited liability company 'Société de Sucrerie Brésiliennes - SSB' was founded in Paris with the Maurice Allain presidency, bringing together the partners Fernand Doré, Lucien Mellier, Edmond Steinheil (Porto Feliz) and Count Léon de Bertier de Sauvigny (Cupim). According to Phillippe Allain (2014), the company was created to operate for 30 years, with the contribution of the plants: Rafard and Porto Feliz, inherited by Maurice Allain's wife, Ida Wagner, from her father, Alexandre Wagner; with the acquisition of the Lorena plant, by his brother-in-law Théodore Duvivier (later closed due to a mosaic epidemic); and the Cupim and Paraíso-Tocos plants, located in Campos, Rio de Janeiro; in addition to the Piracicaba plant, of which he was already a partner, and acquired its share control. "In addition to these assets, there was an alcoholic drinks plant in Piracicaba and two offices (the headquarters in São Paulo and a branch in Rio de Janeiro)" (Allain, 2014). Thus, with the French ones, the Piracicaba plant became the largest company in the state in production and the most important in the country, with annual production of 100 thousand sugar bags and three Sugar Million liters of alcohol.

According to Meira (2007), in the subsequent period, the foreign plants that most developed in Brazil were exactly the old central devices acquired by the French capital, and in 1909, the net profit of these plants grew, with production prior to the mosaic crisis, in about 60% of the Sugar Mill volume in São Paulo. The author argues that SSB's plants mirrored the assembly of a factory structure inspired by technological innovations imposed by the consequences of the Industrial Revolution on the sugar production in Brazil, considering that the central sugar Mills created in the imperial period were the precursors of the modern sugar and ethanol park in São Paulo (Meira, 2007, p. 51).

The Piracicaba Central Sugar Mill was, until the end of the 1920s, the largest and most important industry in the region. Until the end of the Old Republic period, a pest known as Mosaico seriously devastated the sugar cane fields in São Paulo, however, it ended up motivating the subsequent increase in sugar production in the State (MEIRA, 2007).

To solve the serious problem of the spread of the pest, the Piracicaba Experimental Station developed several fundamental studies for its eradication, defending the renovation of the cane fields, using Javanese canes resistant to the mosaic. The combating the plague success in São Paulo led to a rapid recovery in sugar production, serving as an example for other states, such as Rio de Janeiro and Minas Gerais (Szmrecsányi, 1998, p. 287 in Meira, 2007).

Thus, SSB achieved increasing profits from its foundation in 1907, until the period of the Mosaic crisis in the 1920s. This process was accentuated after the market crisis in 1929/30, as it reinforced the tendency for government intervention in the market sugar, justifying the creation of the Sugar and Alcohol Institute - IAA in 1933, in the Vargas government with the primary objective of balancing domestic production and consumption, leaving the government with responsibility for excesses. Due to the crisis resulting from the crash of the New York Stock Exchange, this period was characterized by price fluctuations and falls in the market due to the large stocks of agricultural and industrial products, coupled with lower wages and a consequent retraction in consumption. Thus, sugar production was affected by the incidence of sugar large stocks, because the product obtained only negligible prices, making its commercialization unfeasible (Ramos, 1999; 2007; Meira, 2007; Guimarães, 2012).

The Second World War years were characterized by a shortage of sugar in São Paulo, as goods from Pernambuco (most of the volume) stopped arriving at the port of Santos. After a long dispute against the IAA planners, represented mainly by its president, Barbosa Lima Sobrinho, the production of sugarcane, sugar, alcohol and brandy was partially released in the State of São Paulo. With the new policy, after a century apart from being a sugar exporter, the State of São Paulo resumed its former position, becoming the largest sugar producer in Brazil, partially due to the evolution promoted in the industrial area of production. São Paulo producers had definitely exceeded Pernambuco's in terms of the cane crushing and sugar production, since the 1953/54 harvest (Sampaio, 2011).

In the 1950s and in the first half of the 1960s, plant owners achieved prosperity, with few and occasional failures and failures. During this period, in 1959 Coopersucar was created, bringing together 32 cooperative plants and, in 1963, the IAA organized the 'Directive Program for the Sugar and Alcohol Policy', later converted into the 'National Sugar Industry Expansion Plan', with the objective of doubling the country's sugar production, in an eight-year interval, between 1963 and 1971. The policy

brought an increase of 98.9% in the São Paulo quota, accompanied by the authorization for the new Sugar Mill units installation, which started in 1964 (Andrade Neto, 1990; Sampaio, 2011).

Between the years of 1967 and 1968, the top management of SSB determined, through the general representative in Brazil, the nationalization and the respective change in the corporate name of the former 'Société de Sucrerie Brésiliennes', which came to be called 'Usinas Brasileiras de Açúcar SA', better known by the acronym 'Ubasá', covering only the plants and their Brazilian headquarters in São Paulo. In 1968, after the company nationalization, Ubasá sold its shareholding control to the Deltec Group, after 85 years of industrial activities. Stipp Netto (2009) informs that the international group, among its several companies, maintained Swift, which started to manage the Piracicaba, Rafard and Porto Feliz plants (Stipp Netto, 2009).

In 1969 the Silva Gordo Group acquired the share control of Ubasá from Deltec. The business group belonged to Banco Português do Brasil S.A., and was controlled by banker José Adolpho da Silva Gordo, who was São Paulo's finance secretary under the government of Adhemar de Barros. At the time, José Adolpho had also acquired Refinadora Paulista SA, which, in addition to the Usina and the Monte Alegre Paper and Pulp Plant in Piracicaba, maintained the Tamoio Plant in Araraquara, and the Guatapar Farm, in Amrico Brasiliense - SP, where a large pulp Sugar Mill was being built (Stipp Netto, 2009).

From 1969 to the first half of 1970, the new administration promoted structural and organizational changes in all its companies and industrial units. Months later, on January 1, 1971, the company's board of directors gathered all the employees who became part of the new team of companies and their units, participants in the new organization chart, to receive a diploma with the new titles and respective positions, in the Noble Salon on the headquarters of Banco Português do Brasil SA, then located at Paulista Avenue, in São Paulo (Stipp Netto, 2009).

Despite the administrative reorganization, the Silva Gordo Group, motivated by urban growth and the real estate appreciation of the region around the plant and the sugarcane cultivation farms, decided to close the plant's activities in 1972. According to Stipp Netto (2009), as a result from the sale of the controlling interest in the Silva Gordo Group Companies, possibly completed in November 1972, the plants from the former Ubasá were

transferred to a new real estate business group (Stipp Netto, 2009).

Piracicaba Central Sugar Mill carried out its last harvest between the years 1972 and 1973, with its sugar production setting a record, having been the most voluminous of its almost centennial existence, with 742,186 bags of sugar of 60 kilos. According to Stipp Netto (2009): "Precisely in the last few years, when the industrial part was no longer provided for investments, maintenance and necessary reforms, scrapped and diseased, the Central Sugar Mill showed its bravery, leaving a great legacy for everyone us, reaching this historic mark" (Stipp Netto, 2009).

From the definitive end of the industrial company character, the 'Terras do Engenho' real estate development started by 'Companhia City' was started with the subdivision of old cane production farms, which were configured in the current neighborhoods of Nova Piracicaba, Santa Rosa, among others. Thus, all the plant's machinery was sold as scrap, leaving only the buildings partially ruined by the dismantling process.

After years of abandoning the industrial site, in 1989, Piracicaba prefecture expropriated the area that currently forms the Central Sugar Mill Park, which had already been highlighted in the subdivisions promoted in the previous decade. In the same year, on August 11, the Piracicaba Cultural Heritage Defense Council - Codepac toppled the remaining set, including all buildings and also the native forest. On August 26, 2014, Condephaat also decided to list the entire extension of the park.

3.2 The manufacturing facilities of the Piracicaba Central Sugar Mill

The Piracicaba Central Sugar Mill industrial yard was set up during its years of operation, according to the needs of the production system, and in addition to the construction of various industrial equipment, it also promoted landscape changes in the old São Pedro farm area, including landfill and construction of retaining walls on the Piracicaba River and the deforestation of the site, whose wood was used in the buildings and also served as firewood for the furnaces.

Among the first buildings constructed, the sugar factory, installed in 1882, stands out, which was structured by an internal frame of prefabricated iron, imported from France and covered by a metal dome in four waters with a lantern, finished off by a spire with a lightning rod. The main factory entrance was marked by a door similar to the typical fortifications of Portuguese origin, composed of

pilasters, entablature and a pediment in a low arch that sported a clock, consisting of volutes crowning the ensemble. The windows of this building were exposed glazed arches and their doors were also executed with the same arch model, with glass flags. The only documentary record on this factory site is a filigree stamped on the company's stock papers, which, although illustrative, allows the analysis and understanding of its original configuration, free from other buildings attached later. In 1905, already in possession of SSB, the building (fig. 1) had undergone extensions on the left side, with attachments connected to the Sugar Mill block, as shown in figure 3, which also shows the distillery, the two original chimneys, a large warehouse, former office and other small, unidentified facilities.



Fig.1: Piracicaba Central Sugar Mill in the early 20th century. Source: DPH Ippap Archive. Photo: José Bidschovsky.

Starting the need to expand the plant's manufacturing plant, the sugar factory was expanded, with the insertion of two side blocks with lantern cover (fig. 3), and a consequent new main frontage in apparent masonry, however, preserving the original interior assembled with the prefabricated iron structure, including the original dome. With the new configuration, the Sugar Mill building was also expanded and fully attached to the sugar factory.

After several expansion reforms to adapt manufacturing activities, the old sugar factory was demolished to make way for a larger building in the 1940s. Divided into two parts to serve as a factory and refinery, the new building was named as 7A and 7B (also known as 'twin' buildings) and has Art-déco style features on the platbands (fig. 4), combined with traditional elements from the eclectic repertoire, usually used in the apparent masonry factory buildings such as the knocked down arches, the cycles, friezes and moldings.



Fig.2: SSB Plant (Central Sugar Mill) at the beginning of the 20th century. Source: Archive staff.

Another highlight for the primitive set of Central Sugar Mill was the industrial block for storing sugar sacks, divided into four gables, with an oval oculus on each 'pediment' (fig. 3). In addition to buildings of an industrial character, buildings with traditional residential characteristics were also built, such as the administrative headquarters dated 1898, the only remaining part of the Cia. Niágara phase, currently occupied by the Ippap's Department of Historical Heritage. The house was built following the Luso-Brazilian tradition, with an eave roof and guillotine windows with dark leaves, however, it already has characteristic elements from the late 20th century. In the 1920s, it underwent a renovation that modified its frontage, with the insertion of decorative elements from the Eclectic repertoire. Due to the decorative elements characteristics in the front window frames, it is possible that the work was carried out by the Danish engineer Dr. Holger Jensen Kok, who used the same repertoire in other works.

In addition to Dr. Kok, who ran the company between 1911 and 1920, many professionals worked on different constructions in the factory complex, like the (probably) German Daniel Rinn, who built the distillery building (Building 6) in 1916, and the building the offices in 1937 (Building 4); the French chemical engineer Jean Balbaud, who replaced the engineer Rinn in the 1930s, built the Sugar Mill building (Building 5) and chimneys; and the Frenchman Marc Mourras, designed the entrance portal. There is also a record of the participation of engineer Garcez, from São Paulo, in the construction of one of the chimneys, which may also have contributed to the construction of other works on the site. Despite the registration of engineers as authors of the building projects, no references have yet been identified about the presence of architects as authors of the works, and it is possible that they were actually designed by engineers,

related to the industrial character of their functions, since several of these buildings were built around the machinery already assembled on site.

SSB replaced over time and depending on the manufacturing needs, the old buildings with others of apparent masonry (interior and exterior), from the 1920s. However, the apparent masonry pattern was always followed in all constructions, some more elaborate than others, as well as the prefabricated metallic system, which was also used in the other buildings, both in structural systems and in the roof shears. From the time of 'Central Sugar Mill', apparently no other buildings remained, although some of which are still remaining have been built using existing frameworks, as in the case of Building 5, former Sugar Mill. This building was enlarged with a new frontage and it was probably engineer Baulboud's project, the extension, and not the original construction that was already part of the original complex block.

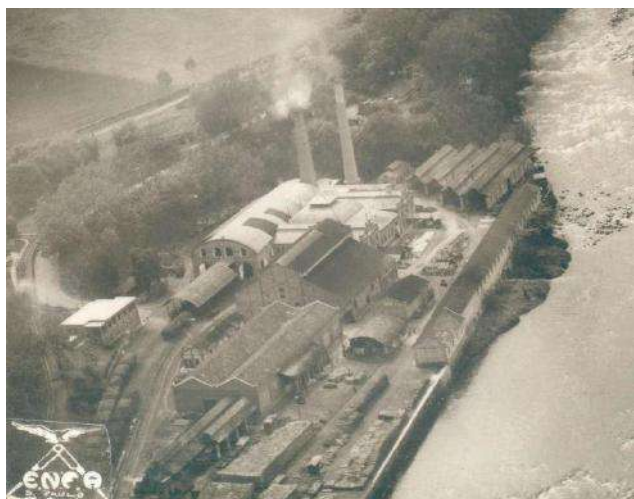


Fig. 3: Piracicaba Central Sugar Mill in 1939. Source: IHGP Archive.

From the constructions promoted by the French, the old Distillery building (Building 6) and the Office building (Building 4) also stand out, attributed to engineer Daniel Rinn, who reveal extreme constructive skill. The original date of construction of the distillery is 1916, whose inscription is forged on the main entrance transom, however the building was expanded in 1934, when the central building gained two more blocks. It was built with exposed masonry walls, structured by beams, pillars and crossed interlocking pieces, all metallic. This structural system, which is modulated, even made it possible to expand the pavements, since the structural parts could be reproduced and fitted. The building brings together several types of fillings, from full arched spans to glazed guillotine windows, with all four frontages differing.

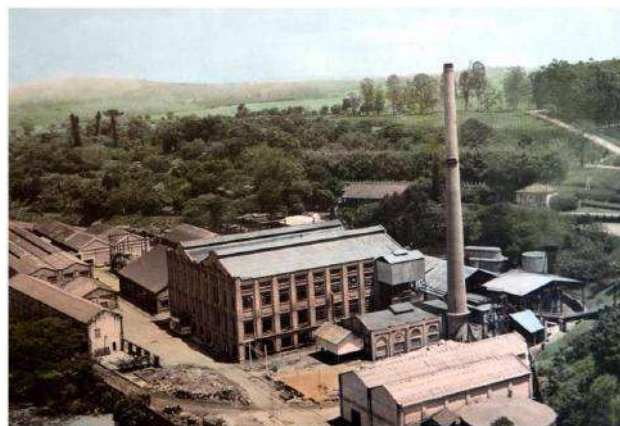


Fig.4: Ubasa's Piracicaba Plant (Central Sugar Mill) in the late 1960s. Fonte: Piracicaba City Council Archives.

The Office building was built following a pattern very close to the residential building, with a stone masonry frame, guillotine and shutter windows and a balcony with access to the administrator's office and also to the other work rooms. The highlight of this building is the ornamentation built capriciously with raised bricks.

Of the Frenchmen presence, the French garden stands out between the old residence of the administrator (also built in apparent masonry, with details and ornamentation in bricks), and the old administrative house. From the residence, a fountain surrounded by a bower, in front of the building, connects via a staircase, with the office area, which can be accessed by a fan staircase.

Other buildings (fig. 4) were added or eliminated according to the need for production or storage, especially the buildings that are located after the old railway yard, on the left, in the complex. The warehouses (buildings 14, 14A, 14B and 14C) followed similar programs modulated according to the required size and distinguish themselves with clearly lower power consumption.

3.3 The Cultural Landscape constituted

Based on the iconography produced by postcards and photographs from the company's archive, as well as from former employees, it is possible to perceive the primitive constitution and the transformations of the Central Sugar Mill complex in the cultural landscape of Piracicaba, formed by the presence of the Piracicaba River and his waterfall, exuberant elements of nature, which are made up of the built set that added or eliminated elements over the years, until its current version.

Upon appropriating the territory, the entrepreneurs who built the Piracicaba Central Sugar Mill created a movement that involved economic, social and cultural activities along its historical path, as well as having to

resolve the physical limitations of crossing the river and occupation of its margins, bringing urban transformations that distributed all these elements in a peculiar and peculiar logic. The Central Sugar Mill spatial organization process is unique and contributed to this area becoming a historical and cultural complex with considerable patrimonial value, registered at the municipal and state levels.

As understood by Mascaró (2008), the cultural landscape of this region can be defined as “an ecological reality, materialized physically in a space that could be called natural (if considered before any human intervention), in which the elements and structures are inscribed built by men, with a certain culture [...]”. Thus, the landscape starts to be understood as a product of the humanization process that modified the river's natural intricacies, incorporating urban-industrial, agrarian, economic, social and cultural activities, which formed the different visual perceptions that today are materialized in the scenario of the city.

According to Weissheimer (2009) “the concept of cultural landscape is already used in other parts of the world - such as in Spain, France and Mexico, for example - and enables the quality of life of the population and the motivation responsible for the preservation of this heritage”. These innumerable socioeconomic and cultural activities layers must be preserved for the revaluation of the city's spaces, with special emphasis on the Central Sugar Mill Park.

The territory formation through its history makes us understand the importance of maintaining spaces and the continuous conformation and development of the city. In the Piracicaba Central Sugar Mill case, since its original formation, there have been numerous changes in the manufacturing plant, with the insertion or suppression of buildings and industrial assemblies, which modified the landscape constituted there. However, the impact caused by the changes varied according to the scale of the interventions, the largest of which was the demolition of the original factory and its replacement by the new building that comprised the factory and the refinery. Some of the substitutions were punctual and did not bring a greater visual impact on the landscape, and thus, did not significantly change the perception of the historical ensemble.

IV. CONCLUSION

The cultural landscape of the region consisting of the Rua do Porto and the Piracicaba Central Sugar Mill riverside complex constitutes a natural space in which built

elements and structures were inscribed. Thus, the appropriation of that territory is configured based on the humanization process that formed the different visual perceptions that are currently materialized in the city scenario.

Although changed over the years, as a cultural landscape, the remaining and definitive industrial version, combined with the nature constituted by the Piracicaba river waterfall and the native forest, is inseparable from the Piracicaba imaginary, with a strong identity appeal, being considered one of the main signs of the city and recognized by all its population.

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Surgical procedures and their correlation with the rate of nosocomial infection: negative impacts on the recovery process of inpatients in the Paraense Amazon

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Abstract— *The study aimed to bring current data on hospital infections, identifying the number of infections in four years in five hospitals in western Pará (Brazil). Data collection was carried out by consulting the information bank of the Health Department of the Municipality of Santarém. These hospitals operate in the municipality of Santarém, in the northern region of Brazil. Public or private hospitals that perform surgical procedures were used as inclusion criteria. The study identified that the Regional Hospital of Baixo Amazonas has the highest rates of nosocomial infections and that bloodstream infection was the most frequent in this unit. In addition, there was a notable correlation between the total number of surgeries performed in hospitals and the total number of deaths from nosocomial infections and between the total number of infections and the total number of deaths from infections.*

Keywords—*Hospital infection, Amazonia, surgical procedures.*

I. INTRODUCTION

Hospital infection (HI) is one acquired after the patient's admission to the hospital and whose manifestation is triggered during hospitalization or after discharge⁽¹⁾, which may be related to the patient's clinical condition and procedures (such as bladder catheterization, access venous tube, nasogastric tube, complex surgeries, among others) performed by the health team in the hospital. Scholars claim that from the moment that patients started to be treated in hospitals, the transmission of infectious agents in the hospital environment became a cause for concern, since the occurrence of this contributes to the development of complications in the clinical picture and to increased risk of death, especially for more serious and immunocompromised clients⁽²⁾.

In view of this concern, strategies were created in Brazil to prevent infections (such as those in the bloodstream, surgical sites, intestinal, respiratory and digestive tracts, and in other topographies) in hospital environments. Among these strategies are the Hospital Infection Control Commissions (CCIH), which are responsible, basically, for standardizing measures to prevent the transmission of microorganisms from one patient to another (both directly and indirectly⁽³⁾), and from patient to patient. health professionals and vice versa.

Despite the existence of this Commission, hospital infection rates in Brazil are still considered high. In 2000, the IH prevalence rate of the reference and teaching hospitals, located in the capital Teresina, was released, and is presented as follows: Hospital Areolino de Abreu, 37.7%; Maternity Dona Evangelina Rosa,

11.3%; Children's Hospital Lucídio Portela, 35.7%; Hospital for Infectious-Contagious Diseases, 23.7%, and Hospital Getúlio Vargas, 31.1%. Thus, the prevalence of IH in the five reference hospitals in Teresina was 27.9%⁽⁴⁾, that is, 12.9% more than the prevalence registered at the national level, which is 15%, according to the data from the Ministry of Health⁽⁵⁾. In addition to these significant results, other researchers estimate the occurrence of great variation in the coefficients of lethality due to nosocomial infection, ranging from 9 to 58%, reaching 40% among bloodstream infections, according to a multicenter study in Brazilian hospitals⁽⁶⁾.

Given such statistical data, there is a need to invest in research focused on the theme, since through these, it is possible to identify whether factors such as the complexity of hospitals, the demand for care and the techniques used during hospital procedures, are contributing to the occurrence of the rates presented, and from that, investing even more in actions that aim to inspect, control and reduce the rates of nosocomial infections in Brazil and in the world. With the above, the study aimed to bring current data about hospital infections, identifying the amount of infections in four years in five hospitals in the west of Pará (Brazil), and correlating these infection rates to the number of surgeries performed in hospitals and the coefficient of deaths from infection found in these same units.

II. METHODOLOGY

It is a quantitative, analytical, cross-sectional research, being a modality of epidemiological study in which factor and effect are observed in the same historical moment. We investigate "cause" and "effect" simultaneously and determine the association between exposure and disease. Its main advantage is to generate information necessary to understand the endemic-epidemic process and thus subsidize intervention strategies⁽⁷⁾.

Table 1. Chi-square test to assess types of infections by hospital and ANOVA to assess comparisons of infections in all hospitals

	HRBA	HMS	HMSF	HUOP	HIC	P
Urinary tract infection	50	32	0	1	1	<0.0001
Respiratory tract infection	53	24	0	0	4	<0.0001
Bloodstream infection	75	22	1	0	5	<0.0001
Infections in other topographies	58	19	3	1	15	<0.0001
Surgical site infection	60	59	27	3	4	<0.0001
Infection of skin and soft tissues	4	14	2	9	3	0.0033
Intestinal tract infection	0	14	0	0	4	Ns
P	<0.0001	<0.0001	Ns	ns	0.0005	0.0002

Data collection was carried out by consulting the information bank of the Health Department of the Municipality of Santarém, through audits. These hospitals, targets of the research, operate in the municipality of Santarém, located in the west of the state of Pará, in the northern region of Brazil. Public or private hospitals that performed surgical procedures were used as inclusion criteria.

The data were tabulated in the Microsoft Excel 2010 software and analyzed using SPSS 20.0. The Chi-square test was used to assess the types of infections per hospital and in which hospital would be the most incident, ANOVA to evaluate comparisons of infections in all hospitals. Spearman's coefficient to assess the correlation between the total number of surgeries and the total number of hospital infections, the correlation between the total number of surgeries and deaths from hospital infections and the correlation between the total number of hospital infections and the total number of deaths resulting from such infections.

III. RESULTS

The present study reveals that the occurrence of HI in the evaluated hospitals is significant. The data in Table 1 show among the hospitals which stands out considerably, in comparison with the others, in each type of infection and which infection was more frequent, in comparison with the others, in the same hospital. The result of the ANOVA Test (0.0002) identified that among hospitals the one with the highest rate of infection of the urinary tract, respiratory tract, bloodstream, surgical site and in other topographies is the Hospital Regional do Baixo Amazonas (HRBA). The Santarém Municipal Hospital (HMS), in turn, stood out in terms of the incidence of skin and soft tissue infections and the intestinal tract.

* HRBA - Regional Hospital of Baixo Amazonas, * HMS - Municipal Hospital of Santarém, * HMSF - Hospital and Maternity Sagrada Família, * HUOP - Hospital Unimed Oeste do Pará, * HIC- Hospital Imaculada Conceição, * ns - does not apply, * p- statistical significance.

The result of the Chi-square test reveals that in HRBA, the most incident infection was that of the bloodstream; in HMS and HMSF the greatest number of infections were

those in the surgical site; in HUOP, skin and soft tissue infections were the most frequent; and in HIC, there was a greater occurrence of infections in other topographies.

Table 2. Spearman 's coefficient to assess the correlation between total surgeries and total hospital infections.

	Total surgeries	Total hospital infections
HRBA	3971	255
HMS	3879	188
HMSF	2091	31
HUOP	1272	16
HIC	1058	36
coefficient Spearman		0.7000
P		0.1881

* HRBA - Regional Hospital of Baixo Amazonas, * HMS - Municipal Hospital of Santarém, * HMSF - Hospital and Maternity Sagrada Família, * HUOP - Hospital Unimed Oeste do Pará, * HIC- Hospital Imaculada Conceição, * p- statistical significance.

In this research, the Spearman Coefficient (0.7000), shown in Table 2, detected that there is no significant correlation between the total number of surgeries and the total number of nosocomial infections in the evaluated hospitals.

Table 3. Spearman 's coefficient to assess the correlation between total surgeries and deaths from nosocomial infections.

	Total surgeries	Deaths from hospital infections
HRBA	3971	40
HMS	3879	24
HMSF	2091	0
HUOP	1272	0
HIC	1058	0
coefficient Spearman		0.8944
P		0.0405

* HRBA - Regional Hospital of Baixo Amazonas, * HMS - Municipal Hospital of Santarém, * HMSF - Hospital and Maternity Sagrada Família, * HUOP - Hospital Unimed Oeste do Pará, * HIC- Hospital Imaculada Conceição, * p- statistical significance.

The Spearman coefficient (0.8944), shown in Table 3, detects that the greater the number of surgeries, the greater the probability of deaths from IH. This fact is triggered since the surgical center is one of the most critical areas of the hospital environment, considering that the activities performed in it are of high potential for contamination, which can lead to the occurrence of deaths from IH. However, despite the relevant coefficient found, there

are no similar or corroborative results in the literature, which reinforces the need for further research addressing the subject studied.

Regarding the data obtained in Table 4, the Spearman coefficient shows that there is a significant correlation (0.8944) between the total number of hospital infections and the total number of deaths resulting from such infections.

Table 4. Spearman 's coefficient to assess the correlation between total hospital infections and total deaths from such infections.

	Total hospital infections	Deaths from hospital infections
HRBA	255	40
HMS	188	24
HMSF	31	0
HUOP	16	0
HIC	36	0
coefficient Spearman		0.8944
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* HRBA - Regional Hospital of Baixo Amazonas, * HMS - Municipal Hospital of Santarém, * HMSF - Hospital and Maternity Sagrada Família, * HUOP - Hospital Unimed Oeste do Pará, * HIC- Hospital Imaculada Conceição, *p- statistical significance.

IV. DISCUSSION

The coefficient found by the ANOVA Test in relation to the HRBA, may be due to the fact that this institution provides medium and high complexity care to patients in serious condition and who need major procedures. Therefore, for meeting a demand with a high degree of vulnerability of the immune system, and for the possible existence of technical failures by health professionals during the execution of hospital procedures (such as bladder catheterization, venous access, complex surgeries, mechanical pulmonary ventilation, among others.), the urinary tract infection index, respiratory tract, blood flow, surgical site and other topographies in this unit, were more expressive when compared to the other institutions evaluated.

As for the fact that the HMS has the highest amount of infection of the skin and soft tissues and of the intestinal tract, it should be noted that this situation may have occurred due to inadequate asepsis of the environment, to the immune system of the individuals, to insufficient nutritional supply for recovery. the clinical picture, the long period of hospitalization to which patients are submitted to this unit, which provides a greater risk of developing pressure ulcers and consequently infectious foci, in addition, the inputs may not have been sufficient to meet all demand assisted (taking into account that the HMS receives patients from over 22 municipalities across Pará).

Another issue that can be raised about this high quantity in the HMS, are the care of the health team, especially nursing, which may not have been adequate, given that in most municipal hospitals in Brazil there is a

disproportionality between the number of patients professionals and the number of customers.

Although HRBA and HMS have the highest rates of HI, we can consider that it is not only these that have this high incidence, but that there have been cases of underreporting in other hospital institutions, since the HI commissions have not yet been put in place. practice in its entirety. Researchers claim that underreporting not only translates into unreal infection rates in a given service, but also prevents the implementation of effective measures to control and prevent its complications ⁽⁸⁾.

Regarding the results obtained from the Chi-square test, only the incidence of infection in the bloodstream of HRBA was similar to that found in other studies conducted in Brazil. At the State Hospital of Surumé -SP, in 2011, it was observed that bloodstream infection was also the most frequent, affecting 97 patients (72.9%), constituting 38.2% of the total of 254 infections. In other studies carried out, the incidence of infections in surgical sites, skin and soft tissues and in other topographies, were the lowest found in hospitals, a result that corroborates that obtained in this research. In an analysis performed at a large University Hospital in the city of Belo Horizonte in the years 2009 and 2010, infections of the surgical site, skin and other topographies such as: eye, ear, nose, mouth, each represented only 2.9% of all infections ^(9, 10).

These results presented, mainly with regard to the findings of bloodstream infection, reinforce the idea that the innumerable invasive procedures (such as central and peripheral venous access) performed in hospital units, combined with the disuse of PPE's, and the inadequacy of sepsis and antisepsis employed during the performance of

such procedures, can increase the rate of infection in this topography in hospitals in Brazil.

Regarding the results found in other research regarding infection at the surgical site, certain reflections are generated, since the surgical procedure is one of the procedures in which the patient is more likely to acquire infections due to the exposure to which he is submitted, despite In addition, research shows that the coefficient of infections in this region is still not significant. This means that the number of surgical procedures performed in a hospital will not necessarily lead to an increase in infection rates.

The result of the Spearman coefficient (0.7000), shown in Table 2, reinforces the thesis that the surgical procedure is not the only determinant of the occurrence of HA. It is necessary to remember that there are endogenous and exogenous sources to the patient that also contribute to the development of these infections. Among several scholars, there is a consensus that about 70% to 80% of hospital infections are of endogenous origin, that is, they are due to predisposing diseases or clinical conditions, which aggravate the patient's susceptibility⁽¹¹⁾. The exogenous infection, in turn, caused by microorganisms from the hospital sector (present in the environment, in the hands of professionals or in the instruments used in the patient), also contributes widely for the client to acquire the infection.

From the above, it is clear that the surgical act itself, when combined with endogenous and exogenous factors, can be considered a risk factor for the development of IH and also for the occurrence of deaths from these infections. The following tables identify precisely the correlation between the total number of surgeries performed in hospitals with the total number of deaths from IH and the correlation between the total number of hospital infections and the total number of deaths resulting from such infections, respectively.

In Brazil, this problem is considered serious considering that 720,000 people are infected in Brazilian hospitals per year and, of these, 144,000, that is, 20%, evolve to death. In a study carried out in a pediatric teaching hospital in São Paulo, of the 69 deaths that occurred in 1993, nosocomial infection was the direct cause of death in 30.4% of children, another 50.8%, the infection contributed to death. In another study carried out at a University Hospital in Belo Horizonte in 2009 and 2010, of the 254 patients followed, 60 (23.6%) died. In the analysis of patients who died, 5 (8.3%) were colonized by resistant microorganisms and 9 (15%) had infections related to health care^(12, 2, 10).

In view of the relevance of the statistical results presented, it is reinforced how important it is that the actions of the Hospital Infection Control Program are actually carried out in hospital units, in order to change the current Brazilian scenario regarding the theme. Brazil, despite many efforts, still faces an adverse reality of what can be considered satisfactory: lack of human and material resources in health institutions (mainly public ones), absence of Hospital Infection Control Commission working in most hospitals, or even, professionals exercising the function without adequate knowledge of the activity - which results in an increase in hospital infection rates in the country⁽³⁾.

V. CONCLUSION

The study identified that the Hospital Regional do Baixo Amazonas has the highest rates of most hospital infections and that bloodstream infection was the most frequent in this unit. In addition, there was a notable correlation between the total number of surgeries performed in hospitals and the total number of deaths due to nosocomial infections and between the total number of infections and the total number of deaths resulting from infections.

Such results reinforce the thesis that the studied theme is an important problem to be debated and evaluated. It is known that in many hospitals, situations such as work overload and the disproportionate relationship between the number of patients and the team contribute to routine breaks in preventive procedures, such as hand hygiene. Because of this situation, the coordination of hospital institutions needs to continually develop strategies to inhibit the occurrence of inappropriate habits by health professionals, and thus contribute to reducing the incidence of infections in hospitals.

One of the strategies that could be adopted would be the educational actions, since they allow the reflection of the performance of each one and provide the learning and modification of improper practices carried out on a daily basis. In addition, another strategy that could be adopted by health teams and academic researchers, would be aimed at the constant conduct of research on HI, since through these, they would present current data that would allow understanding the epidemiology of these infections, and from that, reduce the share of morbidity, mortality and hospital expenses, directing control measures for infections.

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Evaluation of regression of periradicular lesions submitted to endodontic treatment in a single session and filled with PBS CIMMO Hp and Endofill cement: Clinical case report

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Abstract— Endodontic treatment has as main objective the cleaning and modeling of the root canal, thus removing the microorganisms that provide the infectious condition through chemical and mechanical preparation. The objective of this study is to present a case report on the evaluation of the regression of periradicular lesions submitted to endodontic treatment in a single session and filled with PBS CIMMO Hp and Endofill cement. It is a study with an applied research principle, a qualitative and quantitative approach, with an exploratory character, carried out on a 29-year-old female patient who had two uniradicular teeth (8 and 9) with periradicular injury caused by an infectious and asymptomatic process. Endodontic treatment in a single session was performed simultaneously on the two dental elements with ProDesign S rotating files, localization of the working length through foraminal locator and irrigation with 2.5% sodium hypochlorite and final irrigation with 17% EDTA. After complete chemical-mechanical preparation, dental element 9 was filled with endodontic cement endofill and dental element 8 was filled with bioceramic endodontic cement PBS CIMMO HP. Radiographic follow-up was performed for a period of 1, 2 and 8 months in order to observe the repair process of the lesions and the regression of the periradicular lesion and it was observed that the regression of the periradicular lesions submitted to endodontic treatment in a single and filled session with cement PBS CIMMO Hp and Endofill were similar in the two dental elements. Given the context, it is possible to conclude that the type of endodontic cement did not interfere in the regression time of the periapical lesion.

Keywords— Periapical lesion. Endodontics. Cements.

I. INTRODUCTION

Dental pulp is a loose connective tissue, consisting of cells, extracellular matrix, blood vessels and nerves (LOPES & SIQUEIRA., 2015). Pulp vascularization is provided by blood vessels that enter the pulp via the apical foramen or foraminae and then extend and branch in the coronary direction (Lopes & Siqueira., 2015).

Teeth with normal pulps generally do not show any spontaneous symptoms, the symptoms produced from the pulp test are mild, do not cause discomfort to the patient and result in a transient sensation that resolves in seconds. Radiologically, there may be varying degrees of pulp classification, with no evidence of resorption, caries or

mechanical exposure of the pulp. No endodontic treatment is indicated for these teeth (Hargreaves & Berman, 2017).

Pulp and periradicular pathologies are inflammatory in nature and of microbial etiology; caries and infection of the root canal system represent the main sources of persistent microbial aggression to the pulp and periradicular tissues, respectively (Lopes & Siqueira, 2015).

The pulp is generally unable to eliminate the aggressive bacteria, it defends itself temporarily and slows the spread of infection and tissue destruction, with the persistence of irritating agents the damage will spread throughout the pulp, the bacteria or their by-products, and irritating agents coming of the necrotic pulp, diffuse from the

canal in the periapical direction, causing inflammatory lesions. Thus, bacteria play an important role in the pathogenesis of pulp and periapical diseases (Bergenholtz, 2016). One of the main objectives of endodontic treatment is to minimize the amount of pathological microorganisms and debris in the root canal system (Anderson et al., 2018).

Control of the infection is carried out in the chemical-mechanical preparation. In the process, endodontic files are used to promote the mechanical removal of microorganisms, being able to eliminate a significant amount of microorganisms and to model the main root canal. During the chemical removal process, the use of an irrigating solution with antibacterial activity enhances intracanal disinfection, being able to reach areas of the conduit that were not touched by the instrumentalization (Torabinejad & White, 2016).

To be successful in endodontic treatment, it is necessary to seal the root canals, with gutta-percha and endodontic cement, there are cements of different compositions, which allow the sealing of the root canal system and prevent local recontamination, favoring the success of the treatment (Marques et al. 2011).

For successful treatment, filling materials play an extremely important role. When choosing cement, the physical and biological properties of the material must be kept in mind (VALERA et al., 2000)

After treatment, the apical sealing must be observed by depositing repaired mineralized or fibrous tissue. The induction of this repair is linked to the correct execution of the endodontic treatment phases as well as the origin of the obturator material that remains in close contact with apical connective tissue. and periapical, it is observed that some cements are irritating to apical and periapical tissues, which can hinder, prolong and even prevent repair. (LEONARDO., 2008)

There is a high number of endodontic cements in the market of different compositions, being oxide and zinc-eugenol (OZE), calcium hydroxide cements, resin cements, glass ionomer cements and silicone based (LOPES & SIQUEIRA. , 2015).

Bioceramic cements are gaining ground in endodontics, studies have sought to compare bioceramic endodontic cements with conventional endodontic cements and have shown considerable evidence classifying this material as the gold standard for various clinical procedures, have good sealing properties, being able to increase tooth

resistance, biocompatibility , high pH, no resorption, easy handling inside the root canals, low cytotoxicity, does not suffer contraction and is chemically stable (LIMA et al., 2017).

In this context, the objective of this study is to present a clinical case on the evaluation of the regression of periradicular lesions submitted to endodontic treatment filled with pbs cimmo hp and endofill cement.

Case report

Initially, anamnesis was performed, according to the form, intra and extra-oral clinical examination and periapical radiographic evaluation (use of radiographic positioner). The selection of the patient followed the following criteria:

The patient attended had two uniradicular dental elements, with pulp necrosis and periradicular bone rarefaction in the apical region, and asymptomatic for endodontic treatment. The two dental elements were performed in the same session.

II. CLINICAL PROCEDURES

The service protocol made was as follows:

Initially, anamnesis, tactile inspection and periapical radiography of the dental element were performed, followed by anesthesia with Lidocaine 1: 200000 (Dentsply / Sirona Tulsa Oklahoma, USA). Subsequently, tooth prophylaxis was performed using a straight white AC brush (Microdont, Socorro - SP) and Herjos prophylaxis paste (Vigodent, Rio de Janeiro - RJ), caries removal with low rotation spherical drills (Dentsply / Sirona Tulsa Oklahoma, USA). And coronary opening with 1014 and 3082 drills (KG Sorensen, Barueri - SP).

The absolute isolation was done with a rubber sheet (Madeitex, São José dos Campos - SP), Ostby isolation arch (Prisma, São Paulo - SP) and various isolation clamps (KSK, Rio de Janeiro - RJ) disinfecting the operating field with 0.2% chlorhexidine (A Fórmula manipulation pharmacy, São Paulo-SP).

Initial exploration with K file # 10 or 15 (Dentsply / Sirona Tulsa Oklahoma, USA). It was made up to the apparent length of the tooth.

III. INSTRUMENTATION TECHNIQUE

Made with the Prodesign S engine and rotary system (Easy, Belo Horizonte - Brazil), followed by the

preparation of the cervical third with files 30/10 Prodesign S (Easy, Belo Horizonte - Brazil) and 08/25 Prodesign S (Easy, Belo Horizonte - Brazil) crown - apex respecting the anatomy of the canal always maintaining a minimum distance of 5 mm from the apical limit on the radiography and in curved channels until the beginning of the curvature. Then, dentistry was performed with foraminal Root ZX locator (J Morita, Kyoto - Japan), obtaining the actual tooth length. A foraminal patency will be performed with the rotary file 25/01 Prodesign S (Easy, Belo Horizonte - Brazil) 1 mm beyond the actual length of the tooth, defined by an electronic foraminal locator. Patency check with file (10 or 15). Subsequently, a 06/25 file instrumented 1mm short of the actual length of the tooth.

Throughout the instrumentation, irrigation was performed with 2.5% sodium hypochlorite (Manipulation pharmacy - Formula and Action - São Paulo - SP), Luer Slip 10 mL plastic syringe (Advantive, NanchangJangxi - China) and disposable needle 25 x 0.55 (BD, Curitiba - PR). 30 mL of solution was used per experimental unit. The needle was inserted throughout the instrumentation process until it reached 2 mm below the working length.

The canals, at the end of the preparation, were dried with capillary tips (Ultradent Products, Inc, South Jordan, Utah, USA) coupled to a high-power sucker and with absorbent paper cones (Tanari, Manacapuru - AM).

The final irrigation was carried out with 3 mL of 17% EDTA (Pharmacy of manipulation - Formula and Action - São Paulo - SP). First, 1 mL of 17% EDTA was introduced, followed by ultrasonic vibration with a 25 IRRIS insert (VDW; Endo Ultrasonic Files, Endodontic Synergy, Munich, Germany) at a frequency of 30 kHz. The ultrasound insert will be connected to a piezoelectric ultrasound operating at 30 kHz (CVDent 1000; CVD Vale, São José dos Campos, SP, Brazil), set at power level 3, over a period of 20s. This process was repeated 2 more times. After this

process, irrigation was carried out with 5 mL of sodium hypochlorite (FarmáciaFórmula&Ação, São Paulo - SP). The canals were dried with capillary tips (Ultradent Products, Inc, South Jordan, Utah, USA) coupled to a high-powered sucker and with absorbent paper cones (Tanari, Manacapuru - AM).

After complete mechanical chemical preparation, different cements were used:

Table 1. Represents the endodontic cement used to fill each element.

Dental Elements	
8	PBS CIMMO HP Cement
9	EndofillCement

After handling the endodontic cements (Table - 1), the channels were filled, in a single session, by the Continuous Condensation Wave technique (Buchanan, 1994) which follows the principles of the Schilder technique (1967) using the Touch'n Heat equipment . For this purpose, accessory M and FM cones (Tanari, Manacapuru - AM) were selected. These were calibrated using a calibrating endodontic ruler (Dentsply / Maillefer, Ballaigues - Switzerland) and adjusted to the working length. The Thermoplasticizer of the Touch'n Heat device performed the cutting, plasticization and condensation of the gutta percha inside the channels, up to 11 mm, inside the root canal. This filling phase is called "Down Packing". Subsequently, thermoplasticized gutta percha was introduced to perform the "Back Fill"

Final restoration was performed in composite resin and final radiography was performed with a radiographic positioner (Indusbello, Londrina - PR). The dental elements were preserved at 1, 2 and 8 months, analyzing the regression of the pathology and symptoms (Figure - 1) and follow-up computed tomography after 8 months (Figure - 2).

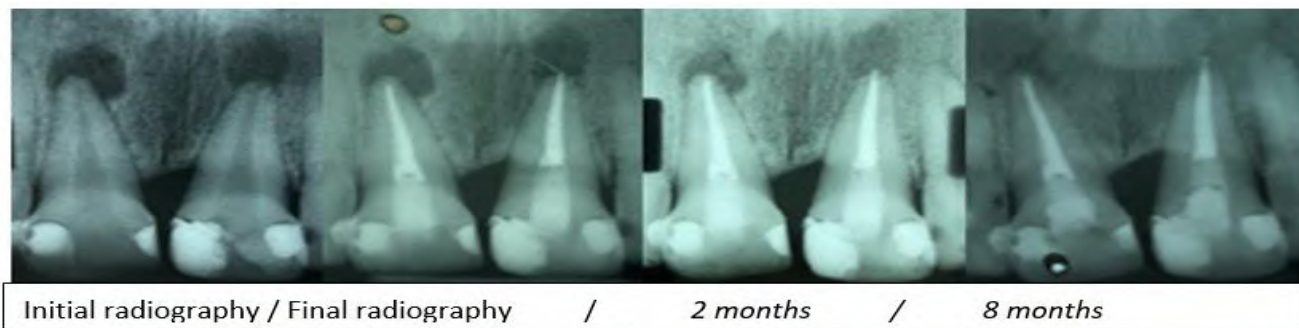


Fig.1: Radiographic monitoring during the period of preservation of periapical lesions

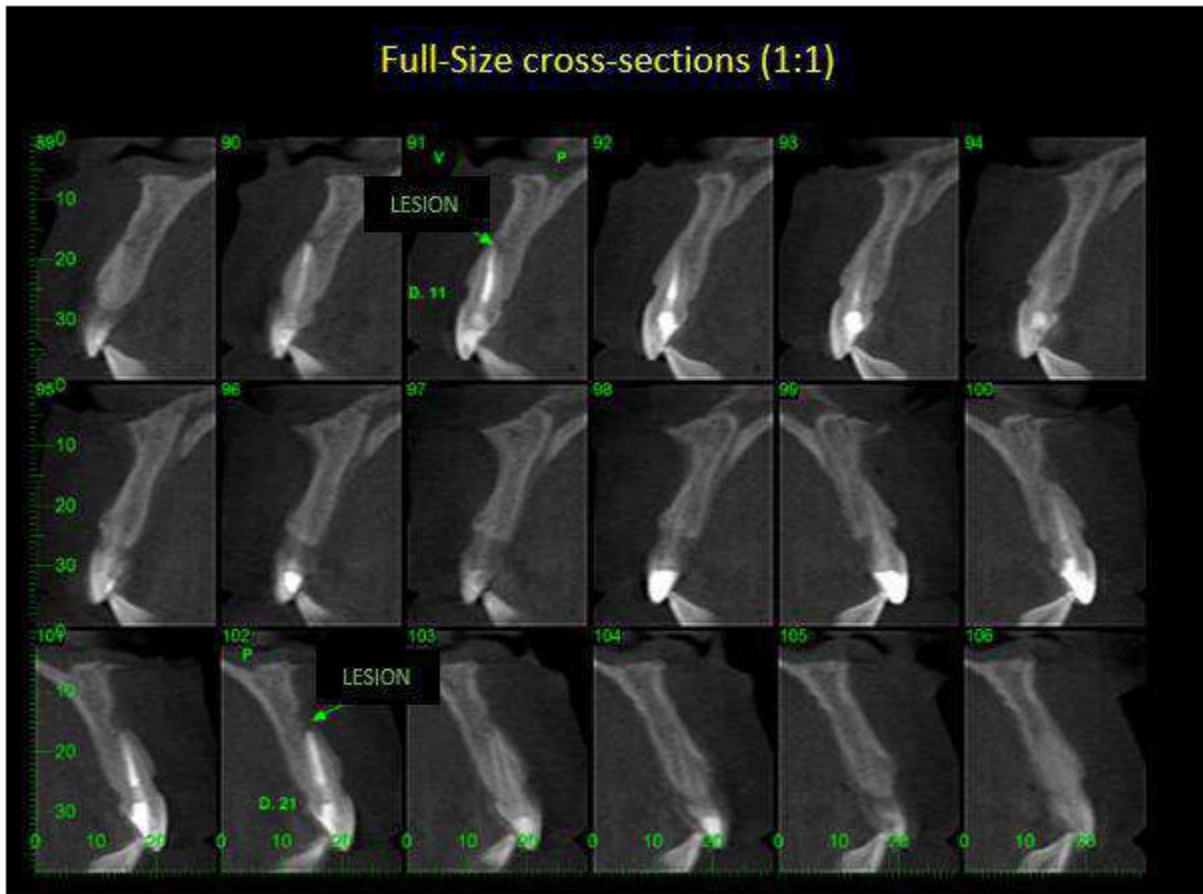


Fig.2: Proservation computed tomography after 8 months

Source: Own authorship

IV. DISCUSSION

The limitations of conventional techniques include not promoting root regeneration and repairing dental alveolar lesions. The proposed use of PBS HP CIMMO® (LOPES & SIQUEIRA., 2015) determines an innovative alternative to fill channels and provide root regeneration and, consequently, repair of dental alveolar lesions, corroborating with the recent proposals of regenerative dentistry. However, in this study there was no difference between regeneration of the periapical lesion between the endofill and PBS HP CIMMO®.

For the repair of periapical lesions after endodontic treatment to occur, it undergoes a regeneration process in which the altered periapical tissues are replaced by native tissues to restore the original function and architecture. Repair is a process by which altered tissues are not completely restored to their original structures. Histological

examination of most tissue cuts in animal and human studies reveals that the healing of periapical lesions after endodontic treatment occurs more through repair than regeneration of periapical tissues, the extent of the repair is proportional to the degree and extent of the lesion tissue and the nature of tissue destruction. The bone that has been reabsorbed is replaced by newly formed bone; the reabsorbed cement and dentin are repaired by cellular cement. The periodontal ligament, which is the first tissue affected, is the last to be restored to its normal architecture. (TORABINEJAD & E. WALTON., 2010).

Studies have been carried out with the purpose of testing the properties of several endodontic cements, Soares & César (2001) evaluated the quality of periapical repair, after endodontic treatment of thirty (30) teeth with chronic periapical lesion, in a single session, filled with cement based on zinc oxide and eugenol, which were re-

evaluated clinically and radiographically on a quarterly basis and, at the end of 12 months, 13 (46.4%) were fully repaired and 13 (46.4%) partially repaired and 2 (7 , 2%) had no repair. In this study, it was observed that periapical repair was similar in both dental elements, regardless of the type of endodontic cement.

It is known that the biocompatibility of zinc oxide cements is not favorable, which can lead to tissue damage, this is attributed to the presence of eugenol, considering these factors, the proportion of powder and liquid of the cement is important in its biocompatibility, as well as the more fluid the mixture is, the more intense the inflammation when compared to a thicker mixture. (Leonardo & Leonardo., 2017).

Garrido et al (2006) studied in vivo and evaluated the biocompatibility of endodontic cement endofill, selaer 26, ah plus and cop endo, a better pattern of apical tissue tolerance was found in cope endo and AH plus cements when compared to sealer 26 and endofill. In this study, regression of the periapical lesion was observed in both clinical cases.

Perassi et al (2008) performed a morphological study of the tissue response to four endodontic cements, the cements were implanted in polyethylene tubes in the dorsal subcutaneous tissue of male *Mus musculus albinus* mice. The evaluations were carried out in two experimental periods: 7 and 50 days. After these periods, the animals were killed, the tissue fragments surgically removed and processed using routine histological techniques, the Endofill cements caused moderate inflammatory infiltrate at 7 days, and discreet at 50 days, in the Endofill cement and there was persistence of mild infiltrate. inflammatory with the presence of a thin fibrous capsule and a thin band of amorphous tissue.

Although Endofill contains eugenol, which gives it cytotoxicity, it has a good tolerance for apical and periapical tissues, in the present study it was observed that this characteristic was not able to cause an inappropriate behavior to tissue repair of the element, thus presenting a satisfactory result. regarding the repair of the periapical lesion and the success of endodontic treatment.

As seen radiographically, in figure 1, although with variable sizes, in the period of 2 months of follow-up, there is a rapid tissue repair of elements 8 and 9, but there was no significant difference between the element repair, Sjögren et al., (1997) says that probably the repair seems to be more simplified in the most distant sites of the root apex, thus occurring rapid deposition by involving only bone and

vascular tissue. It is observed that at 8 months of repair, regeneration became different for elements 8 and 9, becoming slower, according to Sjögren et al., (1997) this fact may be due to the process of restructuring the periodontal ligament or the presence of foreign factors such as the filling material, dentin shavings and remaining infection in the apical and peri-apex region. However, it was possible to observe in the 8-month preservation computed tomography (Figure 2) that the regression of the periapical lesion in the elements was similar in both elements. Thus, it is necessary to use more precise complementary exams to evaluate the regression of periapicopathies related to the dental element.

There are several factors that lead to endodontic success or failure, which can be microbial and non-microbial. In order to achieve success, one must pay attention to biomechanical preparation, antiseptic effectiveness, absence of pain, edema, normal periapical bone structure, presence of perfect coronary sealing, correct choice of filling material, correct sealing of root canal systems., overfilling and overextensioning the filling materials towards the peripexix, leading to both physical and chemical aggressions. The fact that is most associated with failure are overfilled canals, teeth with pre-existing periapical lesions and teeth that have not been properly restored after endodontic treatment (PEREIRA JUNIOR, et al., 2010)

Immura (2000) in a study that sought to observe the success factors in endodontics when analyzing 2,000 clinical cases, regarding the periradicular clinical-radiographic state found that 94.6% of treatment success occurred in cases where teeth periapical was normal before endodontic treatment and 84.4% for teeth that had a chronic lesion.

Benatti (2010) evaluated periapical repair in endodontic treatments in which there was leakage of endodontic cement filling Endométhasone, it was observed that in the 7 patients who returned for follow-up, 6 cases had endodontic success, with lesion regression or periapical repair. In the study of these records and the patients who returned, it was noted that there was a reabsorption of the obturator cement in the periapical region in all cases, concluding then that the presence of leakage of obturator cement does not interfere with the failure of endodontic treatment, but rather a technique well executed with adequate restoration of the dental element.

Obtained by various chemical processes, the use of bi ceramics in filling cement has recently been made possible, bioceramics are biocompatible, similar to the

biological process of hydroxyapatite formation and the ability to induce a regenerative response in the human body (LIMA et al., 2017).

Bioceramic cement arrived on the market with the objective of being a biocompatible material to tissues, presenting low cytotoxicity, easy to handle, providing an increase in root resistance, besides not undergoing contraction and being chemically stable, they are easily manipulated, and applied without major complications, working both in repair and in sealing with great efficiency, Merlo (2018) concludes that bioceramic materials have good working properties, with biocompatibility, adequate sealing, short and adjusted setting time, alkaline pH, good ion release ability. calcium and antibacterial activity.

Cardoso & Albuquerque (2019) describe in a clinical case report and treatment of a primary endodontic lesion with periodontal involvement of tooth 46, which had the bio-ceramic cement Bio C Sealer as the filling material of choice, radiographic follow-up was performed after 4 months. treatment and showed significant repair of the periapical region.

Mendes (2019) in a study that sought to evaluate cytotoxicity, bioactivity and cell migration in stem cell culture and bioceramic endodontic cements concludes that of all the materials studied showed cell viability and bioactivity. Sealer Plus BC and MTA Fillapex cements, based on silicate, promoted better cell migration, compared to resin cements based on AH Plus and Sealer Plus which did not achieve wound closure in the study. Sealer Plus BC obtained satisfactory results in viability, cell migration and bioactivity tests.

In this study, it is observed that although all the characteristics of bioceramic cements stand out in relation to those based on zinc oxide and eugenol, it was not a decisive factor for the repair of the lesion of the filled element with the pbs cimmo hp to occur in a more effective when compared to endofill.

V. CONCLUSION

It was possible to conclude, in this case report, that the type of endodontic cement did not interfere in the regression time of the periapical lesion.

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A Review Study- Base Shear Reduction by Using Optimum Size of Beam in Top Floors in Multistoried Building at Different Levels

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Abstract— India is the country where infrastructure is going very fast and also our country fastest emergent economy in the world and infrastructure plays a extremely very important responsibility in it. The Construction of high-rise structure in India is growing day by day. Consequently fresh thoughts and venture are wanted to make the structure secure, financial and durable. The base shear reduction by use of most favorable Size of Beam in Top Floors in Multistoried Building at different level is the one of the . It reduces the dimension of beam at the top floors of the structure to decrease its self-weight.

Keywords— Base Shear, Beam Size, Base Shear Reduction, High Rise Structures.

I. INTRODUCTION

The humankind is emergent more rapidly and the requirement of the world is that the fresh thoughts and technology in area of construction. The multistory building and high rise structure are the today's humankind requirement. To create them secure, safe, long-lasting and suitable it is very desirable to include fresh thoughts of construction in it. The reduction of base shear under seismic loading is the new method. In this method the beam size of the building top floors are reduced which helps to reduce the base shear of the building under seismic loading. It also makes the building economic and reduces the dead load of the building.

Column

Column is the vertical member which helps to transmit load to one end to another. It is prepared with reinforced cement concrete (RCC). Its major benefit is that it refuse to accept compressive load.

Beam

Beam is the Horizontal member which helps to transmit load to slab to column. It is prepared with reinforced cement concrete (RCC). Its major benefit is that it accept tension load.

Shear Wall

It is a member of structure which used to resist lateral forces i.e. wind force, seismic force. In further words,

Shear walls are members to resist the horizontal forces on structures. Shear wall provides strength to the structure.

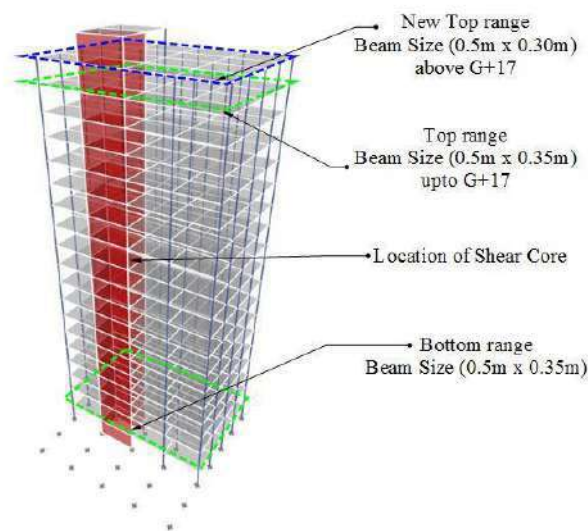


Fig. 1: 3D View of model with various size of beam size at top floor

Multistorey building

When the building has numerous storey's it is known as multistory building. And it contains perpendicular flow in the form of lifts, stairs and ramps. The multistory buildings are the want of today's contemporary world because it carries additional loads and offer extra strength

than solo storey buildings. It reduces the ground use and consequently makes overall expenditure lowest.

Base Shear

Base shear is the sliding force that is generated at the bottom of the building especially due to earthquake forces. Base shear of a building is directly proportional to its weight.

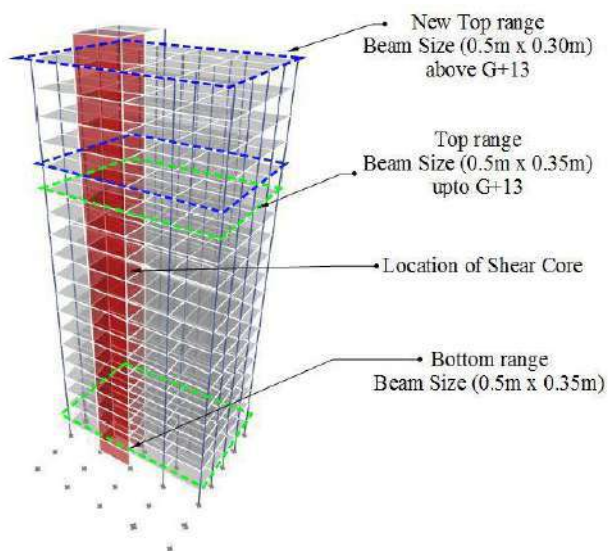


Fig. 2: 3D View of model with various size of beam size at different level of top floor

Above model shows the variation of beam size in the structure. As per the figure shows the high rise structure with shear wall. It is also consider as model for reduction of base shear due to various range of beam size.

II. LITERATURE REVIEW

Wensheng LU et. al.

The paper briefs about the tests of some scaled high-rise multi-tower structure models on the trembling table. By considering the effect of flexible transfer floor in a new analytic model is shown. The test result considers the theoretical dynamic behavior comparison. The combination floors between towers at top levels, and the stiffness of foundation role to structural dynamic behavior is also described in this paper. Many suggestions and theoretical guidelines are also accomplished.

Priyanka Soni et. al.

Research paper study shows Shear walls are structural systems which offer stability to structures from sideways loads similar to wind, seismic loads. Author study about the stability. These structural systems are built by RCC, plywood and timber un-reinforced masonry, reinforced masonry at which these systems are sub separated into

coupled shear walls, shear wall frames, shear panels and staggered walls. Paper examine the shear wall situation also. The current study shows in the paper that attention of studying and analysis of a variety of examine works concerned in development of shear walls and their performance towards tangential loads. As shear walls resist main portion of tangential loads in the lesser portion of the structure and the frame supports the lateral loads in the higher portions of building which is suitable for soft storey high rise building, building which are similar in nature constructed in India, We have also find out the physically calculation of all cases is more time consumable as see in reference paper both physically and software based are calculated but we have completed and obtained results approximately. So used of software is reasonably priced.

Tiwari Darshita et. al.

As per Researcher Concrete is the the majority beyond doubt and crucial matter being utilize in building structure all through the humankind Umpteen variety of concretes were study in numerous laboratories and brought to the ground to go with the exact wants. though, normal fine aggregates (i.e. river sand) are so far and/or will be better to any further matter in manufacture concrete but their accessibility is incessantly being exhausted suitable to the deliberate overexploitation all through the earth due to fast urbanization and manufacture of other facilities. therefore, part substitute of fine aggregate by the other well-matched matter like sintered fly ash, flattened rock dust, quarry dust, glass powder, reused concrete dust and others are being investigate from the precedent twenty years, in vision of conserve the ecological balance. In this direction, an test examination of strong point and toughness was undertake to use "Spent Fire Bricks" (SFB) (i.e. devastate matter from foundry bed and walls; and lining of chimney which is adopt in many industries) and "Glass Powder" for part alternate of fine aggregate in concrete.

N. Anand et. al.

As per paper Self compact concrete (SCC) is a latest age group of concrete that consolidates with no any outside attempt. Due to its compensation over the conventional concrete, the use of of SCC increase gradually. thoughtful of the behavior of SCC is vital in the design of building subjected to prominent heat. A learning was conceded out to recognize the behavior of S.C.C. beams of a variety of grades uncovered to prominent temperature in flexural loading. The beams were uncovered to a temperature of 900_C. The warm sample were refrigerated moreover by water or air. The investigate exertion was conceded out for diverse grades of concrete. It is establish from the outcome that the failure of strength

of SCC beams of superior grades was more than that of the lesser grade SCC beams. It was also established that the decrease in compressive, tensile and flexural strength of the sample depend on kind of warm up and cooling circumstances

C. Marthong et. al.

The Researcher write The consumption of fly ash in RCC or concrete as part substitute of cement is accepting huge significance nowadays, mostly on report of the development in the long-standing toughness of concrete joint with environmental profit. Three grades of OPC specifically: 33, 43 and 53 as classify by BIS are normally utilize in manufacture business. This essay reports a relative learning on effects of concrete property when OPC of changeable grades were partly replace by fly ash. The main changeable investigate in this learning is deviation of fly ash amount of 10% , 20% , 30% and 40% . The compressive strength, durability and shrinkage of concrete were mostly premeditated. Test outcome show that, enclosure of fly ash usually improve the concrete property up to convinced percent of substitute in all grades of OPC.

Aasif Khan et. al.

As author write By reviewing and analyzing above literatures I found that no one have discussed and work on Base Shear Reduction by Using Optimum Size of column in Top Floors of multistorey building. Reducing the column size on the top floor of the building is the new way of reducing cost as well as dead load of the structure. And there are more efforts and work is needed on this top. The base shear reduction by using Optimum Size of column in Top Floors in Multistoried Building under seismic loading is the one of them. It reduces the size of column at the top levels of the building to reduce its self-weight

Aasif Khan et. al.

At the present days the structure are ready with lots of current traditions like tall structure etc and there necessity is satisfied by fresh modernization and latest thoughts. A multiplicity of innovators bounded by them used to build the structure with their own alternative and also the insist of market. The parameter of assessment of consequence such as displacement and storey drift are obtained in fundamentals of the any multistoried structure situated in earthquake Zone-III, earthquake effects are acting on the building under 7 diverse best sizes of column for decrease of base shear. For base shear decrease using the best dimension of column columns with same concrete grade in multistoried building under seismic loading, to study the decrease of base shear and inspect with the alliance of E-Tabs design software. As per proportional outcomes in all

parameters model F and Model G is very efficient in all Models respectively.

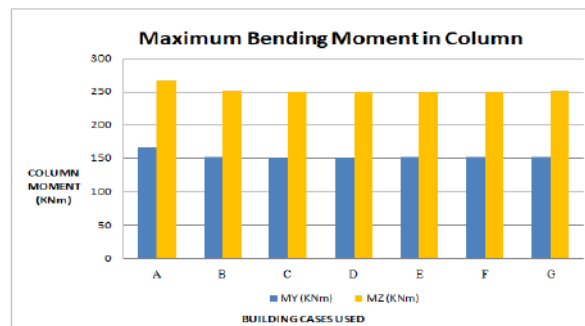


Fig. 3: Maximum Bending Moment in Column

From all the results, we consider the maximum bending moment in column the outcome in all parameters model F and Model G is very efficient in respectively as well as for all model cases.

Mahendra Kumawat et. al.

The researcher state that this study analyses the different parameters of design software model with different grades like stresses displacements base shear etc in longitudinal and transverse direction. After this, the most efficient grading will be analyzed after all parameters. There are total 5 grades of structure multistoried building at medium soil condition under seismic forces for earthquake zone III exist. In this investigate, the parameter of evaluation of result such as displacement and storey drift are obtained in requisites of the twin tower multistoried structure located in earthquake Zone-III, earthquake effects are performing on the construction under 5 different Shapes and scrutinize with the assistant of Staad pro design software. The overall result shows shape Z and U is very efficient cases for twins tower.

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This paper summarizes that it is really important to use analytical methods before construction of multistory buildings in seismic and non-seismic areas. By reviewing all the Papers we can easily understand the importance of analytical methods. We can easily calculate the effect of seismic loading by using the software's like staad pro and E-tabs before construction of multistory buildings. Calculation and modeling is the main purpose of the conclusion The Analysis is carried out for seismic zone III. The structure model are analyzed and compared with different porch location for the seismic zone III as per IS 1893-2016 for response spectrum analysis. The assessment of results is carried out for Displacement, Storey Shear, and Base Shear etc. The results are obtained and

represented in the forms of graphs and tables for the seismic zone. location 1 is very efficient cases for porch in building.

III. CONCLUSION

By reviewing and analyzing various research processes it is seem that in field of base shear reduction by using Optimum Size of Beam in Top Floors in Multistoried Building at different level has many possibilities. It is study that durability depend on the shear reduction. It is required to observe that the structure with various possibilities of Reduction of base shear. By comparing various model in seismic zone and it is observed that it is having high resisting tendency to seismic zone.

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Market-oriented Performance Appraisal Model of Traditional Enterprises with Financial Dilemma —A case study of YL company

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Abstract— Since the 21 century, China’s economic development has entered a new normal, and the driving force of economic development has changed from factor and investment drive to innovation drive. To meet the requirements of the new normal economic development, some complicated traditional enterprises in lines of iron and steel, coal, and aluminum industries, actively promote market-oriented reform, take the market as the guide to reshape the management mechanism, and continuously improve their market adaptability and core competition. YL, the market-oriented performance appraisal mode of the company, we should give full play to the strategic driving role of performance management in the development of the company and lead the traditional enterprises out of the financial predicament as soon as possible.

Keywords— Financial Dilemma, Traditional Enterprise; Market-oriented; Performance Appraisal Model; YL Company.

Under the condition of the market economy, with the acceleration of market information dissemination, the rapid response to market changes has become an important magic weapon for enterprises to win. Some traditional enterprises in lines of the iron and steel, coal, and aluminum industry are integrated with different business sectors, different business models, and different management and control methods [1]. Because of their large scale and complex internal composition, they still can not connect with the market well, so that the benefits are low, and fall into financial difficulties[2-4]. The market-oriented performance appraisal model can promote the internal units to the market, stimulate the internal vitality of the enterprise, realize the win-win situation between the enterprise and the individual, enhance the core competitiveness of the enterprise, and finally realize the goals of overcoming difficulties and transforming and upgrading.

I. YL COMPANY BACKGROUND

YL company was completed and put into production in early 1960. It mainly produces and sells alumina, caustic soda, chlorine gas, cement. After several asset restructuring and divestiture, it has become a listed company with assets of nearly 1 billion yuan. Due to the recession of the whole aluminum industry in recent years, the operating income of the YL company has continued to decline, and the profit of financial statements has shown a loss. According to the goal of turning losses and increasing profits, YL company establishes a market-oriented, whole process evaluation and incentive and restraint mechanism and implements a market-oriented performance appraisal model. A plant is the Major unit of YL company, using alkali-lime sintering alumina production process. In recent years, in the face of intensified market competition, the factory has carried out secondary entrepreneurship, potential tapping, and innovative development, reaching an annual production capacity of about 300000 tons. At

present, the factory is taking the operation transformation as an opportunity to construct a comprehensive management system of 4+X to achieve the vision goal of “continuous optimization of indicators, continuous reduction of costs, the simultaneous growth of enterprise performance and employee income. “ To enhance the competitive strength of enterprises and unremitting efforts.

II. IMPLEMENTATION OF YL COMPANY’S MARKET-ORIENTED PERFORMANCE APPRAISAL MODEL

2.1 Determination of business objectives

(1) Targeting according to market requirements for survival and development

Based on the actual profit of the previous year and referring to the advanced level of the return on assets of the industry, the subsidiary and the simulated subsidiary of the company set challenging business objectives according to the profit caliber at full cost. Production auxiliary service unit, according to its primary income open-source and controllable expenses to determine the profit model and business objectives, as a business entity assessment. The department of the company’s organs, according to the company’s business objectives and measures to get rid of difficulties, decomposes and determines the departmental creation and cost control indicators, critical work, key objectives, critical technical and economic indicators. A factory belongs to the production unit of the YL company. It mainly adopts the combination of market-oriented rules and quota budget control to determine the profit target. The total cost and the corresponding profit target loss before the thermal power unit is put into operation, and the annual operating target of the plant is determined as the break-even under the total cost after the thermal power unit is put into operation.

(2) Accounting caliber, price system in line with the market

Methods of profit accounting for A plant: the profit index is calculated according to the full cost, including the profit under the complete cost of metallurgical grade alumina, aluminum hydronium and non-aluminum products; the raw materials such as aluminum ore, limestone, coal, oil, alkali,

coke and natural gas purchased from outside are settled according to the purchase price; the price of power energy such as electricity, steam and water is settled according to the company’s current cost; the aluminum hydronium for chemical A plant is shared 50% according to the profit difference between aluminum hydronium and metallurgical grade alumina; the loss of production is borne by itself; the rental income of kiln No.8 is recorded in the profit of A plant, and the impact of asset loss is not included in the examination; Monthly share of the company’s expenses of 10,000 yuan, monthly operating expenses according to the actual accounting; roasting, red mud treatment, internal transportation, measurement and other internal related transactions, according to the previous year’s internal price system settlement.

2.2 Principles of performance appraisal

(1) Objective management principles. Draw small accounting units, quantify management goals, undertake responsibility step by step, optimize value chain, excavate potential point, ensure to realize the stage goal of getting rid of difficulties under the condition of break-even under total cost [5]. To each unit and its management team, strictly according to the management goal responsibility letter implements the performance management.

(2) The principle of market orientation. We are taking each unit as the operating entity, determining the operating target according to the market requirements of survival and development, accounting the operating results according to the market price system, measuring the operating performance according to the industry benchmark and market level, and putting each unit in the market environment.

(3) Value incentive principle. Adhere to the benefit-oriented, according to the benefit improvement and profit contribution rewards and penalties, encourage all units to enter the market to create results and strong management to reduce costs and efficiency, encourage employees to achieve personal value in value creation and efficiency [6].

(4) The principle of one factory and one policy. According to the central business characteristics and control methods of each unit, the company strengthens the

combination of total amount control and independent distribution of authorized units.

2.3 Methods and procedures for performance appraisal

(1) Performance appraisal methodology

Performance appraisal is divided into monthly assessment and annual assessment, mainly including unit performance appraisal and middle management individual performance appraisal. (1) Measures for assessing units. First, monthly control measures. Total wages and benefits linked, the annual total wage base is equal to the unit's per capita wage times the year's total control staff. The company, by monthly assessment of the allocation, cumulative control. Monthly profit target, check 6% increase in total wages, and 10% of the increase in total wages, not completed according to the reduction of 10% of the total wages. Each unit, according to profit progress, cost digestion capacity, production and operation situation, reasonable arrangement of the monthly total payment plan, to ensure that the total wage progress and benefit progress match. Second, annual regulation and control measures. To complete the annual business objectives of the unit, the annual per capita wage increase by 10% regulation, profit growth, reported to the company approval can exceed 10, can not be completed by 6% reduction regulation. (2) Performance appraisal for middle managers. First, the primary monthly assessment of total profits, operating cash flow, fundamental economic and technical indicators improvement and management responsibility determine monthly compensation. Second, the primary annual assessment of the completion of business objectives, the completion of business objectives of the unit managers, the implementation of liability mortgage risk incentives, excess profit commission, and other incentives.

A plant failed to meet its profit target in June 2019, Deduct the total salary at 15% of the profit owed. A 10% increase in December profits, Taking 15% of the profits; simultaneously, alumina can be reduced by 6%, Reduce the total cost by 15% of the total incentive wage. Over-achievement of business objectives, Per capita wage growth is regulated by 12 percent. According to the monthly profit target, Determine the basic monthly salary of the factory director, party secretary, and deputy director; the year is awarded 100% of the liability mortgage,

according to the increase of 2% of the amount of reward.

(2) Performance Appraisal Procedures

Each month, each unit in the available, total wages within the total amount of the month to declare the total wage payment plan, each department put forward the results of the unit assessment and its leadership reward and punishment opinions, after the leadership signed, transferred to the human resources department summary. The company holds the performance appraisal meeting, studies, and decides the appraisal assignment result. Each unit reports the monthly assessment results of the middle-level deputy to the human resources department of the company. At the end of the year, the company liquidates the total salary according to the completion of the business objectives of each unit.

2.4 Characteristics of the performance appraisal model

(1) Market-oriented assessment model. According to the control mode of subordinate units and the degree of mercerization, the company vigorously promotes internal market-oriented management [7]. It implements the differentiated assessment mode and methods, such as profit sharing, subsidy dry market-oriented operation, liability risk mortgage, base salary plus commission, etc.

(2) Market accounting system. The company strengthens the management idea of "taking the benefit as the center, taking the market as the direction, "sets up the internal settlement center, establishes the internal market price system, implements the company, the subordinate unit, the workshop, the shift group four-level market operation accounting method, establishes the budget product price sharing (bear) mechanism.

(3) Market dynamic adjustment mechanism. To improve the market-oriented consciousness of the unit, the company introduces the market performance concept, implements the linkage between the budget target and the market price, and adjusts and optimizes the organization performance appraisal caliber and the way according to the control mode, the market environment, and the production and operation change, so that the performance appraisal result can be effectively connected with the market.

(4) Market-oriented distribution mechanism. The company implements the overall budget management,

decomposes the overall budget target step by step to the main market body at all levels, takes the internal market main body as the accounting point, takes the internal market settlement as the link, achieves the budget management in the timely calculation, the standard management system calculation, Performance management everyone, achieve independent management.

III. LIMITATIONS OF THE MODEL AND SUGGESTIONS FOR IMPROVEMENT

3.1 Limitations

YL company’s market-oriented performance appraisal model has the characteristics of market, goal, win-win, and flexibility, and has achieved excellent results in practical application, but there are still some limitations. It is mainly manifested in three aspects:

First, The level of assessment is not comprehensive. Grass-roots employees are the most basic units of the organization, and the personal will, degree of effort, and execution of employees play an irreplaceable role in the implementation of the market-oriented performance model of enterprises. The company pays more attention to the assessment of units and middle-level managers, and the individual assessment of grass-roots employees is not specific.

Second, the performance appraisal index system is not

perfect. The performance index is the basis and foundation of performance appraisal related to whether the company’s strategic objectives can be implemented in place. The company’s performance indicators are relatively single, and index design is not reasonable.

Third, the organizational security system is not perfect. An excellent organizational security system can promote the implementation of performance goals and improve the efficiency and efficiency of performance appraisal. The company’s current organizational security system is not perfect; communication is not a smooth phenomenon.

3.2 Suggestions for improvement

Enterprises should carry out market-oriented, benefit-centered, and 5 S lean management as the concept to build a full-staff performance management system. The system includes:

First is the implementation of full-staff assessment. In addition to assessing organizational performance, three levels can be set up for personnel assessment, including senior management performance appraisal, middle management performance appraisal, and employee post-performance appraisal, and different assessment benchmarks can be set according to the characteristics and requirements of different levels, such as linking senior management with an annual salary, adopting target responsibility assessment.

Table 1: Type of organizational performance appraisal model

Type of unit	Control Mode	Assessment Mode
Holding subsidiary	Investment management	A term assessment for determining profit targets based on investment profit margins
Subordinate factories and mines	Operational control	Set the operating target based on quota for budget assessment
Auxiliary production units	Asset management	Determine profit target by market + fixed budget
Logistics and other services	Subsidized dry market operation	Fixed allowance for depreciation of non-operating assets, decreasing year by year
Corporate Headquarters		Assessment of the achievement and performance of execution objectives

Table 2 Key performance appraisal indicators for managers

Indicator categories	Indicator name	Target value	Assessment criteria
Resource development	Rate of achievement of new reserves	Completed reserves of newly developed aluminum resources of 400,000 tons	Annual liability
Asset size	The growth rate of total assets	≥5%	Annual liability
Work volume	Output completion rate	100% actual rate of aluminum production	Failure to complete the deduction in proportion to the difference

Table 3 Performance Appraisal Indicators

Evaluation indicators	Indicator values	Rating criteria
Talent recruitment	High-end recruitment	4 points outstanding
	Recruitment of university students	Failure to complete deduction of 2 points per person, 4% deduction over budget
	New Project Talent Deployment	Failure to complete deduction of 2 points per person
Professional technical management	Selection and organization of chief engineers and experts	Incomplete deduction of 4 points, not in place deduction of 2 points
	Do an excellent job of all kinds of professional titles evaluation and recruitment work	Failure to complete deduction of 2 points per person
	Implementation of the treatment, housing.	4 points outstanding

Second, set up a two-dimensional performance index system. The vertical performance index system can be divided into four levels: company, unit, department, and individual, and each layer can adopt a different horizontal performance index system. Different posts and different index values and scoring standards are set up for individual post performance appraisal index system.

Third, construct the whole process organization safeguard system. Set up a performance management committee and be fully responsible for company performance management. The committee has an office responsible for

the daily work of the company's organizational performance, with the cooperation of relevant functional departments. The same is true of all subordinate enterprises and units. Simultaneously, the operation mechanism of information feedback is established to maintain efficient communication of vertical and horizontal information, to promote the effective implementation of performance appraisal indicators.

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The use of theory of problematization in the preparation of an intervention plan in a riverside community in the state of Para: Experience report

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Abstract— Objective: to report the experience of using problematization theory in the elaboration of an intervention plan in a riverside community in the state of Para about sexually transmitted infections. Method: This is a descriptive study, the story kind of experience, realized by nursing an

academic institution of higher education private in the city of Belem do Para/Brazil. The action was carried out in a riverside community on the island of Cotijuba in that city on July 20, 2020. Around 200 riverside dwellers participated in the action, including men, women, children, adults and the elderly. It was used as a methodology the Arch of Charles Maguerez, obeying the five stages of the Arch, namely: I- Identification of the Problem, II- Key Point, III- Theorization, IV- hypothesis and V- application / intervention in reality. Situational strategic planning was used to support the development of the intervention plan, which was developed based on the planning cycle, which is composed of four stages: explanatory moment, normative moment, strategic moment and tactical-operational moment. Results: The riverside community was receptive to the proposed methodology; the population held little knowledge on the subject; the need to integrate the community and find a support network for STI prevention was evident; The action provided the graduates with the possibility of a more complete training. Conclusion: The community in which it intervened, benefited from the actions and services carried out, given that there was participation and attachment during the entire process of action, contributing to the strengthening of a line of care, integral and resolute.

Keywords— Health, Health Education, Nursing, Vulnerable Populations, Sexually Transmitted Diseases.

I. INTRODUCTION

It is known that in recent years, public policies have led to several complex compliance initiatives, involving various causes, social processes that are not linear, systems with open mechanisms with uncertain, contingent designs and with several unforeseen events. In this sense, its implementation is influenced by the complexity of the initiatives in recognizing that there are several dynamics at the institutional and community level that define each context, in addition to requiring different resources to reach specific targets [1].

It is noteworthy that the management of health services is a complex process due to the magnitude of the actions to be developed so that they are indeed effective, given that there is a great deal of bureaucracy in trying to reconcile the different individual, corporate and collective interests. Furthermore, Brazil is formed by a vast decentralized and unequal territory, with singularities and specificities and that, for this reason, undergo different management processes. [2].

Nesse In this context, due to the geographic extension of Brazil, there are people living in urban areas, people living on the banks of rivers, the so-called riverside communities. This term is used to distinguish people who typically live on the banks of rivers. These peoples, despite living close to the big cities, have a specific culture and very different ways of life, where rivers are the main means of access and interaction between these peoples [3].

It is noteworthy that the health care of riverside peoples is established by the National Policy for Primary Care, which was instituted in the country through Ordinances MS / GM No. 2,488 and 2,490 of 2011, which implement

and operationalize the actions and health services, as well as defines the financial values of transfer to the Health Teams of Riverside Families and the cost of Basic Fluvial Health Units that are responsible for promoting health to this population [4].

In this perspective, the riverside communities that hold traditional peoples and often vulnerable to this reality, still marginalized, suffer from the fragility of health actions and services provided by the inconsistencies of public health policies, which, added to the difficulty of access and lack of professionals willing to act in the prevention, promotion and rehabilitation of the health of riverside residents and who are trained to deal with the demands of this population, end up not enjoying the rights related to health that are inalienable and mandated by law [5].

Considered as a serious public health problem, Sexually Transmitted Infections (STIs) reach worrying levels due to the large proportions they reach; vulnerability to STIs, such as the difficulty of preventing early diagnosis and barriers related to the difficulty of access to treatment, corroborates the increase in the number of cases of infected people and which contribute to the worsening of the health situation [6].

The “HIV / AIDS Epidemiological Bulletin”, from the Department of Diseases of Chronic Conditions and Sexually Transmitted Infections, from the Health Surveillance Secretariat, from the Ministry of Health, in 2018, when analyzing mortality by Federation Unit, O Para it is among the ten states that presented a coefficient higher than the national (4.4 deaths per 100,000 inhabitants) with an index of 7.6 [7].

The aforementioned bulletin also points out that there was an increase in the standardized mortality rate for AIDS between the years 2008 and 2018 and Para is among the ten Federation Unit that present this situation. According to the index composed of indicators of detection rates, mortality and first CD4 count in the last five years, the State of Para is in third place. In relation to the capitals, the city of Belem occupies one of the five highest positions in the ranking and among the municipalities with 100,000 inhabitants or more, of the first 20 belong to Para [7].

Thus, this research is justified by the vulnerability of people bordering STIs, as it is related to the low level of knowledge and the lack of information of these people in relation to the disease. It is noted that this vulnerability is related to three areas: individual, social and programmatic. Individual vulnerability is linked to information, especially when that information is not incorporated into individual actions aimed at prevention. Social issues are related to access to information or access to health and education services that can aggravate the process of vulnerability to AIDS, for example. Programmatic vulnerability is related to the capacity of institutions such as family, school, health services and the community to institute effective policies for the control and prevention of STIs.

The aim of this study is to report the experience of using problematization theory in the elaboration of an intervention plan in a riverside community in the state of Para.

II. METHODS

This is a descriptive study, an experience report, carried out by nursing students from a private Higher Education Institution located in the city of Belem do Para / Brazil. The action was carried out in a riverside community on Cotijuba Island in that city, far from urban centers on July 20, 2020. Around 200 riverside dwellers participated in the action, including men, women, children, adults and the elderly. The Arch of Charles Maguerez was used as a methodology to promote the success of the action, considered an active methodology that allows the planned realization of care. In order for the action to be faithful to what was proposed by the Theory of Problematization described by the Arch of Charles Maguerez, the five stages of the Arch were obeyed, namely: I- Identification of the Problem, II- Key Point, III- Theorization, IV- hypothesis and V- application / intervention in reality. Furthermore, when using this Theory of Problematization, its premises were chosen to provide support and guidance to the educational practice carried out. Thus, in the first

stage, in which the problem had been identified, on March 13, 2020, a technical visit was made to that island, with the riverside community, in order to approach the various local entities, such as families, managers and local support networks to raise, identify and outline which are the most relevant health problems and weaknesses perceived by the community, in order to enable the design of actions to be developed through the theme raised. In the second stage, in which the key point to be explored and worked out, after the technical visit at the action site, the importance of developing activities aimed at prevention and treatment related to STIs was defined, given that this was a critical point reported by all participating entities during the visit to the community, considered as a real and potential problem within the riverside dwellers. Continuing, in the third stage of the arch, in the theorizing phase of the problem encountered, for two months there was theoretical immersion, investigation through gray literature, scientific articles, videos, research and conversations with specialists in order to develop a teaching- learning that privileged the construction of knowledge among the entire riverside population and that served each audience in a specific way. In the fourth stage proposed by Charles Maguerez, the hypotheses were realized, for which intervention strategies were developed in order to solve the problems identified, finally, in the fifth and last stage, the application was made in reality, where academics returned to the community, provided with an intervention assistance plan to develop with the riverside dwellers, the explanatory problem tree and the strategic situational planning were used to support the development of the intervention plan (FIGURE 1), which was developed based on the planning cycle that consists of four stages, namely: explanatory moment, normative moment, strategic moment and tactical-operational moment. An activity based on play was carried out, given the low level of education identified among the community and for this strategy to provide the acquisition of knowledge in an interactive and participatory way. In a simple and dynamic way, theorizing about the theme occurred, addressing the STI theme, highlighting the disease, prevention and treatment measures.

III. RESULTS AND DISCUSSION

Table 1: Description of the Central Problem, Root of the problem and consequences.

CENTRAL PROBLEMS	PROBLEM ROOT	CONSEQUENCES
High rate of HIV- AIDS infection in	- Sex tourism - Low level of	- Dissemination of the disease in the

<i>the state of Para and the vulnerability of the traditional people of the riverside community.</i>	<i>health literacy on sex and sexuality</i> - <i>Difficulty in accessing health services in the region</i> - <i>Promiscuity</i> - <i>Unprotected sexual intercourse</i> - <i>Incest</i> - <i>Sexual abuse</i>	<i>riverside region</i> - <i>Deaths related to the disease</i> - <i>Subjectivity in disease notification data</i> - <i>Diagnosis and late treatment;</i> - <i>Low level of reach for infected people;</i>
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The riverside community was very receptive to the proposed methodology, contributing positively to the implementation of the action; in addition to providing an exchange of knowledge with the facilitators, they also demonstrated a real interest in acquiring more information about the topic addressed.

It is observed that the use of active teaching methodologies allows the construction of a critical-reflective education, favoring the teaching-learning process, building an interpersonal relationship between the facilitator and the student in the firmament of knowledge. Education is based on a problematized point and provides the act of self-learning, in order to face the problem situation based on meaningful learning [9].

For this, in the IV stage of Arch de Maguerez, we sought to develop health education activities based on active teaching-learning methodologies in order to raise their awareness of the importance of early diagnosis, prevention and treatment of STIs.

It is revealed that for health promotion to be effective, it should not be restricted to the mechanistic activity of practice, but, above all, to occur with the instrumentalization of health education, which requires more than understanding the theme and of concepts; it is necessary to make the interrelation between the acquired knowledge and the communication and the accessible transfer of information seeking to qualify education [10].

However, during the V stage, it was found that the riverside residents had little knowledge about the theme, as identified in stage I of the Arch; however, they were shown to be participative in the proposed activities.

It is inferred that limited knowledge and insufficient health literacy demonstrate greater difficulties with a given treatment, in addition to the evident low adherence to the proposed treatment and the therapeutic regimen, low

understanding of the potential risks and health problems, low ability to perform self-care with prevention, control and treatment measures with a consequent worsening of the general health status, which can even lead to death [11].

The need to integrate into the community and find a support network was highlighted in order to elucidate the importance of the discussion on sexual health and STI prevention.

It corroborates with the results above by emphasizing that the territory has a particular history, environment, economic and social relationship that are unique in the relationship between health and disease production. For this, it is extremely important to analyze the health situation with the participation of different authors present in the community in the construction of an epidemiological diagnosis, to identify living conditions, health demands as well as factors that increase risks and those that are potentially favorable to minimize them [12].

The action provided the students with the possibility of a more complete education, based on a moral education, which makes the student understand the responsibility of doing that his profession presupposes, in a critical and reflexive way, with the opportunity to gain autonomy in face of reality of the society in which they live.

It appears that in problem-based learning, the student is encouraged to develop skills and abilities to resolve issues, based on research and by learning by doing. A problem close to the real is brought before the student, planned in a safe and simulated environment, to prepare and enable the student to perform better in his professional life [13].

It is also noted that the use of the Charles Maguerez Arch in the teaching process is effective in arousing the student's curiosity and skills. The Ministry of Health highlights the use of active Methodology to provide professional training that are rooted in the models of care, in the perspective of bringing these measures to the curriculum structure, thus demonstrating positive results in the autonomy and training of students [14], [15].

The use of Strategic Situational Planning was also very important for the effectiveness of the intervention and user satisfaction. The use of this instrument has an enormous potential to act on complex problems and can be used as a management tool that involves the implementation of teaching-service processes, considering that it involves multiple facets to better evaluate acting on problems, based on a participatory and interactive process between all the actors involved in the provision of services [16].

IV. CONCLUSION

It was noticed that health education with the use of active methodologies, facilitates the understanding of the participants on the theme, in addition to guiding the formation of a humanist, critical and reflective professional who is in fact qualified for the exercise of the profession, who he is able to know and intervene in problem situations. It is also noted that the full participation of the student occurs in the exercise of learning by doing, motivated and guided by the teacher. The use of problematization theory in the teaching-learning process functioned as a didactic strategy for enabling the achievement of goals, through planning and acting on a studied key point.

The developed learning process enhanced the competences and skills of the students, given that the use of problematization caused a disquiet in the students, mediated by the teacher, through a problem situation created in a safe, realistic environment, where mistakes can still be made and which seeks reproduce reality faithfully.

The community in which it intervened, through actions that outlined and systematized by an active methodology created on top of a problem, benefited from the actions and services performed, given that there was participation and linkage of the community throughout the action process contributing to strengthen a line of care, integral and resolute.

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Analysis of the Management of disposal of Antibiotics in Health Units in Amazonas

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Abstract— *The residues generated by the disposal of medicines are present, both in the terrestrial and in the aquatic environment, generating impacts, from the morphological alteration of fish to the appearance of bacteria super-resistant to antibiotics. In view of the social scenario, it is essential to implement an environmental education, through the adoption of public actions aimed at preserving the environment. In this work, the environmental impacts of drug disposal will be analyzed with the pharmacy and nursing professionals registered with the regional councils: Regional Pharmacy Council (CRF - AM) and Regional Nursing Council (COREN - AM), in December 2018 a January 2019. A survey carried out among the types of drugs most consumed and discarded by pharmacists and nurses registered with CRF - AM and COREN - AM. The effect of making the population aware of the disposal of medicines by pharmacists and nurses registered with their respective regional councils was evaluated in order to propose the environmental impact generated by the disposal of medicines in the environment. Finally, the socio-demographic profile of pharmacists and nurses registered with CRF - AM and COREN-AM was evaluated through interview questionnaire form.*

Keywords— *Disposal of Medicines; Disposal – Environment; Environmental Education, Environmental health.*

I. INTRODUCTION

The presence of drugs in the environment is an emerging problem with regard to environmental impacts, as they compromise water quality, fauna, aquatic species and public health (Hubbard, 2007). Although advances in the field of drug discovery and chemical production of substances that make it possible to advance in the fight against various pathologies, few studies are published on the action of drugs in contact with the environment, and on the potential damage to public health. Studies by Ternesa et al (1999) in Germany, Canada and Brazil have shown that drug residues such as natural estrogen and estradiol are present in domestic sewage and its effluents from treatment and sewage plants (TEE). Impacts from the presence of estrogen in the aquatic environment were described by Sumpter (1998) in the finding of the feminization of male fish exposed to these effluents.

According to the Federal Pharmaceutical Council

(2010), Brazil ranks among the ten countries that most consume medicines in the world, with the finding that there is a pharmacy (or drugstore) for every 3,300 (three thousand and three hundred) inhabitants.

This scenario is worrisome when trying to understand the demand and supply, the relationship of consumption and disposal, a counterpoint, when considering that medicines are pharmaceutical substances technically obtained and elaborated for prophylactic purposes, in which pharmaceutical supplies and their correlates are regulated and previously established in the provisions of Law No. 5,991/73 by the National Health Surveillance Agency - ANVISA.

In the midst of so many changes in the health and disease process, a new conception is needed for professionals working in the health field, that new skills and capacities are developed to ensure the development of policies that support the government, society and health,

WHO (2016), such attitudes are foundations for actions that stimulate health promotion, that defend health at its different levels and, mainly, that health professionals are more involved in its promotion.

In view of the need to adopt more sustainable measures in daily life and which mainly aim to reduce the impacts on the environment, waste, whatever its origin, are the main targets of these concerns as they are by-products of contemporary life, highly consumerist and source of nature modification. Then, the concern arose as to the most correct destination for the disposal of medicines, since these are present in our daily lives. Faced with such questioning, the following questions emerge: “would these drugs, when disposed of incorrectly, cause damage to the environment?” and, “which public could disseminate measures that promote the disposal of correct medicines?”.

In Brazil, the regulation of medicines is carried out by the National Drug Policy, whose purpose is “to guarantee the necessary safety, efficacy and quality of medicines, the promotion of rational use and the population's access to those considered essential” (BRASIL, 2001, p. 9).

According to Melo et al. (2012, p. 2) antimicrobials can be defined as “substances that have the ability to inhibit growth and / or destroy microorganisms. They can be produced by bacteria, by fungi, and they can be totally or partially synthetic”. This class of drugs was discovered in 1982 by Alexander Fleming who found that the compound penicillin produced by fungi was able to inhibit bacterial growth. We also add that penicillin was the first type of antibiotic discovered by accident, being a bactericidal substance most used and recognized worldwide for years, Guimarães et al. (2010, p. 05).

Over the years, penicillin has been the subject of studies and contributed to the development of a series of drugs with bactericidal and bacteriostatic capacity, (MELO et al., 2012).

According to Guimarães *et al.*, (2010) there are several types, but for the purposes of understanding antibiotics, it is important to separate them into gram-positive, which dye color when exposed to violet crystal, and gram-negative, which dye red, this information is determinant for choosing the appropriate treatment. According to the same authors, there are several types of antibiotics, which are indicated according to the infection and the affected area, since there is an immense variety of these beings in nature.

The use of antibiotics has revolutionized healthcare, saving lives and preventing serious health complications, but overuse has serious adverse effects that can be reversible, debilitating or fatal to the health of people and communities. As an example, the harmful effects of a

person's healthy flora can be cited, resulting in opportunistic bacterial infections such as *Clostridium difficile*, which can be fatal.

The main concerns are the bacterial resistance this time to the choice of the medication will not have the desired clinical effect. Due to the overuse of antibiotics, resistant microorganisms entered the public's radar, posing a serious threat to the health of the population. Consequently, in May 2015, the World Health Organization endorsed a global action plan to combat this problem, with specific emphasis on antibiotic resistance (STEIN, *et al.*, 2018).

Antibiotic therapy has brought the most revolutionary change in the history of medicine to the field of infectious diseases. Over the years, due to negligence regarding the use of antimicrobials or at random, some bacteria have become resistant to the action of several antibiotics, especially vancomycin, which is considered the most potent. The most worrying microorganism in this respect is *Staphylococcus Aureus*, which has been resistant to several types of antimicrobials.

Another concern is with the group of antibiotics, according to Carvalho et al. (2009, p. 06), for their potential in promoting the development of bacterial resistance, and for being used in large quantities. A survey conducted in the United States, cited by Carvalho et al. (2009, p. 06), published in 2008 confirms that about 41 million American citizens from 24 metropolitan areas receive drinking water contaminated by a variety of pharmaceutical products, including antibiotics, which can enrich the environment with resistant bacteria capable of infecting man.

According to Storel *et al.*, (2014, p 33) Inadequate disposal is done by most people due to the lack of information and disclosure about the damage caused by medicines to the environment and the lack of collection points. To this end, the lack of information causes people to discard these drugs in the common garbage or in toilets, but according to Hope (2011), the Brazilian sewage system is not prepared to adequately treat toxic waste from medicines in the country. home environment. The classification of solid waste generated in health establishments is based mainly on nature and associated risks, as well as on the criteria established by the Ministry of Health.

Any material from the health facility should be considered waste from the moment it is rejected, because its usefulness or clinical management is considered complete and only then can you start talking about waste that has an associated risk.

Hospital Solid Waste is waste from health care activities, research in establishments such as hospitals,

clinics, gas stations, laboratories and others.

For Hope (2011, p. 23), the different types of industries, such as medicines, are great agents that cause environmental impact, in which they present different degrees of consumption of natural resources and also release pollutants, as industries often use techniques inadequate resources that help to degrade natural resources and threaten the life of the planet.

Hope (2011), the rational use of medicines is not an isolated attitude, but a joint action that should be exercised with the participation of patients, families, health professionals, legislators, public policy makers, industry, commerce and government policies, each adequately exercising the functions of its competence in the global process.

According to Storel et.al (2014), medicines are essential for maintaining the health of the population, however, the media gives a great incentive to excessive consumption of medicines and this increases the accumulation of unused medicines in homes. this, the subject of this research is the analysis of the management of antibiotic disposal in health units in Amazonas.

II. MATERIALS AND METHODS

This research involves standardized techniques of data collection, questionnaires and observation, when carrying out surveys identifying the most used drugs, most consumed types, etc.

In this sense, this study adopted the descriptive model in which the facts are observed and recorded, classified, without interference from the researcher, involving the use of standardized techniques for data collection such as questionnaires, Pardanov and Freitas (2013).

In order to obtain information for data analysis, questionnaires were applied, which corroborate with that described by Cano (2012) where the strategies adopted for the production of scientific knowledge are based on the interest of the generation and validation of theories.

Cross-sectional studies are recommended when the objective is to study the frequency and associated factors of a given health event that manifests itself in a given population. It can be said that they are ideas to answer the following questions: "What are the frequencies of the risk factors and the outcome under study?". "Is there an association between the risk factor and the outcome in question?" (BASTOS AND DUQUIA, 2007).

In the first stage of this work, contact was made with the Regional Councils in order to present the research objectives and obtain authorization for its development. In

the second stage, the questionnaire was applied to the CRF-AM and COREN-AM, with the professionals duly enrolled in these. advice, to gather data on knowledge regarding the disposal of medicines in the environment, environmental education, and public health.

The third stage of the research consisted of analyzing the data and proposing measures to reduce the environmental impact generated by the disposal of medicines in the environment as forms of environmental education and promotion of public health.

The population that was studied is made up of professionals from the pharmacy and nursing fields, registered in their respective CRF – AM and COREN-AM.

Vieira (2011) defines population or universe as the set of units about which information is sought. Sample is any subset of units taken from a population to obtain the desired information.

Of this, the equation to determine the sample size (n) based on the estimate of the population proportion, as will be described in Equation 1 below, "Z" is the equivalence rate of the 95% confidence interval, which is 1,96, "e" is the sample error, which is 5%, "p" is the proportion of individuals in the population to be studied, which is 80%, while "q" is the proportion of the population that will not be studied, corresponds to 20%. Then we will have the proportion of 80% and 20% having as reference a homogeneous population, as they are professionals in Nursing and Pharmacy.

Equation 1 - Equation for sample calculation based on the estimation of the population proportion

$$n = \frac{Z^2 \cdot p \cdot q \cdot N}{e^2 \cdot (N - 1) + Z^2 \cdot p \cdot q}$$

Source: Falco, 2008

Thus, applying Equation 2 to COREN –AM:

$$n = \frac{1,96^2 \cdot 0,8 \cdot 0,2 \cdot 9,050}{0,05^2 \cdot (9,050 - 1) + 1,96^2 \cdot 0,8 \cdot 0,2}$$

$$n = 240$$

Equally applying Equation 3 to C. R. F - AM:

$$n = \frac{1,96^2 \cdot 0,8 \cdot 0,2 \cdot 5,696}{0,05^2 \cdot (5,696 - 1) + 1,96^2 \cdot 0,8 \cdot 0,2}$$

$$n = 236$$

The result of this sample calculation for the one studied at the Regional Pharmacy Council comprised 236 (two hundred and thirty-six) professionals and the Regional Nursing Council 240 (two hundred and forty)

professionals. Based on this equation, the number of questionnaires needed for the research was obtained from the respective councils. The data above were obtained from COREN - AM and CRF - AM.

The process of data collection used was the online questionnaire, self-applicable, objective questions and with the purpose of investigating the disposal of medicines, environmental education and the damage to public health with the Pharmacists and Nurses. The Web Survey questionnaire was made available on the Survey Monkey virtual platform. Data were collected from December 2018 to January 2019.

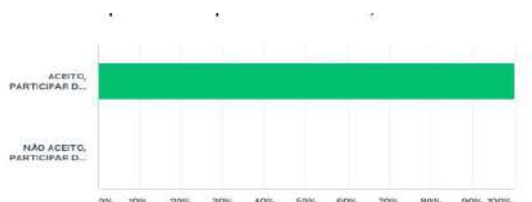
The inclusion criteria adopted in the research consisted of individuals of both sexes, aged eighteen or over; be enrolled in the Regional Pharmacy and Nursing Councils as a professional with a college degree and be working in the profession. Furthermore, it was necessary that he / she accepted to participate in the research, voluntarily and anonymously, signing the Informed Consent Form (ICF) on the study, before starting the questionnaire. Participants who did not meet the above criteria were excluded from the survey.

III. RESULTS

Among the profile of these professionals interviewed, we have professionals aged mostly between 35-45 years old, female, with single marital status and who have a higher level of education, specialization and who exercise their profession mostly in private institutions. It is important to note that all respondents accepted to participate voluntarily in the research.

For the composition of the sample of this research, the participants should agree to voluntarily grant their data in order to make possible the ethical procedures and to proceed with the collection of information. The graph below shows 100% of the acceptance of the participants who composed the sample of this research.

Graph 1 - Acceptance of participation in the research



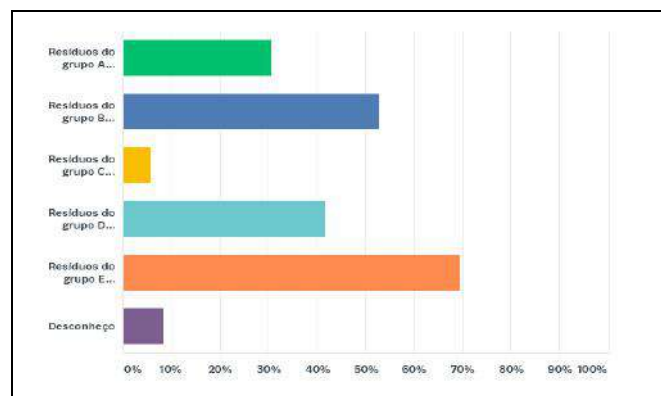
Source: Own authorship (2020)

After acceptance and due completion of the free and informed consent term, specific questions regarding the

composition of this research were applied. When questioned about age, most respondents were in the 31 to 45 age group, covering more than 70% of the participants, followed by the 18 to 30 age group with approximately 20%, as shown in the graph above.

When asked about the waste generated in their work environment, considering a sample composed of nurses, the graph below was obtained.

Graph 2 - Waste for hazardous work



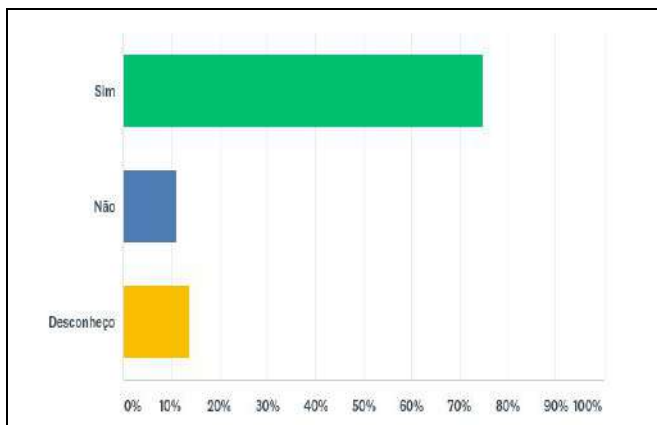
Source: Own authorship (2020)

These data point to a large amount of waste in group E (around 70%) and group B (over 50%) that refer to sharp cutting hospital materials with potential damage to health and chemicals that need special disposal, respectively. Residues in groups D and A also present significant portions of disposal (around 30-40%) which are equivalent to household and infectious ones, respectively, the latter needing special treatment for disposal.

According to Almeida *et al.*, (2016) a considerable portion of waste, including hazardous waste, is disposed of inappropriately, allowing contamination of the environment and resulting in risks to the population. According to the authors, the presence of drugs in the common garbage, although in a smaller amount than the other routes, also needs attention. These inputs are sent to landfills where they can come into contact with the population working in these places, as well as contaminate the soil.

The waste management plan in health services is essential to minimize the effects on the environment. When asked about the existence of this type of planning in the workplace, most participants (more than 70%) responded that there is a plan, as shown in the graph below. Professionals report that despite the large number of waste, there is, however, a waste management plan.

Graph 3 - Existence of a waste management plan in the workplace.

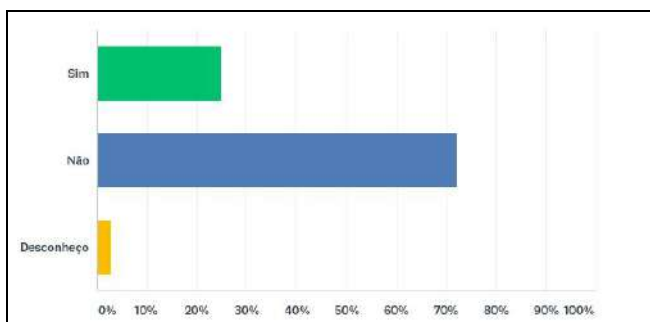


Source: Own authorship (2020)

It is interesting to note that a large portion of the interviewees reported that they were unaware of the procedures for separating waste according to dangerousness, adding up to around 15%.

Regarding training for the disposal of medicines, around 70% of respondents reported not having received any form of training or basic training for proper disposal, compared to 25% of respondents who said they had guidance for this, as shown in the graph below.

Graph 4 - Drug disposal training



Source: Own authorship (2020)

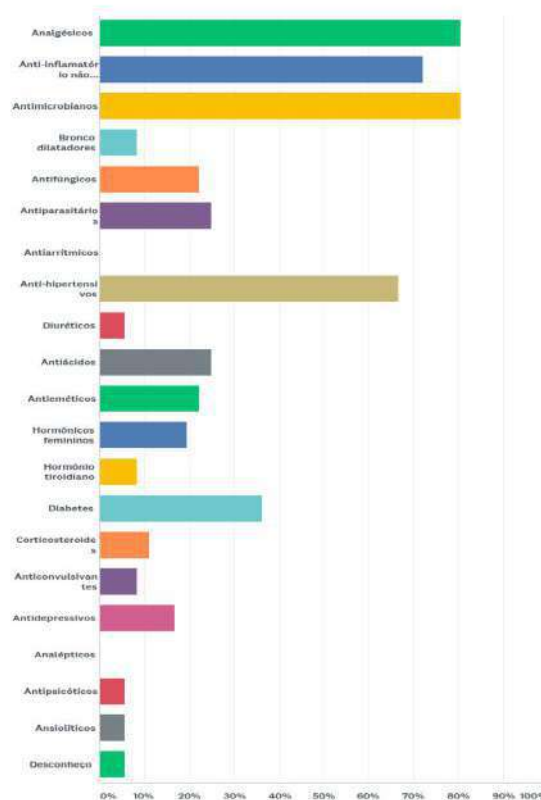
It is interesting to note that a large portion of the interviewees reported that they were unaware of the procedures for separating waste according to dangerousness, adding up to around 15%.

Regarding training for the disposal of medicines, around 70% of respondents reported not having received any form of course or basic training for proper disposal, compared to 25% of participants who said they had guidance for this.

Regarding the class of drugs most used in the workplace and separated for disposal by the interviewee, a large

amount of analgesics (80%), antimicrobials (80%), anti-inflammatory drugs (70%) and antihypertensive drugs (60%), which are the most used drugs in hospital settings. Antiarrhythmics and antiepileptics were not mentioned in the respondents' responses (Graph 5).

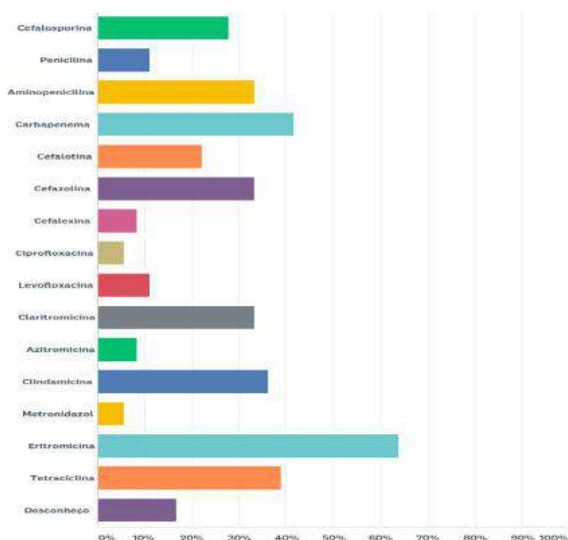
Graph 5 - Most consumed medications in the work environment



Source: Own authorship (2020)

With a focus on the antimicrobial classes, it was pointed out that erythromycin (64%), carbapenema (42%), tetracycline (38%), clindamycin (36%), aminopenicillin (32%), clarithromycin (32%) and cefazolin (32%) are the classes of antibiotics least consumed in hospital environments, as shown in the graph below.

Graph 6 - Antibiotics least consumed in hospitals

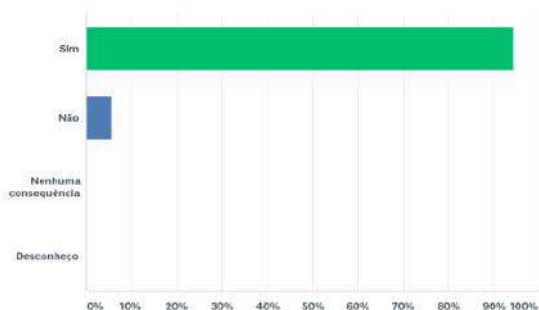


Source: Own authorship (2020)

These findings corroborate those shown by Guerra et al. (2020) when stating that Cefepime, piperacycline, meropenem, tazobactam and vancomycin are the most widely used antibiotics in the hospital environment, whereas erythromycin, carbapenema, tetracycline, clindamycin, aminopenicillin, clarithromycin and cefazoline are the least consumed and therefore generate smaller amounts of solid waste.

Participants were asked about their opinion on the possibility of inappropriate drug disposal causing damage to the environment. The vast majority (around 94%, stated that there is a possibility of improper disposal generating damage to the environment, as shown in the graph below.

Graph 7 - Disposal of medicines and damage to the environment

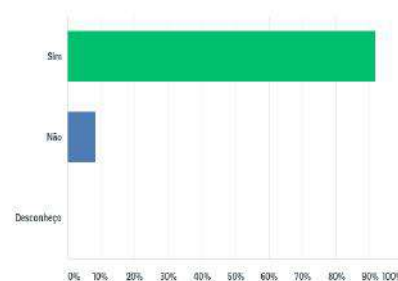


Source: Own authorship (2020)

Regarding the improper disposal of medicines, with the disposal of household waste and damage to public health,

the vast majority of respondents (92%) stated that there is an important and dangerous correlation, as noted below.

Graph 8 - Disposal of medicines and damage to public health

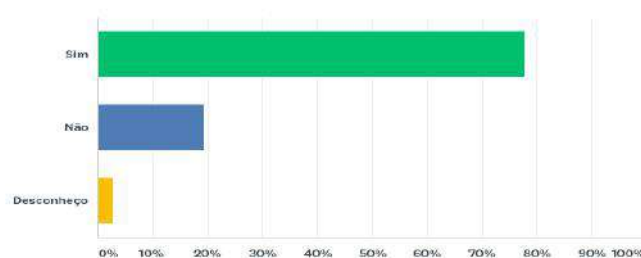


Source: Own authorship (2020)

The lack of training for the correct disposal of medicines can result in serious damage to the environment. According to the data presented, most of the professionals who perform the disposal do not have training, but they do it in the same way. One of the main damages to the environment was demonstrated by Al-Maadhed et al. (2019) by pointing out the presence of several types of antibiotics commonly used in hospitals in Qatar in effluents close to these places or even landfills. These authors also demonstrated how the removal of these antibiotics from water is complicated and, in the case of gentamicin, practically impossible.

Regarding the relationship between the inappropriate disposal of drugs and the appearance of super resistant bacteria, the majority of respondents (78%) stated that there was a positive relationship in their respective opinions. However, in relation to the proportions of responses in the previous questions, a small but significant group of respondents (approximately 20%) stated that they did not see this correlation, as shown in the graph below.

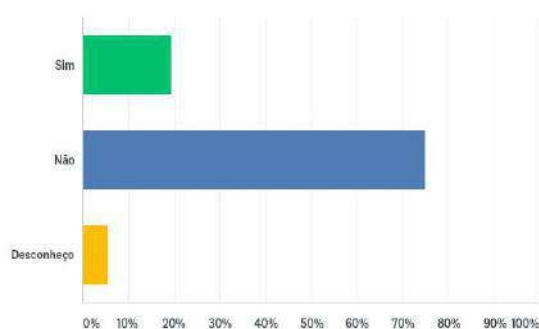
Graph 9 - Disposal of antibiotics and super resistant bacteria



Source: Own authorship (2020)

In this sense, the study by Irshad *et al.*, (2019) pointed out that there is a strong correlation between the increase in resistance and microbial pollution due to the inappropriate disposal of medicines. The explanation for this, according to the authors, would be that the presence of antibiotics in the environment would make it possible for bacteria to contact these compounds and induce changes in the survival mechanism to promote resistance, Chi *et al.*, (2020) reinforce these findings by pointing out that there is a greater presence of antibiotic resistance genes in bacteria from soils contaminated with hospital waste, which points to an important public health problem.

Graph 10 - Segregation of residues at home



Source: Own authorship (2020)

Based on these data, the vast majority of participants, that is, 75%, responded that they do not segregate residues from the residence, which makes up more than half of the answers obtained. What draws attention is that around 8% of the participants did not know the act of segregating waste, demonstrating a lack of information and even those who had it did not perform the act.

It is also necessary to make the population aware of the correct final destination of medicines and the problems that can be caused, if it is done incorrectly. Gondim (2012) adds that awareness can only be achieved through communication, through educational programs and campaigns to collect medicines in disuse.

IV. CONCLUSION

As a result of this research, it was possible to reveal the types of drugs most consumed and discarded by pharmacists and nurses registered with CRF/AM and COREN/AM, between December 2018 and January 2019, as well as by their users, which antibiotics stood out due to their potential risk. And also to unveil the impacts that this medication has on the environment and what its improper

disposal can cause. It was possible to find out how medication is disposed of in the places where these professionals work. And to identify the view of nursing and pharmacy professionals about the consequences of the disposal of medicines in relation to the environment. As well as the importance of the conscious performance of these professionals.

This survey showed that a large proportion of respondents have incorrect disposal habits, which, in turn, directly impact drug treatment and nature. Continuing education of health professionals and the population is necessary in order to make the population aware of the correct use and disposal of medicines. The frequency of inappropriate disposal, together with the scarcity of information on the subject, reinforces the real need for permanent education of health professionals and the population in general, to raise awareness of the correct use and disposal of medicines. In addition, stricter actions are needed to monitor compliance with national and state laws related to the reverse logistics of medicines, in order to minimize the potential clinical and environmental impacts caused by the incorrect disposal of medicines.

The findings of the present study revealed that although most professionals are aware that the correct disposal of medications is essential to avoid damage to the environment and increased bacterial resistance, few receive training and continuing education to perform such activity without equivocation.

As for the orientation of the population, there was a lack of policies and campaigns aimed at this in most of the cases addressed. This is worrying, as it may result in the disposal of antibiotics in household waste that is destined for landfills and open dumps, contaminating effluents and increasing bacterial resistance.

In general, this paper points to the need for a review of the solid waste management plan in hospitals in Amazonas, especially regarding the disposal of antibiotics. However, further studies are needed to build an intervention plan appropriate to each specific hospital.

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Prevalence of Congenital Syphilis in Northern Pará: Chronological Analysis of the Years 2014 To 2018

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Abstract— Objective: to analyze the prevalence of congenital syphilis in the State of Pará from 2014 to 2018. Method: This is a descriptive study with a quantitative approach of all cases of congenital syphilis reported by the Acute Notification Information System (SINAN) and the Living Born Information System (SINASC) in the period from 2014 to 2018 where the results are presented in the form of graphs and tables. Result: The frequency of congenital syphilis in the State of Pará showed an increasing trend in the period from 2014 to 2018, with 2017 showing a higher number of cases, totaling 5.7 cases per thousand live births. In 2018 there was a decrease from 5.7 to 5.5 cases per thousand born alive, but still surpassing the goal set by the ministry of health and remaining an old public health problem. CONCLUSION: The study points out the need for greater involvement of health sectors and professionals in the eradication of the disease in the state of Pará, promoting primary actions of prevention and awareness of the severity of congenital syphilis for the mother and the newborn.

Keywords— Congenital syphilis, Live birth, Epidemiological Surveillance.

I. INTRODUCTION

Syphilis is a systemic infectious disease that presents itself as a challenge to society because, despite the existence of effective and low-cost treatment, it remains a serious public health problem. It is a sexually transmitted infection (STI) of etiological agent *Treponema pallidum*, caused by the spirochete and highly pathogenic bacteria (Silva et al., 2017).

The mode of transmission can be during sexual intercourse without the use of condoms, in pregnancy or at the time of delivery and blood, the incubation period varies from 10 to 90 days (on average 21 days), its transmissibility is through the lesions (treponema) being the main form and vertical at any stage of pregnancy, since when performing the treatment all right is to be cured, the antibodies produced are not protective, ie, new exposure generates new infection (Cardoso, 2018 & Brazil, 2019).

The clinical manifestations present in different stages: primary, secondary, latent and tertiary syphilis, with higher risk of transmission in primary and secondary classifications. The inclusion of gestational syphilis (GS) as a compulsorily notifiable STI is justified by its high prevalence and rate of vertical transmission that can vary from 30% to 100% if untreated or inadequately treated (Marques et al., 2018).

The epidemiological situation of syphilis worldwide is variable, as global estimates indicate, especially in the gestational period, syphilis leads to over 300,000 fetal and neonatal deaths per year in the world and increases the risk of premature death in another 215,000 children, in the last decade in Brazil, there has been an increase in notifications of cases of syphilis in pregnant women and congenital women (Brazil, 2018). It is estimated that on average each year more than 12 million new cases of syphilis occur in the adult population and of these, more than 2 million are pregnant women (Rojas, 2018).

The choice of this theme is justified by the need to make a survey of the prevalence of syphilis in the last five years, through the considerable increase of congenital syphilis in the State of Pará, bringing with it the recrudescence of stillbirths and their severe sequelae, which according to the Epidemiological Bulletin of Syphilis the North of the country reached the incidence rate of 5.5 per 1,000 live births and Pará registered 5.1 (Rojas, 2018).

Through this, this study becomes essential in order to contribute to the discussion on this topic and enable the knowledge of real values in the state of Pará. In addition to following the restructuring of the proposals to confront syphilis in this region. This study aims to inform the

characterization of risk groups for this pathology, adding the numbers of withdrawal from treatment, the lack of inclusion of partners and family barriers, thus enabling the alarming increase of congenital syphilis. In view of this, the following research question arises: What are the factors for the occurrence of this pathology in the State of Pará?

In this sense, the objective was to analyze the prevalence of congenital syphilis in the State of Pará from 2014 to 2018.

II. METHOD

This is a descriptive epidemiological study, with a quantitative approach, whose secondary data were obtained by consulting the database of the Notification Aggravates Information System (SINAN) directed to the state of Pará, and considering updated data from the Living Births Information System (SINASC) in order to contribute to the statistical calculation.

The data collection was carried out through a documental research, the samples consisted of congenital syphilis notifications in the years 2014 to 2018, through SINAN and SINASC, using the variables as: child's age, mother's age, ethnicity, schooling, mothers and partners who performed or not the prenatal.

Data on live newborns, less than 7 days old until 12 years old, with positive result for syphilis in the years 2014 to 2018, classified, and reported and registered as congenital syphilis were included, according to data extracted from SINAN. Also all children born to mothers with syphilis (from clinical and/or laboratory evidence), diagnosed during pregnancy, delivery or puerperium.

We excluded cases of children over 13 years of age, born dead reported with congenital syphilis, and data from years before 2014, as well as cases of gestational syphilis and acquired syphilis.

The steps of data collection and analysis were: extracted from SINAN, notifications of Congenital Syphilis published in 2014 to 2018, soon after the exploration of this material was carried out, condensing the information to perform the descriptive statistical analysis of all the data that were transcribed into a spreadsheet in the Microsoft Excel program of Windows version 2013. To obtain the prevalence, the ratio between the number of existing cases of Congenital Syphilis in a given year of diagnosis and the total number of live births of mothers living in the same place, reported in the period from 2014 to 2018 divided by the total number of exposed newborns in the same year and multiplied by 1000, thus

tracing the results, and preparation, analysis of tables and graphs.

The following formula was used to calculate the prevalence estimate:

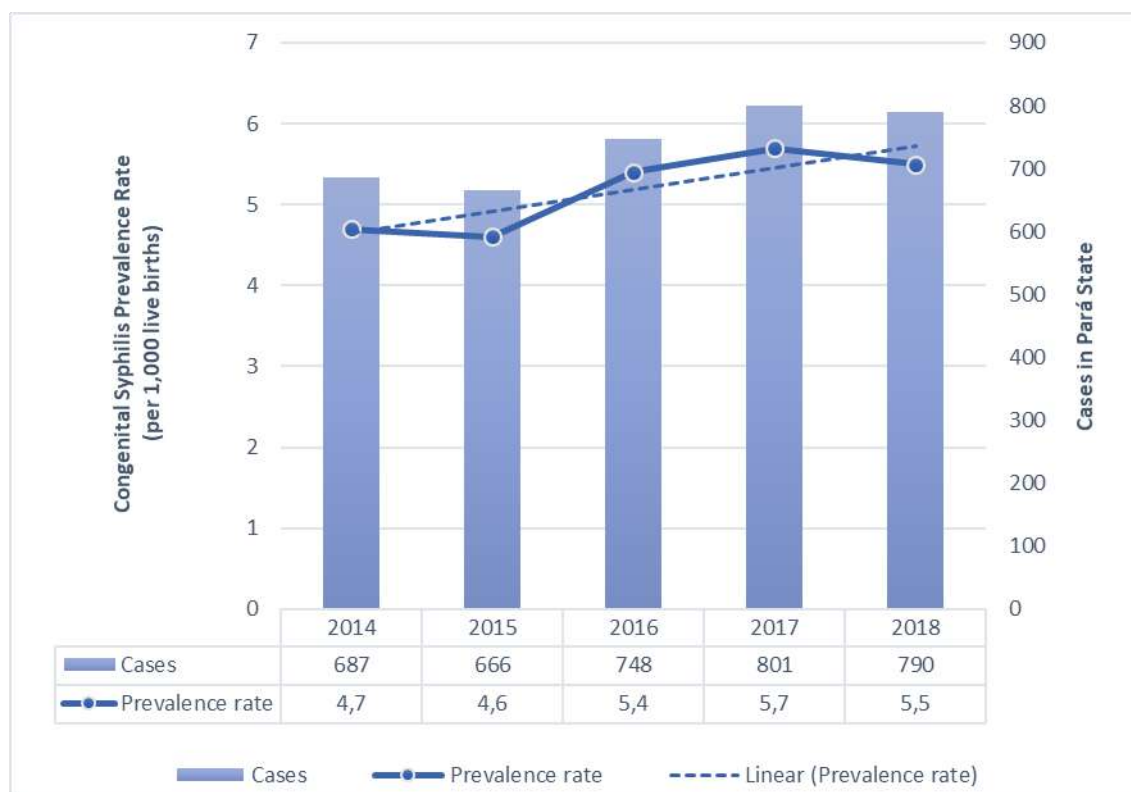
$$\text{Prevalence rate} = \frac{\text{n}^\circ \text{ of existing cases} \times 1000}{\text{n}^\circ \text{ of exposed people}}$$

Since the secondary data presented here are available to those who are interested without any form of access restriction in the information system of aggravated notifications, there was no need for approval of the Research Ethics Committee.

III. RESULTS

The results of this study show that when investigating the number of cases of Congenital Syphilis (CS) in the State of Pará according to SINAN data, 3,692 cases of CS were reported between the years 2014 and 2018, with 2017 showing a higher absolute number of cases with n= 801, with a prevalence rate of 5.7% and the linear trend indicates an increasing straight line (Graph 1).

Graph 1 - Congenital syphilis cases in children under one year of age and prevalence rate (per 1,000 live births) per year of diagnosis in the State of Pará, between the years 2014-2018.



SOURCE: Elaborated by the authors of the research, with data MS/SVS/DCCI - Department of Chronic Conditions Diseases and Sexually Transmitted Infections. Notification Aggravated Information System - SINAN Net/ Living Born Information System - SINASC. Note: (1). Preliminary data for the last 5 years.

Regarding the profile of mothers notified with congenital syphilis in Pará, it was 50.3% in the 20-29 age group, 31.8% had incomplete primary education, 73% of the brown color or 15.3% were indigenous, 82.5% performed prenatal, the moment of diagnosis 40.9% was

during prenatal, however 33.6% also went to the process of delivery or curettage and 19.1% after delivery, which increases the risk of transmission of the disease to the newborn (TABLE 1).

Table 1 - Cases of congenital syphilis according to age, education, race or color of the mother, prenatal performance and the moment of diagnosis of maternal syphilis. Pará, 2014-2018.

Variables	NC	%
Mother's age group		
10 a 14 anos	59	1,5
15 a 19 anos	1.087	27,6
20 a 29 anos	1.976	50,3
30 a 39 anos	502	12,7
40 anos ou mais	43	1,0
Ignored	259	6,5
Mother's education		
Illiterate	28	1,0
1st to 4th series incomplete	329	12,5
4th incomplete series	150	5,7
5th to 8th series incomplete	836	31,8
Complete Elementary School	321	12,2
Incomplete High School	473	18,0
Complete High School	458	17,4
Incomplete College	26	0,9
Complete College	25	1,0
Not applicable	26	1,0
Ignored	1.034	12,5
Breed or Mother's Color		
White	204	4,6
Black	96	2,1
Yellow	53	1,1
Brown	3.230	73,0
Indigenous	677	15,3
Ignored	162	3,6
Prenatal Care		
Yes	3.059	82,5
No	526	14,1
Ignored	121	3,2
Momento do diagnóstico da Sífilis Materna		
During prenatal	1.516	40,9
Moment of birth/curetage	1.246	33,6
After the birth	711	19,1
Not realized	43	1,1
Ignored	190	5,1

Source: Elaborated by the authors of the research, with data MS/SVS/DCCI - Department of Chronic Conditions Diseases and Sexually Transmitted Infections. Notes: (1) Data until 06/30/2019; (2) Preliminary data for the last 5 years. Legend: Number of cases (NC).

As for the groups at risk for this pathology, the highest number of cases in children under 7 days of life was evidenced, presenting 95%, 2.4% in children between 7 and 27 days and 1.4% with ages between 28 and 364 days, already in relation to mothers, it is noted that, 54% of

inappropriate treatments occurred during the last five years, another group identified were the partners, because although there is availability of treatment for men, in the first place 61% of partners were not treated according to the cases of CS (Table 2).

Table 2 - Cases of congenital syphilis according to the child's age, the treatment scheme of mothers and partners. Pará, 2014-2018.

Variables	NC	%	
Child's age			
Less than 7 days	3.546	95,6	
7 to 27 days	91	2,4	
28 to 364 days	55	1,4	
1 year	7	0,1	
2 to 4 years	6	0,1	
5 to 12 years	1	0,0	
Ignored	0	0	
Maternal treatment scheme			
Adequate	351	9,4	
Inadequate	2.021	54,5	
Not realized	881	23,7	
Ignored	453	12,2	
Treated partner			
Yes	702	18,9	SO UR CE: Elab
No	2.274	61,3	
Ignored	730	19,6	

orated by the authors of the research, with data Source: MS/SVS/DCCI - Department of Chronic Conditions Diseases and Sexually Transmitted Infections. Notes: (1) Data until 06/30/2019; (2) Preliminary data for the last 5 years. Legend: Number of Cases (NC).

IV. DISCUSSION

According to data from the Syphilis Epidemiological Bulletin in (2016), in Brazil in the last five years a constant increase in the number of cases of syphilis in pregnant women, congenital and acquired, was observed, which can be attributed, in part, to the increase in the coverage of testing, with the increase in the use of rapid tests, reduction in the use of condoms, resistance of health professionals to the administration of penicillin in Basic Care, worldwide shortage of penicillin, among others. In addition, the improvement of the surveillance system can be reflected in the increase of notified cases (Brazil, 2016).

The studies by Henderson (2018) and collaborators, conducted in a reference maternity ward in the State of Pará, state that the number of syphilis cases found in this region exceeds those of other national states, i.e., notification rates in the North remain high.

When this study was compared with the research of Trevisan & Collaborators (2018), conducted in a municipality of Paraná also prevailed between 20 and 29 years a higher frequency of notifications at that age. Lafeta (2016) explains that it is in this age group that the woman exercises her full sexuality and the peak of the reproductive phase. The public most affected and adolescents with the infection is noticeable, and they are

beginning early and unprotected sexual activity (Souza; Rodrigues; Gomes, 2018).

Moreover, because they are a public with low schooling, they are more exposed to the disease, as shown in the research of Silva (2019), that the incomplete level of education influences the knowledge on how to prevent Sexually Transmitted Infections (STIs).

Marques et al. (2018), corroborate that most of the cases occurred in brown mothers and this result, becomes a disadvantage causing problems of social inequality of access to health services, thus influencing in the adequate prenatal care mainly the mothers who are indigenous.

It is possible to observe in other research that the diagnosis is being made in the prenatal period, more in a late period compromising the assistance to the quality treatment to this pregnant woman, because the syphilis can be transmitted to the baby in the ninth week of pregnancy and this delay in the diagnosis can lead to the identification of the cases only during the delivery, curettage or postpartum, thus increasing the chances of congenital syphilis occurring (Terra, 2019; Cardoso, 2018; Araujo et al., 2018; Oliveira et al., 2017).

Regarding the age of newborns notified with congenital syphilis, it is evident in the research of Padovani & Collaborators (2018), states that they are diagnosed at birth with a few days of life, these data compare with those published in the Epidemiological Bulletin, being the majority of newborns diagnosed with congenital syphilis in the first week of life (Brazil, 2016).

To reduce the risk of newborns being diagnosed at birth with congenital syphilis, it is essential to perform quality follow-up during prenatal care, identifying early and contributing significantly to reduce the health risks of pregnant women and the fetus (Silva et al., 2017).

In this study in relation to inadequate maternal treatment, similar data shown in a survey in Palmas Tocantins over a period of five years were identified flaws with 43.8% were inadequately treated, which explains the high incidence in this municipality (Costa Neto et al., 2018).

According to Menegazzo & Collaborators (2018), all pregnant women received the treatment, however 85% was considered inadequate and also the partners were not treated, which corresponds as a major error in prenatal care and implying increased vertical transmission of the disease.

It is noteworthy that in this study a high number of untreated partners, the same was evidenced in a survey conducted in Porto Velho shows that the prenatal follow-

ups were made the treatment of the pregnant woman properly, plus 56.86% of the partners were not carried out, since it is of paramount importance to perform the correct treatment of the couple to prevent complications for the baby (Silva et al., 2017).

With this study it was possible to determine the following factors related to the frequency of congenital syphilis, such as the diagnosis made during prenatal care, more in a late period, thus compromising the quality of care for this pregnant woman.

Another study points out failures in treatment during prenatal care and states that it has been one of the most relevant risk factors associated with high prevalence of the disease (Costa Neto et al., 2018). Silva & Fernandes (2015) corroborate that in order to reduce this failure, measures must be taken at different levels of public administration, thus promoting initiatives to improve prenatal care and efficiently ensuring the prevention and treatment of this disease.

It was possible to notice the large number of untreated partners, for Melo (2019), emphasizes in the results of his research about the devaluation that men have with health services, because they constitute as a space more of the female presence, with that they do not prioritize the prevention and only make the search for the service when it comes to presenting the symptoms, so early diagnosis and treatment is not performed.

Low schooling affects the limitation of knowledge about preventive measures of STIs, so the population does not have access to information about this infection, so these results compare with the data from Azevedo et al., (2017), in which it identifies risk factors related to syphilis infection such as low schooling, teen pregnancy and limited access to health services.

V. CONCLUSION

The findings of this study helped analyze the Congenital Syphilis Prevalence Rate, as well as its increase in the absolute number of cases in the State of Pará during the last five years, as evidenced by the linear trend that indicates an increasing straight line and requires immediate interventions in order to minimize its occurrence.

It was possible to characterize the main factors, as well as the risk groups, observing that the deficiency in prenatal care, and late diagnosis of pregnant women contribute to a higher occurrence of syphilis cases in children under seven days old, as well as the lack of participation of the partner

of these pregnant women in the treatment process, contributing to a possible reinfection of the mothers.

The study also points out the need for greater involvement of health sectors and professionals in the prevention, diagnosis, and treatment of congenital syphilis, through assistance protocols, as described in the guidelines and recommendations made available by the Ministry of Health. Thus, enabling a possible eradication or decrease in the prevalence rate of the disease in the state of Pará, however, the need to promote primary actions of prevention and awareness of the severity of congenital syphilis for the mother and the newborn is reiterated.

Therefore, it is necessary to train the multiprofessional team, which has a very important role in promoting changes in the disease picture. Reflecting on an effective and adequate prenatal care, allowing a closer relationship between professional and user, acquiring a more critical and humanized look, especially in relation to the partners of infected pregnant women, contributing so that they can become aware and adhere to the treatment.

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Influence of knowledge for organ and tissue donation for transplantation

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Abstract— Objective: to investigate the opinion and intention of the adult population in the city of Belém, State of Pará, Brazil, regarding the donation of organs and tissues for transplantation. Method: a cross-sectional, population-based, descriptive study with a quantitative approach, carried out in the city of Belém of Pará, Brazil, from July to August 2019. Results: 387 participants were interviewed, where 70.8% expressed a positive opinion regarding donation and intention to donate organs and tissues; and 50.9% had expressed their desire to be a donor to a family member. 88.6% of the interviewees would authorize the donation of organs and tissues after the death of a family member, provided that he previously expressed his willingness to be a donor. However, only 59.7% would authorize the donation of organs from a loved one diagnosed with brain death. There was a greater intention to donate, among female individuals, aged between 18 to 27 years, students, with family income between 3 to 5 minimum wages, who have children, Catholics and who live 3 to 4 hours a day with the family. Conclusion: this study allows us to conclude that older individuals with less education have less intention to donate their organs. The lack of information on organ donation and transplantation and all the consequences of not knowing the donation process is certainly a limiting factor for the increase in the number of donors.

Keywords— Transplant. Procurement of Tissues and Organs. Knowledge.

I. INTRODUCTION

Organ and tissue transplantation is an effective therapeutic alternative for patients with severe diseases, whether acute or chronic, and who have no other therapeutic alternative. This process involves several actions in the assistance to the Potential Donor (PD) by the professionals of the multidisciplinary team, aiming at the hemodynamic maintenance and viability of the organs for transplantation, in addition to handling the doubts and

conflicts that permeate the relationship with family members who experience the pain of loss⁽¹⁾.

The donation of organs and tissues is a noble act that can improve and expand the possibilities of survival. Often, organ and tissue transplantation can be the only life expectancy or the opportunity for a fresh start for people who need an organ or tissue. Therefore, they are themes that have aroused a lot of interest and instigated several discussions in society in general. The lack of clarification and the way in which information is disseminated through

the mass media, commonly generate myths and reinforce controversies and prejudices on this topic⁽²⁾.

The donation of organs and tissues allows several people on the waiting list for transplants (unique registration in Brazil) to have the prospect of survival, which can be done in two ways: between living / intervening (inbreeding kinship up to fourth degree), or through deceased donor of multiple organs in Brain Death, or deceased donor of stopped heart, where it is only possible to capture tissues like corneas for example⁽³⁾.

Transplantation has become an excellent option in the treatment of terminal organ failure. This position was achieved after major advances in the areas of intensive care, immunology and pharmacology; however, when the demand is compared to the availability of organs, there is a huge gap that prevents the increase in transplant rates, since the number of patients waiting for this procedure exceeds the supply of organs⁽⁴⁾.

Transplantation is a complex process, which begins with the identification and maintenance of potential donors. The potential donor in brain death can donate the following organs and tissues: heart, lungs, liver, kidneys, pancreas, intestines, corneas, skin, bones, tendons, bone marrow and blood vessels. With regard to the living donor, who can donate even organs or fragments of liver or lung or even tissues such as blood and bone marrow, there are rules to be met, such as: the donor must have a blood relationship of up to four degrees with the recipient, in case there is no blood relationship there is a need for judicial authorization in Brazil. In both cases, there is a need for numerous tests, such as HIV1, HTLV, hepatitis B and C, VDRL, serology for cytomegalovirus, chagas disease, in addition to liver, renal, pancreatic, cardiac and pulmonary function tests⁽⁵⁾.

The PDs of organs and tissues in BD are individuals who are diagnosed and declared dead under the terms established by the Federal Medical Council resolution n. 1.480 / 97, which provides for the registration in the medical record of a Term of Declaration of Brain Death (TDME), describing the elements of the neurological examination that demonstrate the absence of the reflexes of the brain stem, as well as the report of a complementary examination⁽⁶⁾.

After the identification of the potential donor, health professionals inform the family of the suspected brain death, perform the supporting exams, notify the potential donor to the Intra-hospital Organ and Tissue Donation Commissions for Transplantation (CIHDOTTs) or the Organization for the Search for Organizations Organs (OPOs) that forward the notification to the Central

Notification, Collection and Distribution Organs (CNCDO) / State Transplant Center (CET)⁽⁵⁾.

Resolution no. 1,480 / 97, emphasized that it was necessary: clinical examinations, performed by different doctors, one of whom was a neurologist or neuropediatrician, and complementary examinations, performed at variable time intervals. Resolution no. 2,173 of December 15, 2017, maintain the same criteria, only establishing new time limits between examinations and define the new medical specialties authorized to perform the clinical examinations of the diagnosis of brain death. Complementary exams must clearly demonstrate: absence of electrical brain activity, or absence of metabolic activity or absence of cerebral blood perfusion⁽⁷⁾.

On the standardization for the diagnosis of brain death in Brazil, the Resolution of 1991, n. 1,346, was revoked in 1997 by resolution no. 1,480. The latter was updated and replaced by resolution no. 2,173 of December 15, 2017 in effect today. The procedures for the determination of brain death occur in a standardized manner, and should be initiated in all patients who have a nonperceptive coma, absence of supraspinatus reactivity and persistent apnea. The patient's clinical condition must also have all the following prerequisites: presence of a brain injury of known and documented cause, irreversible and capable of causing brain death, in addition to other causes that may mimic the condition, such as: hypothermia, disorders basic acids, hydroelectrolytics and use of central nervous system depressant drugs. In this resolution, criteria are also established so that a doctor is considered capable of making the diagnosis, and also expands the medical specialties that will be able to determine the diagnosis of brain death⁽⁸⁾.

In this context, a potential donor is a patient diagnosed with brain death and an effective donor, any potential donor, in which at least one organ or tissue has been removed for the purpose of transplantation⁽⁹⁾.

In the world panorama, Brazil occupies the second place in the ranking of countries with the highest number of transplants performed, behind only the United States of America (USA). It is important to highlight that Brazil is a world leader in terms of transplant surgery performed by the Unified Health System (SUS)⁽¹⁰⁾. In addition, it currently has about 548 health establishments and 1,376 medical teams authorized to perform the transplant⁽¹¹⁾.

The annual growth of effective donors and, consequently, of transplants performed, is also explained by the increase in the number of notifications from DPs to the State Transplant Centers (CET)⁽¹²⁾. There were about 27 thousand transplants performed in 2017. The data

represents the resumption of growth after some years of decline and small advances in relation to the rate of effective donors. Brazil had an increase of 15.7% in the first half of 2017⁽¹³⁾.

Data from 2017 shows the rate of effective donors per million people per year, which was 16.6 pmp, an increase compared to 2016 (14.6 pmp). Regarding the high rate of donations, there is a considerable disproportion between organ donation and people on the waiting list. And these numbers still do not meet the needs of people who wait for an organ and / or tissue⁽¹⁴⁾.

According to the Brazilian Transplant Registry (RBT), the State of Pará still has a low percentage of transplants performed. From January and June 2020, Pará obtained 8.8 pmp / year of notifications from the PD with 3 (0.8 pmp / year) from donors whose organs were transplanted. Non-donors were 92%, as follows: eligible donors with 5.1 pmp, effective donors with 0.7 pmp, donors whose organs were transplanted with 0.7 pmp and finally, donors with multiple organs presenting (0 %) of transplants performed⁽¹⁵⁾.

Despite the unquestionable advances in the current scenarios, the numbers still indicate a very long queue and inversely proportional to the number of transplants performed, showing that the number of organ and tissue donors is still insufficient to supply this demand, which is configured as the only chance of life for many Brazilians^(1,2).

Organ and tissue transplantation, despite being one of the most notable scientific achievements, still presents many obstacles, although it is a technique of great importance to save thousands of lives and restore the health of countless people⁽¹⁶⁾.

The subject in question is on the agenda of both formal discussions between health professionals and questioning by society, involving legal aspects that support the donation and the activity of the health professional, involving ethical and moral aspects, with the need to make organ and tissue donation is a matter of public knowledge⁽¹⁾.

The 1988 Federal Constitution establishes the right to life. And to reinforce this right, Law No. 9.434, of February 4, 1997, establishes the legality regarding the removal of organs, tissues and parts of the human body for the purposes of transplantation and treatment, if it is free will and authorized by the donor or your responsible family member. Organ donation is free. It is a subject that must be well leveled between the donor and his family. The doctor and the multidisciplinary team can contribute to this process in a humanized way, with safe guidelines

for the procedures. Once the BD protocol has started, a real race for life begins, where every minute is crucial for the qualitative outcome of the graft uptake and implantation in the recipient⁽¹⁷⁾.

Anyone can donate organs and tissues, as long as they do not have any infectious diseases or that compromise the functioning of the organs. To be a donor, it is not necessary to leave a written document, it is up to the family to authorize the removal of the organ after the death is confirmed. However, there are still doubts, myths and prejudices when it comes to organ transplantation in humans; a controversial issue that has aroused interest and discussions in various segments of society⁽¹⁾.

Organ donation is an act of charity and love for others. Each year, many lives are saved by this altruistic gesture. The population's awareness of the importance of organ donation is vital to improve the reality of transplants in the country⁽¹⁸⁾. Therefore, we emphasize the importance of carrying out the study, since it will benefit not only professionals and academics, but also society in general. The focus of this study is to investigate the opinion and intention of the adult population, that is, to define what are the factors that influence when making a decision to donate organs and tissues.

It is understood that it is necessary to have a better understanding about the process of donating organs and tissues for transplantation, since doubts generate an unfavorable decision making by the population; understanding that transplantation represents one of the greatest advances in the health area, and in some contexts it is configured as the last therapeutic alternative in terminal organ and tissue failures. However, this subject is still very much brought up by myths, and arouses much discussion and debate in the various segments of society⁽¹⁴⁾.

Given the above, the present study aimed to investigate the opinion and intention of the adult population of the city of Belém, State of Pará, Brazil, regarding the donation of organs and tissues for transplantation.

II. METHOD

Descriptive, cross-sectional, population-based cohort study with a quantitative approach, carried out in public squares in the city of Belém, State of Pará, Brazil, from July to August 2019.

The study was developed based on the application of a digital questionnaire designed and validated by Barcelos⁽¹⁹⁾, completed through interviews.

The questionnaire was made up of two parts and adapted to the objectives of the present study. The first part had the purpose of identifying the profile of the population, containing sociodemographic data (gender, age, profession, etc.). In the second part, we sought to identify the knowledge and opinions capable of influencing the decision of individuals to donate their organs and tissues after death, understanding about the concept of brain death and its diagnosis, the main reasons that would influence the decision to donate their organs and tissues and their relatives and knowledge about the organs and tissues that can be donated.

Inclusion criteria were: adult people, who were in the aforementioned public squares; older than 18 years; of both genders and who felt able psychologically to answer the questionnaire. Exclusion criteria: health professionals and academics were not considered.

According to data from the Brazilian Institute of Geography and Statistics (IBGE)⁽²⁰⁾, Belem has a territorial area of 1,059,458 km² and has an estimated population of N = 1,485,732 inhabitants. Based on this estimate, a 5% margin was adopted as a sampling error, with a 95% confidence level, alpha (α) of (0.05), which implies the use of the value of Z = 1.96, establishing as sample n = 384.06, rounding up to 385 people, who were interviewed, Fontelles⁽²¹⁾:

$$No = \frac{No}{1 + \left(\frac{no}{N}\right)} \text{ where, } No = \left[\frac{Z \cdot \alpha/2}{E}\right] \cdot Po \cdot (1 - Po)$$

Calculation:

$$No = \left[\frac{1,96}{0,05}\right]^2 \cdot 0,5 \cdot (1 - 0,5) = 384,16$$

$$No = \frac{384,16}{1 + \left(\frac{384,16}{1,485,732}\right)} = 384,06 = 385,00$$

Being:

n = Size of the studied population.

N = Approximate value of the sample size.

P = Sample proportion.

E = Sample error (margin of error).

Trust level: 95%.

For this study, a number of 385 was adopted, plus 2 more participants, resulting in a sample of 387 participants.

Weekends and holidays were scheduled when there were schedules in the respective public squares to approach the participants. At the time, the research methodology and objectives were explained. After clarifying doubts about the study, the Free and Informed

Consent Term was delivered with the appropriate guidelines to be analyzed and signed by the possible research participants.

The statistical treatment seeks to identify, by means of absolute frequencies, whether the data converge to any particular differential or whether there is a trend or not, using the descriptive statistics of the data based on absolute and relative frequencies, and in followed by the application of statistical tests⁽²²⁾.

In the measurement of absolute and relative frequencies, the quantitative research used aims to give statistical treatment to the data, with the purpose of identifying trends, adherences and associations between the variables under study⁽²³⁾.

In this study, the Chi-square likelihood ratio test was used for independent samples. It is a hypothesis test that uses statistical concepts to reject or not a null hypothesis (**H0** = there is no significant trend between frequencies). It is a statistical test for n samples whose proportions of the different modalities are arranged in frequency tables, with the expected values being deduced mathematically, trying to determine whether the proportions observed in the different categories occur as expected or show any tendency. To perform the test, a significance level of p-value <0.05 was adopted, that is, if p-value <0.05 **H1** is accepted = there is a significant trend between the frequencies.

To verify the correlation between demographic, socioeconomic, cultural factors and the decision of individuals to donate their organs and tissues after death, Pearson's Chi-square test (Wilks' G²) was performed for independence between nominal variables and the ANOVA test with Tukey for numerical variables, as it was observed that the data do not have a normal distribution.

Thus, the data collected were tabulated, interpreted, processed and analyzed using descriptive and inferential statistics. For data analysis, computing resources were used, through processing in the Microsoft Windows Excel system, Statistic Package for Social Sciences (SPSS)[®] version 24.0, all in Windows[®]7 environment.

The fulfillment of the requirements of the National Health Council (CNS) and the National Research Ethics Commission (CONEP) through Resolution n. 510/16 making it clear that "public opinion polls with unidentified participants should not be registered or evaluated by the CEP / CONEP system", and should not, in these cases, submit the research protocol to the system.

III. RESULTS

There was a significant predominance (p-value <0.05) of female individuals (236; 61%), aged between 18 and 27 years (153; 39.5%), whose main occupation is students (95; 24, 5%), single (197; 50.9%). In addition, it was found that most are from the municipality of Belém (321; 82.9%), State of Pará (377; 97.4%) (Table 1).

Table 1: Sociodemographic characteristics of the investigated participants regarding the intention to donate their organs and tissues after death (n 387). Belém, State of Pará, Brazil, 2019.

Description	n	%	P-Value ⁽¹⁾
Genre			
Female	236	61,0%	0.018*
Male	151	39,0%	
Age			
18-27	153	39,5%	<0.0001*
28-37	75	19,4%	
38-47	65	16,8%	
48-57	46	11,9%	
58-67	30	7,8%	
68-77	14	3,6%	
78-88	4	1,0%	
Occupation			
Student	95	24,5%	<0.0001*
homemaker	24	6,2%	
Self-employed	23	5,9%	
Retired	21	5,4%	
Receptionist	21	5,4%	
Teacher	14	3,6%	
Administrator	8	2,1%	
Others	78	20,2%	
Place of origin			
Belém	321	82,9%	<0.0001*
Ananindeua	24	6,2%	
Mosqueiro	6	1,6%	
Marituba	4	1,0%	
Others	32	8,3%	
State of origin (Brazil)			
Pará	377	97,4%	<0.0001*
Rio de Janeiro	4	1,0%	

Maranhão	4	1,0%	
Amapá	1	0,3%	
Ceará	1	0,3%	
Marital status			
Single	197	50,9%	<0.0001*
Married	111	28,7%	
Stable union	56	14,5%	
Widower	15	3,9%	
Divorced	8	2,1%	

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

⁽¹⁾ Pearson's Chi-square test (Wilks' G²) for trend (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H₀: The observed frequencies occur in the same proportion for the different groups.

H_a: The observed frequencies differ significantly for the different groups.

Decision: As the computed p-value is less than the significance level of alpha = 0.05, the null hypothesis H₀ should be rejected and the alternative hypothesis H_a accepted.

It can be seen in Table 2 that there was a significant predominance (p <0.05) of individuals who have children (227; 58.7%), of Catholic religion (238; 61.5%), who keep themselves informed through the internet (253; 65.4%), living 3 to 4 hours a day with the family (134; 34.6%) and with a good family income (261; 97.4%), receiving approximately 3 to 5 minimum wages (168; 43.4%).

Table 2: Demographic, socioeconomic and cultural characterization of the research participants (n 387). Belém, State of Pará, Brazil, 2019.

Description (cont.)	n	%	P-Value ⁽¹⁾
Children			
Yes	227	58,7%	<0.0001*
No	159	41,1%	
Pregnant	1	0,3%	
Religion			
Catholic	238	61,5%	<0.0001*

Evangelical	111	28,7%
Without religion	17	4,4%
Spiritism	6	1,6%
Atheist	5	1,3%
Umbanda	3	0,8%
Jehovah's Witness	2	0,5%
Agnostic	2	0,5%
Candomblé	2	0,5%
Theistic	1	0,3%

Information

Internet	253	65,4%	<0.0001*
Television	109	28,2%	
Newspaper	20	5,2%	
Radio	5	1,3%	

Living with the family

3-4 hours	134	34,6%	<0.0001*
Full-time	95	24,5%	
Only on weekends	86	22,2%	
1-2 hours	62	16,0%	
Don't have time for family	6	1,6%	
Holidays only	4	1,0%	

Family income

Good	261	67,4%	<0.0001*
Bad	72	18,6%	
Great	38	9,8%	
Excellent	16	4,1%	

Salaries

3-5 salaries	168	43,4%	<0.0001*
1-2 salaries	135	34,9%	
6-9 salaries	65	16,8%	
More than 9 salaries	19	4,9%	

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

⁽¹⁾ Pearson's Chi-square test (Wilks' G²) for independence (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H0: The frequencies observed occur in the same proportion for the different groups.

Ha: The observed frequencies differ significantly for the different groups.

Decision: As the computed p-value is less than the significance level of alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

It can be seen in Table 3 that the significant majority (p <0.05) of the interviewed individuals would authorize the donation of organs from a relative who had warned about their desire to be an organ donor (343; 88.6%). The percentage of interviewed individuals who would authorize the donation of the organs of a relative who had brain death is predominant, even if this relative had not warned about their intention to be a donor (231; 59.7%).

Thus, it is possible to see that (274; 70.8%) of the population has the intention to donate their organs; to the point that (302; 78%) would authorize after death and (190; 49.1%) shows no position. Among those who informed their intention to close relatives, those who really have the power to decide on the donation, we had a percentage of (197; 50.9%), and of them (50; 25.4%), only the mother advised.

Table 3: Distribution of the interviewees' intention about organ and tissue donation for transplantation (n 387). Belém, State of Pará, Brazil, 2019.

Specific questions about organ and tissue donation for transplantation	N	%	P-Value ¹⁾
1- Imagine that a relative of yours had warned you about your desire to be an organ donor. The doctor warned you that this relative died. Would you authorize this person's organ donation?			
Yes	343	88,6%	<0.0001*
Maybe	25	6,5%	
No	19	4,9%	
2- Imagine that a relative has not discussed with you about your intention to donate organs. Then the doctor tells you that this relative is brain dead. Would you authorize the donation?			
Yes	231	59,7%	<0.0001*
Maybe	80	20,7%	
No	76	19,6%	

3- Do you intend to donate any organ in your body?

Yes	274	70,8%	<0.0001*
Maybe	61	15,8%	
No	52	13,4%	

4- Would you authorize the donation of your organs after your death?

Yes	302	78,0%	<0.0001*
No	44	11,4%	
Maybe	41	10,6%	

5- Would you donate any organ in your body to your relatives or friends in life, if it did not pose risks to your health?

Yes	291	75,2%	<0.0001*
Maybe	68	17,6%	
No	28	7,2%	

6- Have you already warned a close relative of you about your intention to donate organs and tissues?

Yes	197	50,9%	0.0613ns
No	190	49,1%	

6- If yes, who?

Mom	50	25.4%	0.0001*
All the family	39	19.8%	
Husband / wife	34	17.3%	
Parents	30	15.2%	
Brothers	16	8.1%	
Children	12	6.1%	
Uninformed	10	5.1%	
Grandmother	2	1.0%	
Cousins	2	1.0%	
Grand daughter	1	0.5%	
Girlfriend	1	0.5%	

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

(1) Pearson's chi-square test (Wilks' G²) for trend (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H0: The frequencies observed occur in the same proportion for the different groups.

Ha: The observed frequencies differ significantly for the

different groups.

Decision: As the computed p-value is less than the significance level of alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

It can be seen in Table 4 that most of the interviewed participants affirm that the lack of information is one of the main reasons that can lead people to non-donation, being this value (196; 50.6%). The common notion among the participants considers the concept that brain death to be a legal definition of death to be true (247; 63.8%). In this sense, (153; 39.5%) respondents consider that a person who had BD is in fact dead, declaring full confidence in the diagnosis of this clinical condition (166; 42.9%).

Already (332; 85.8%) of the participants agree that there is organ trafficking in Brazil and (258; 66.7%) affirms that the average waiting time in the transplant queue is approximately more than three years, considering that the The chance of receiving an organ for transplantation does not depend on the recipient's social class.

Table 4: Distribution of the interviewees' knowledge about the factors that influence the donation of organs and tissues for the transplant, definition of Brain Death and the average waiting time in the transplant queue (n 387). Belém, State of Pará, Brazil, 2019.

Specific questions about organ and tissue donation for transplantation	n	%	P-Value ⁽¹⁾
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7- What reasons can lead people not to donate their organs and tissues after death?

Lack of information	196	50,6%	<0.0001*
Fear	94	24,3%	
Selfishness	40	10,3%	
Religion	37	9,6%	
I don't trust the health system	12	3,1%	
Family not accepted	8	2,1%	

8- Brain death is the legal definition of death. There is a complete and irreversible shutdown of all brain functions. This means that, as a result of severe aggression or serious injury to the brain, the blood that comes from the body and supplies the brain is blocked and the brain dies. Do you agree with this statement?

True	247	63,8%	<0.0001*
I don't know	120	31,0%	
False	20	5,2%	

9- When a person is brain dead, that person is:

Dead	153	39,5%	<0.0001*
Just dead brain	123	31,8%	
I don't know	61	15,8%	
Partly alive	50	12,9%	

10- Do you trust the diagnosis of brain death?

Yes, I fully trust	166	42,9%	<0.0001*
Partially trust	159	41,1%	
I do not trust	62	16,0%	

11- Is there organ trafficking in Brazil?

Yes	332	85,8%	<0.0001*
I don't know	50	12,9%	
No	5	1,3%	

12- The average waiting time in the transplant queue is approximately

Above 3 years	258	66,7%	<0.0001*
More than 1 year	123	31,8%	
Less than 1 year	6	1,6%	

13 - Who is more likely to receive an organ to perform the transplant?

Does not depend on social class	205	53,0%	<0.0001*
Rich	173	44,7%	
Poor	9	2,3%	

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

(1) Pearson's chi-square test (Wilks' G²) for independence (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H0: The frequencies observed occur in the same proportion for the different groups.

Ha: The observed frequencies differ significantly for the different groups.

Decision: As the computed p-value is less than the significance level of alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha

accepted.

In Table 5, the significant majority (p <0.05) of the interviewed individuals state that the organs and tissues that can be donated for the transplant are: Kidney (376; 97%), Blood (346; 89%), Liver (335; 87%), Bone Marrow (328; 85%), Cornea (323; 83%), Heart (322; 83%), Lung (259; 67%), Tissue (209; 54%), Pancreas (138 ; 36%), Bone (112; 29%), Leg (31; 8%) and Brain (25; 6%).

Table 5: Distribution of the investigated individuals according to the knowledge of the organs and tissues that can be donated for the transplant (n 387). Belém, State of Pará, Brazil, 2019.

Which of the following organs can be donated for the transplant?	N	%	P-Value ⁽¹⁾
14 – Cornea			
Yes	323	83.5%	<0.0001*
I don't know	54	14.0%	
No	10	2.6%	
15 - Bone Marrow			
Yes	328	84.8%	<0.0001*
I don't know	48	12.4%	
No	11	2.8%	
16 – Bone			
No	154	39.8%	<0.0001*
I don't know	121	31.3%	
Yes	112	28.9%	
17 – Kidney			
Yes	376	97.2%	<0.0001*
I don't know	10	2.6%	
No	1	0.3%	
18 – Lung			
Yes	259	66.9%	<0.0001*
I don't know	81	20.9%	
No	47	12.1%	
19 – Liver			
Yes	335	86.6%	<0.0001*
I don't know	33	8.5%	
No	19	4.9%	
20 – Brain			
No	288	74.4%	<0.0001*

I don't know	74	19.1%	
Yes	25	6.5%	
21 – Leg			
No	281	72.6%	<0.0001*
I don't know	75	19.4%	
Yes	31	8.0%	
22 – Pancreas			
I don't know	171	44.2%	<0.0001*
Yes	138	35.7%	
No	78	20.2%	
23 – Blood			
Sim	346	89.4%	<0.0001*
No	26	6.7%	
I don't know	15	3.9%	
24 – Heart			
Yes	322	83.2%	<0.0001*
I don't know	60	15.5%	
No	5	1.3%	
25 – Tissue			
Yes	209	54.0%	<0.0001*
I don't know	131	33.9%	
No	47	12.1%	

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

(1) Pearson's chi-square test (Wilks' G²) for independence (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H0: The frequencies observed occur in the same proportion for the different groups.

Ha: The observed frequencies differ significantly for the different groups.

Decision: As the computed p-value is less than the significance level of alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

Table 6 shows Pearson's chi-square test, which serves to detect the existence of an association between demographic, socioeconomic and cultural variables that influence or not the decision of individuals to donate their organs and tissues after death.

It appears that the occupation of most individuals who answered yes (77; 28.1%) and perhaps (14; 23%) with the intention of donating their organs and tissues after death, are students, while the majority of individuals who they do not have the intention, they have occupation of the home (7; 13.5%).

The way of obtaining the information also influences the decision to donate or not, so that the majority of individuals who declared the donation positive (207; 75.5%) or perhaps (29; 47.5%), have access to information through the internet, while those who do not intend to donate (29; 55.8%) have access to information through television.

Another influencing factor observed was salary, it appears that those who answered yes (120; 43.8% or perhaps (33; 54.1%) to donate, receive between 3 and 5 salaries, while individuals who do not intend to donate have a lower income, between 1 and 2 minimum wages.

In summary, the factors that significantly interfere (p <0.05) in the intention of donating the respondents are: occupation, means of information, time spent with the family and salary, that is, we conclude that there is dependence between these variables and the intention to donate organs and tissues declared by the investigated, at a significance level of 5%.

Table 6: Demographic, socioeconomic and cultural factors that influence individuals' decision to donate their organs and tissues after death (n 387). Belém, State of Pará, Brazil, 2019.

		Do you intend to donate any P-organ in your body?						Value
		No (n = 52)		Yes (n = 274)		Maybe (n = 61)		
		N	%	N	%	N	%	
Middle Ages		49, 5	17,6	33, 4	12,9	42, 6	18,3	
Genre	Female	31	59,6%	173	63,1%	32	52,5%	0.433ns
	Male	21	40,4%	101	36,9%	29	47,5%	
Occupation	Retired	5	9,6%	10	3,6%	6	9,8%	0.0351*
	Self-employed	5	9,6%	17	6,2%	1	1,6%	
	homemaker	7	13,5%	12	4,4%	5	8,2%	

	Student	4	7,7%	77	28,1%	14	23,0%	
	Teacher	0	0,0%	12	4,4%	2	3,3%	
	Receptio nist	1	1,9%	17	6,2%	3	4,9%	
Marital status	Married	17	32,7%	73	26,6%	21	34,4%	0.0766 ns
	Divorced	2	3,8%	3	1,1%	3	4,9%	
	Not married	17	32,7%	15	56,9%	24	39,3%	
	Stable union	8	15,4%	37	13,5%	11	18,0%	
	Widower	8	15,4%	5	1,8%	2	3,3%	
Children	Pregnant	0	0,0%	1	0,4%	0	0,0%	0.771n
	No	7	13,5%	13	47,8%	21	34,4%	^s
	Yes	45	86,5%	14	51,8%	40	65,6%	
Religion	Agnostic	0	0,0%	1	0,4%	1	1,6%	0.611n
	Atheist	0	0,0%	5	1,8%	0	0,0%	^s
	Candom blé	0	0,0%	1	0,4%	1	1,6%	
	Catholic	31	59,6%	17	64,2%	31	50,8%	
	Spiritism	2	3,8%	4	1,5%	0	0,0%	
	Evangelic al	17	32,7%	68	24,8%	26	42,6%	
	Without religion	2	3,8%	15	5,5%	0	0,0%	
	Theistic	0	0,0%	1	0,4%	0	0,0%	
	Jehovah's Witness	0	0,0%	1	0,4%	1	1,6%	
	Umbanda	0	0,0%	2	0,7%	1	1,6%	
Informat ion	Internet	17	32,7%	20	75,5%	29	47,5%	0.001*
	Newspap er	4	7,7%	11	4,0%	5	8,2%	
	Radio	2	3,8%	2	0,7%	1	1,6%	
	Televisio n	29	55,8%	54	19,7%	26	42,6%	
Living with the	1-2 hours	4	7,7%	49	17,9%	9	14,8%	0.0251 *

family	3-4 hours	15	28,8%	10	37,2%	17	27,9%	
	Don't have time for family	1	1,9%	5	1,8%	0	0,0%	
	Holidays only	0	0,0%	3	1,1%	1	1,6%	
	Only on weekend s	14	26,9%	56	20,4%	16	26,2%	
	Full-time	18	34,6%	59	21,5%	18	29,5%	
Family income	Good	28	53,8%	19	69,3%	43	70,5%	0.871n s
	Excellen t	4	7,7%	10	3,6%	2	3,3%	
	Great	5	9,6%	29	10,6%	4	6,6%	
	Bad	15	28,8%	45	16,4%	12	19,7%	
Salaries	1-2 salaries	30	57,7%	83	30,3%	22	36,1%	0.041*
	3-5 salaries	15	28,8%	12	43,8%	33	54,1%	
	6-9 salaries	7	13,5%	55	20,1%	3	4,9%	
	More than 9 salaries	0	0,0%	1	0,4%	0	0,0%	
	More than 9 salaries	0	0,0%	15	5,5%	3	4,9%	

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

(1) Pearson's Chi-square test (Wilks' G²) for association (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H0: The frequencies observed occur in the same proportion for the different groups.

Ha: The observed frequencies differ significantly for the different groups.

Decision: As the computed p-value is less than the

significance level of alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

Figure 1 shows the distribution of the individuals investigated regarding the decision to donate their organs and tissues after death, according to age. It appears that the age distribution of the participants does not have a normal distribution because the p-value of the normality test is less than 0.05, so that, although the majority of the investigated have the intention to donate their organs, this position is significantly higher among younger people, with an average age of 33 years ($\mu = 33.40 \pm 12.91$).

In Figure 2, it is observed that the Tukey test for multiple comparisons between the groups of responses of the respondents and their age, pointing out that there is a significant difference between those individuals who claimed to donate or perhaps the organs and those who gave a negative answer.

Table 7: Test of analysis of variance between age and the decision of the investigated individuals to donate their organs and tissues after death (n 387). Belém, State of Pará, Brazil, 2019.

Do you have the intention to donate your organs and tissues after death ?	n	Average	DesvPad	IC de 95%
No	52	49.46	17.63	(45.49; 53.43)
Yes	274	33.401	12.914	(31.672; 35.131)
Maybe	61	42.57	18.28	(38.91; 46.24)

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

(1) ANOVA Test - Analysis of Variance (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H0: The average age of those investigated is not significantly related to the intention to donate organs and tissues.

Ha: There is a significant association between the intention

to donate organs and tissues and the average age of those investigated.

Decision: As the computed p-value is less than the significance level of alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

Combined DevPad = 14.5.

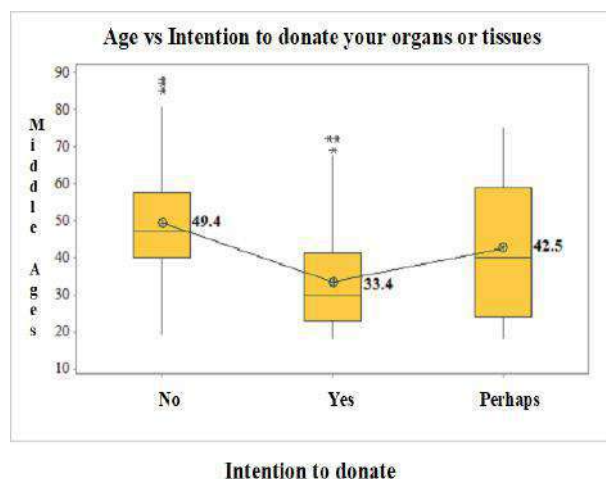


Fig.1: Distribution of the individuals investigated according to age and the decision to donate their organs and tissues after death (n 387). Belém, State of Pará, Brazil, 2019

Source: Research protocol 2019.

In order to determine whether the differences between the average ages of the response groups, “yes”, “no” and “maybe” are statistically significant, we performed the Tukey Simultaneous test which pointed out that the individuals who claimed to have the intention to donate the organs are less than 16 years old ($\mu = -16.06$) when compared to individuals who said they did not intend to donate organs and tissues.

Table 8: Tukey's Simultaneous Tests for the differences in mean age of the investigated, according to the decision to donate their organs and tissues after death (n 387). Belém, State of Pará, Brazil, 2019.

Difference of Levels	Difference Averages	EP of Difference	IC of 95%	Value-T	Value-P Adjusted (1)
Yes - No	-16.06	2.20	(-21.22; -10.90)	-7.29	0.000*

Maybe - No	-6.89	2.75	(-13.32; -0.45)	-2.51	0.033*
Maybe - Yes	9.17	2.06	(4.35; 14.00)	4.45	0.000*

Individual confidence level = 98.02%

Note: Results are based on non-empty rows and columns in each innermost subtable.

Source: Research protocol (2019).

(1) Tukey's Simultaneous Test (p-value <0.05).

* Significant Values; NS - Non-Significant Values.

Interpretation of the test:

H0: The average age of those investigated is not significantly related to the intention to donate organs and tissues.

Ha: There is a significant association between the intention to donate organs and tissues and the average age of those investigated.

Decision: As the computed p-value is less than the significance level of alpha = 0.05, the null hypothesis H0 should be rejected and the alternative hypothesis Ha accepted.

Combined DevPad = 14.5.

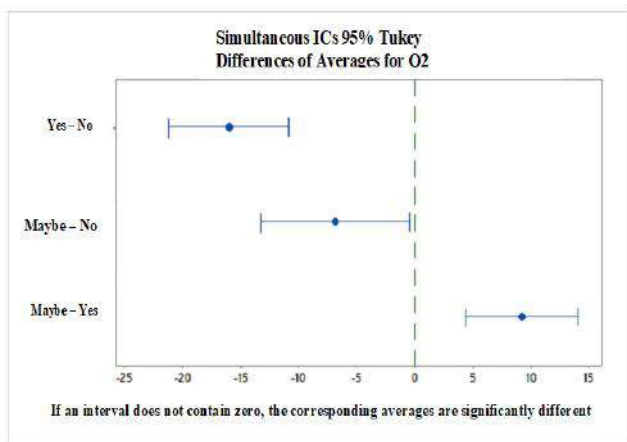


Fig.2: Tukey test for age comparison. Average of those investigated, according to the decision to donate their organs and tissues after death (n. 385). Belém, State of Pará, Brazil, 2019.

Source: Research protocol 2019.

IV. DISCUSSION

In this research, 387 participants were interviewed, 61.0% female and 39.0% male, with a predominance of the

age group between 18 and 27 years old, with singles and students being the most likely to donate organs and tissues.

Most individuals expressed an intention to donate their organs after death and a small portion was undecided (15.8%).

In the present study, more than half of the individuals who intended to donate organs have already communicated this decision to a family member (197; 50.9%).

This result was in agreement with the findings of Guadagnoli and other authors (52%), in the North American population, being higher than that found in the population residing in Hong Kong (33%)⁽²⁴⁻¹⁹⁾.

This fact was an important finding, because 59.7% of the individuals replied that they would authorize the donation of organs from their family members with BD, if they did not know the will of this, while this percentage rose to 88.6%, when the intention to donating was manifested (p-value <0.0001, highly significant).

Siminoff, Gordon, Hewlett and Arnold⁽²⁵⁾, interviewing family members who consented to the donation of organs and tissues, demonstrated that previous knowledge about the intention to donate was strongly associated with the consent to donate organs and tissues for transplantation. In this context, considering that in Brazil, legislation requires family authorization for organ and tissue donation, it is strongly recommended that educational measures should be planned and implemented in order to encourage discussion of the topic with family members. In this understanding, the importance of sensitizing and encouraging individuals with the intention of donating their organs is emphasized to inform this decision to their family members outside the moment of loss and crisis, where possibly they will be better able to understand such desire.

It is considered valid to highlight the change in the legislation that extinguished the presumed donation in Brazil, with the publication of Law no. 10.211 / 2001, legalizing the consented donation, determining that the donation of organs of deceased persons must be carried out with family authorization.

Regarding the concept of brain death as a legal definition of death, 247 (63.8%) of the interviewees considered this statement to be true. This finding is presented as a positive fact, which favors donation, given that many individuals fail to authorize the donation of organs from their family members, because they do not understand brain death as a death criterion⁽¹⁹⁾.

When analyzing the reasons why the interviewees were taken to position themselves for non-donation, there is a lack of information, which is the most relevant issue, adding up an important 50.6% of the studied population.

The lack of information is considered the point that can bring the most negative consequences to the donation process, and the lack of knowledge about what brain death is, how it happens and its irreversion is highlighted in this context, as it is at this moment that the family becomes more inclined to not authorize the donation of organs from their loved ones due to fear and insecurity in the diagnosis.

According to Diniz⁽²⁶⁾, the common notion of death has been the occurrence of prolonged cardiac arrest and the absence of breathing, that is, the total and permanent cessation of human vital functions.

This lack of knowledge reaches 31.0%, when referring to the concept of brain death; reaching 31.8%, when we add those who believe that the body remains alive after diagnosis. And yet, those who do not believe in the diagnosis of brain death add up to 16.0%, leading to a possible non-authorization of the donation.

It was evident that age is inversely and linearly associated with the intention to donate organs. Roels and other authors⁽²⁷⁾; Barcellos⁽¹⁹⁾, suggest that this finding may be related to the fact that some elderly people may have more difficulty in accepting the diagnosis of brain death, considering that they are too old to donate or because they have less knowledge about the topic of organ donation. and tissue for transplantation. In this understanding, we consider that campaigns should be directed to this age group, in order to clarify that most organs can be donated regardless of chronological age.

It is understood that this clarification is particularly relevant considering that with the increase in the life expectancy of the population, the percentage of potential elderly donors, with expanded donation can become considerably relevant and necessary.

Gender was strongly associated with the intention to donate organs (p-value 0.018). This finding is in line with the results of other studies, where male individuals had a lower prevalence of intention to donate organs. Family occupation and income were also strongly related to the intention to donate organs and tissues.

In the meantime, it is worth noting that low education and socioeconomic status have been referred to as the main factors associated with the lower frequency of intention to donate organs⁽¹⁹⁾.

In the present study, the practice of the Catholic religion was predominant (176; 64.2%), however there

was no statistical significance when compared to other religions (p-value 0.611). It is worth noting that religious reasons are often cited as barriers to organ and tissue donation, although the literature shows that most religions are in favor of organ donation; religiosity and individual culture are also revealed as reasons for not accepting the manipulation of the body, because in the imaginary of these families, when handling it, the donor loses its integrity, becoming deformed and not being able to return it as it came to the world⁽²⁸⁾.

Regarding the means of updating, the internet was more prominent as a source of information, representing 65.4%, which leads to infer that the knowledge of these participants has a tendency to establish more based on research in virtual / online sources, which they are easily accessible, the result of the advent of technological advancement.

When asked to respondents about the existence or not of organ trafficking in Brazil, 332 (85.8%) of these people answered yes, demonstrating the interviewees' distrust in the Brazilian health system.

V. CONCLUSION

From the results, we understand that the most relevant points on the theme were addressed, as well as the research objectives were achieved. The data allowed us to reflect on the intention of the adult population in the city of Belém, State of Pará, Brazil regarding the donation of organs and tissues for transplantation, making a comparison with the results available in the current literature on the factors that interfere in the decision to donate.

Knowing the will of the donor becomes essential, since the family tends to consider it. Failure to understand brain death also significantly interferes with family refusal. Knowing the reasons for the refusal can contribute to support the planning of more effective actions, aiming to promote the donation of organs and tissues, thus collaborating to reduce the waiting list.

This study allows us to conclude that older individuals with less education have less intention to donate their organs. This suggests that the design of the campaigns should target interventions in these groups, sensitizing and educating them about the importance of organ and tissue donation, motivating them to make a conscious decision regarding donation and informing this intention to a family member with autonomy to carry out the authorization.

The lack of information on organ donation and transplantation and all the consequences of lack of knowledge is certainly a limiting factor for the increase in

the number of donors. In order to improve this scenario, it is essential that there be greater investments in campaigns on the topic and effective actions that contribute to the increase in the notification of potential donors, the viability and the use of organs and tissues in order to minimize mortality on the waiting list associated with family refusal rates in Brazil.

In view of the limited number of studies found, we reinforce the need for new research on the topic, with a greater number of participants, using variable methods and assessing the problem from other perspectives, so that the understanding of organ donation and tissues can be expanded.

Finally, the research is of great relevance, as it allowed reflections on the reasons that lead people not to become donors, making this a major concern, since it is necessary for the population to become aware of the importance of the act of donating. In this perspective, it is expected to contribute to the development of new studies, reflections and concerns of professionals who deal daily with family refusals in the presence of a Potential Donor.

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Discrete PI controller applied on a brushless motor with a coupled load

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Abstract—Direct current motors are widely used on the actioning of the electromechanical systems. One of the reasons for that usage is due to the possibility of a precise control of its axis rotation and therefore of the actioning performed by the motor. Due to the important role of that motors, this work presents a study about the control of a direct current motor using the discrete Proportional (P) – Integral (I) control technique, that encompassed: (i) the system dynamics description through differential equation and its equivalent transfer function; (ii) the transfer function discretization; (iii) the project of a discrete PI controller for the system; (iv) the control implementation and experimental tests, considering simulations and the real system; and (v) the comparative analysis of the obtained results. The motor considered in the real experiments is one from Maxon® manufacturer, that is a brushless motor of 12V DC integrated with an encoder of 500 pulses per revolution. An arm was connected to the motor's axis in order to represent the load. For the electronic instrumentation of the system, a data acquisition board from National Instruments, model NI-PCI-6602, was used. The data obtained from that board were processed in the Matlab/Simulink® software, in order to generate the control signal to be sent to the system. The results obtained from the simulations and from the real system show that the used control strategy is appropriate for the presented application. Furthermore, the results also support futures comparative studies, considering other control techniques to be implemented in the system described in this paper.

Keywords—Discrete PI Controller, Instrumentation, Brushless Motor.

I. INTRODUCTION

Direct current (DC) motors are widely used on the actioning of the electromechanical systems. Especially, brushless motors are highlighted due to their better indicators of efficiency, mass/power relation, maintenance cost, lower noises, besides a widely range of operational velocities [1].

A Proportional-Integral (PI) controller consists of a control strategy characterized by the jointly actuation of the Proportional (P) and Integral (I) portions related to the error measured/computed of a process to be controlled.

The tuning step of these controllers is defined by the adjust of the K_p and K_i gains, that correspond to the P and I actions, respectively. In general, while P aims a significant improvement in the control's response time, the

part I aims to meet the prerequisites about the steady-state error that, ideally, should be null [2].

Although the PI controllers have a widely application potential, this paper has its theoretical background inspired on correlated works that consider the brushless motor control. In [3, 4], for example, the mathematical modeling and a PI controller implementation on a brushless motor are presented to show its applicability on electrical cars. A Proportional-Integral-Derivative (PID) controller is designed to control spindle-type electromechanical actuators, that are used on a movement platform of 6 degrees of freedom [5], in which the Derivative (D) term helps it to decrease the overshoot and also the steady-state error. A comparative study between PI and Fuzzy controllers' performance is addressed in [6], where both of them are applied on a DC motor. In [7], PI and PID

controllers are designed. They are discretized by the Zero Order Holder (ZOH), Tustin and zeros and pole mapping methods. The objective in this work was to control the angular velocity of the differential drive of a mobile robot. In all mentioned correlated works, the designed PI and PID controllers met the control requirements of each system, a fact that highlights the promising performance of these control approaches. Other examples considering discrete PID controllers and their variations are shown in [8, 9, 10].

This work presents the project of a discrete PI controller to control a DC motor that has a load connected to its axis. This motor is the main component of a didactical prototype for experiments involving control strategies, available at the Automation Laboratory of the Instituto Federal do Paraná, Jacarezinho, Paraná, Brazil. Moreover, the main steps for the control discretization, that are necessary to its implementation on a digital control hardware, are highlighted. In this way, the main objectives of this work is to validate an appropriate and promising control strategy to problems involving the control of DC motors with coupled load.

The rest of this paper is divided as follows: in Section II the main structural characteristics and functioning of the mentioned didactical prototype is presented, highlighting the DC motor. Moreover, the control objectives are also described in this section; in Section III, the details about the discrete PI controller are described; the results are discussed in Section IV and finally the main conclusions are presented in Section V.

II. PROTOTYPE DESCRIPTION

An overview of the didactical prototype for control experiments is presented in Fig. 1, with a special highlight to the motor, the encoder system and to the load coupled in its axis. Specifically, a brushless motor (12V) manufactured by Maxon® along with an incremental encoder of 500 pulses per revolution are used.

The prototype shown in Fig. 1 can be represented by a Single-Input and Single-Output (SISO) system, in which the controlled variable is the angular position of the load (arm), that it connected to the motor's axis, while the manipulated variable is the voltage applied on the motor. The incremental encoder is used to measure the angular position of the arm. The control objective is to stabilize the arm in a desired angle by means of an adequate voltage level applied on the motor.

A data acquisition board from National Instruments manufacturer, model NI-PCI 6602, is used for the angle acquisition from the encoder and for the control signal

application. The control signal is computed by means of the Matlab/Simulink® software using the desired reference and the current arm angle. After this step, the resulted signal is sent to the motor driver and then the appropriate voltage is applied on the motor.

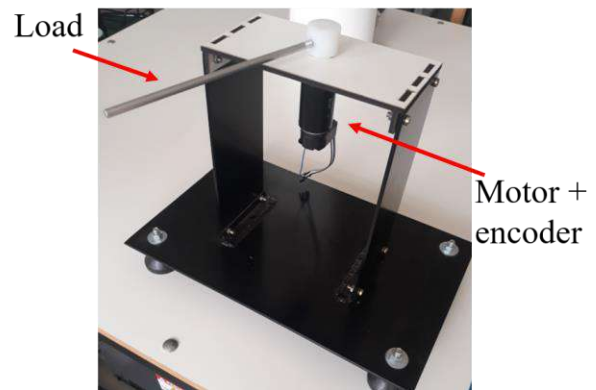


Fig. 1: Didactic prototype for control experiments.

In this work, a PI controller is applied on the described system, according to the block diagram presented in Fig. 2, with the highlights to the prototype (Plant), to the data acquisition system (NI-PCI 6602) and to the software used to the control implementation (Matlab/Simulink®). The details about the project and implementation of the PI controller are presented in the next section.

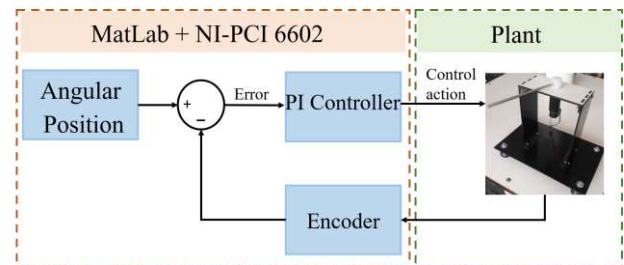


Fig. 2: Control diagram.

III. DISCRETE PI CONTROLLER

Due to its simple implementation, the PI controller is widely used in control systems, mainly fulfilling industrial demands. Different manufacturers of industrial controllers use, basically, variations of the PI control algorithm [1].

Motivated by the constructive simplicity combined with expected satisfactory results, the project of a discrete PI controller is considered in this work, according to the Fig. 2 ("PI Controller" block).

The PI controller in continuous time is defined as [2],

$$u(t) = K_p e(t) + K_i \int_0^t e(\eta) d\eta, \quad (1)$$

in which K_p and K_i are the proportional and integral gains, respectively, and $e(t)$ is the error between the desired reference and the current value of the controlled variable.

In general, a discretization procedure consists of transform a continuous-time signal (analog signal) into a discrete signal, according to the required format (sampling period, quantization, etc) for the computational system. In this sense, the controller can only access the error samples, $e(k.T_s)$, and then it calculates the control signal at the instant $k.T_s$, that is, $u(k.T_s)$, where T_s is the sampling period. The proportional part of the signal $u(t)$ in (1), given by $K_p e(t)$, is computed in discrete time as

$$u_p(k.T_s) = K_p e(k.T_s). \quad (2)$$

However, a special analysis is required to the integral part of the control signal in (1). The Fig. 3 illustrates the integral approximation process (area under the curve) through Euler method. In this case, the area increment is given by the product between the sampling period and the function value at the previous sampling instant. According to this, the following approximation is founded:

$$\int_0^t e(\eta) d\eta \approx \sum_{n=0}^{k-1} T_s e(nT_s) = T_s \sum_{n=0}^{k-1} e(nT_s). \quad (3)$$

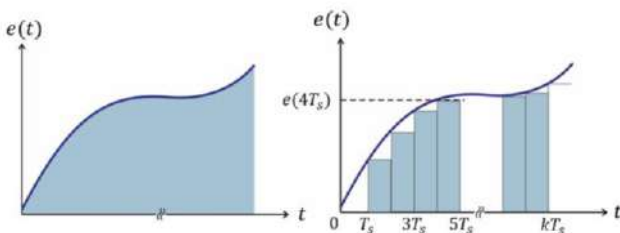


Fig. 3–Integral representation and its approximation through Euler method.

Using (3), the control signal defined in (1), related to the integral part, is computed as

$$u_i(k.T_s) = K_i T_s \sum_{n=0}^{k-1} e(nT_s). \quad (4)$$

Thus, the discrete approximation of the control law (1) can be computed as

$$\begin{aligned} u(t) &\approx u(k.T_s) = u_p(k.T_s) + u_i(k.T_s) \\ &= K_p e(k.T_s) + K_i T_s \sum_{n=0}^{k-1} e(nT_s). \end{aligned} \quad (5)$$

A more efficient way to compute the control signal (5) consists of calculating the increment on the control signal instead of calculating its total value at each instant. For that, consider the increment in the control signal

$$\Delta u(k.T_s) = u(k.T_s) - u((k-1).T_s). \quad (6)$$

From (5) e (6) it follows that

$$\begin{aligned} \Delta u(k.T_s) &= K_p e(k.T_s) + K_i T_s \sum_{n=0}^{k-1} e(nT_s) \\ &\quad - K_p e((k-1).T_s) - K_i T_s \sum_{n=0}^{k-2} e(nT_s) \\ &= K_p [e(k.T_s) - e((k-1).T_s)] \\ &\quad + K_i T_s e((k-1).T_s), \end{aligned} \quad (7)$$

that can be used to compute the control signal. Taking the Z-Transform in (7), with null initial conditions, it is found

$$\begin{aligned} (1 - z^{-1})U(z) &= K_p(1 - z^{-1})E(z) \\ &\quad + K_i T_s z^{-1}E(z) \end{aligned}$$

and then

$$\begin{aligned} \frac{U(z)}{E(z)} &= K_p + K_i T_s \frac{z^{-1}}{(1 - z^{-1})} \\ &= K_p + K_i T_s \frac{1}{z - 1}, \end{aligned} \quad (8)$$

where $U(z)$ is the Z-Transform of the control signal and $E(z)$ is the Z-Transform of the error between the reference and the controlled variable. The Equation (8) describes the transfer function of the discrete PI controller.

Table.1: Parameters of the system.

Parameter	Symbol	Value
Motor's armature resistance	R_a	1.966 Ω
Motor's armature inductance	L_a	0.000424 H
Motor's torque constant	K_m	0.0518 N.m/A
Damping opposing the motor's axis movement	b	2.69e-5 N.m.s/rad
Inertia in the motor's axis	J	1.887e-04 kg.m ²

The controller was designed from the discretized transfer function of the motor system presented in Fig. 1. For that, the parameters presented in Table 1 were considered.

The motor and load dynamic can be described according to the following differential equations [11]:

$$R_a i(t) + L_a \frac{di(t)}{dt} + K_m \frac{d\theta(t)}{dt} = v(t), \quad (9)$$

$$\tau(t) = K_m i(t) = b \frac{d\theta(t)}{dt} + J \frac{d^2\theta(t)}{dt^2}, \quad (10)$$

in which $i(t)$ represents the electric current in the DC motor's armature, $\theta(t)$ is the angle of the motor's axis, $v(t)$ is the voltage applied on the motor, and the other parameter are described in the Table 1.

By some algebraic manipulations in (9) and (10), the dynamic of the motor along with the load is described by the differential equation

$$\frac{d^3\theta(t)}{dt^3} = - \left[\frac{R_a b + K_m^2}{L_a J} \right] \frac{d\theta(t)}{dt} - \left[\frac{R_a J + L_a b}{L_a J} \right] \frac{d^2\theta(t)}{dt^2} + \frac{K_m}{L_a J} v(t). \quad (11)$$

Taking the Laplace Transform in (11), with null initial conditions, it yields

$$\frac{\Theta(s)}{V(s)} = \frac{6.475e5}{s^3 + 4639s^2 + 3.419e4 s}, \quad (12)$$

where $\Theta(s)$ is the Laplace Transform of the angle in the motor's axis, $V(s)$ is the Laplace Transform of the voltage applied on the motor, and the parameter values listed in Table I were already replaced.

Using a Zero Order Holder (ZOH) in the control input, the transfer function (12) was discretized with sampling time of $T_s = 0.02$ s [12], obtaining the transfer function

$$\frac{\Theta(z)}{V(z)} = \frac{0.0261z^2 + 0.0259z}{z^3 - 1.863z^2 + 0.8627z}. \quad (13)$$

Thus, the transfer function (13) was used together with Matlab® in the tuning process of the K_p and K_i gains. The calculated gains for the discrete PI controller are presented in Table 2.

Table 2: Controller's parameters.

K_p	K_i	T_s
0.165	0.115	0.02

For the controller implementation, the software Matlab/Simulink® was used, and the simulation was based on the system transfer function (13) and on the controller transfer function (8).

IV. RESULTS AND DISCUSSION

For the validation of the designed controller and the considered methodology, the control strategy was applied both in simulated experiments and in the real system (prototype shown in Fig. 1), in order to present a comparative study between the results. The experiments consider two distinct cases, named "Case 1" and "Case 2". In the Case 1, a step input (Ref_{step} in Equation (14)) was considered as reference signal. In Case 2, a sinusoidal reference signal (Ref_{sin} in Equation (15)), with a frequency of 0.5 rad/sec, was considered as reference. In (14) and (15) t is the time in seconds.

$$Ref_{step} = \begin{cases} 2\pi, & t \geq 2 \\ 0, & t < 2 \end{cases} \quad (14)$$

$$Ref_{sin} = \begin{cases} \frac{\pi \sin(t/2)}{2}, & t \geq \pi \\ 0, & t < \pi. \end{cases} \quad (15)$$

The results of using the proposed controller in the Case 1 (reference signal (14)) is presented in Fig. 4. Although the real system's response presents an oscillatory characteristic, when it is compared with the simulation's response, in both situations the system's output has stabilized in, approximately, $t = 6.5$ seconds.

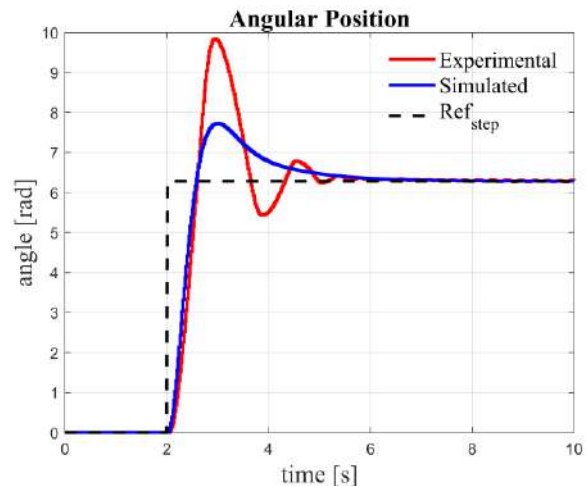


Fig. 4: System's responses with step signal reference of Case 1.

A second analysis of the results of Fig. 4 is about the overshoot part, as summarized in Table 3. It is observed that there is a greater overshoot in the real system.

Probably, these analyzed values can be mitigated with a derivative part inserted in the controller project, or with the application of a more sophisticated tuning method, however more complex. It is noteworthy that this paper reports initial experiments with classical control, which aim the validation of the mathematical model. Obviously, these data suggest other control techniques, such as Fuzzy-PI (intelligent control) for example, can be tested in order to improve the results.

Table.3: Overshoot values for Case 1.

	Maximum value	Overshoot
Experimental	9.795	55.89%
Simulated	7.724	22.93%
Reference	6.283	

Still regarding to the Case 1, the evolution of the angular position's errors along the time is presented in Fig. 5. It is possible to note that the error tends to zero in both situations.

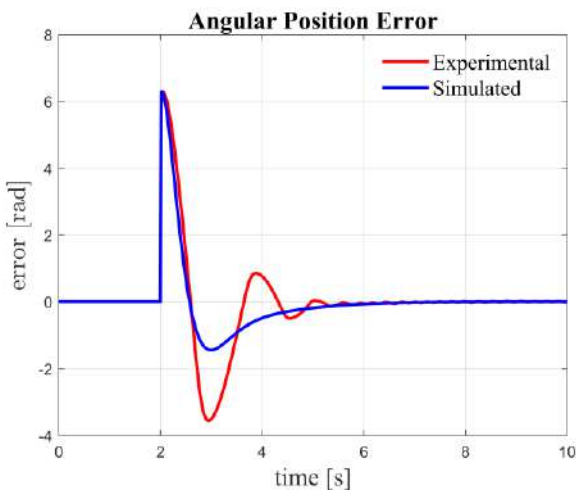


Fig. 5: Angular position's errors for Case 1.

Finally, the control actions (real and simulated) related to the experiments of Case 1 are shown in Fig. 6. It is important to highlight that the motor has a dead zone of 0.27V. This value is compensated in the final control action send to the motor. Moreover, this fact implies an oscillatory response in the real system around the stabilization point.

A similar analysis was addressed considering Case 2 (reference signal in Equation (15)). In this way, the response of the simulation and of the real system experiment is presented in Fig. 7. Although the reference

signal has an oscillatory characteristic, it is possible to observe that the PI controller presented a satisfactory performance in both experiments. However, overshoot still occurs, as shown in Table 4, whose difference between the simulated and the real experiments in this case (30.49%) is practically the same as that found in Table 3 (32.96%).

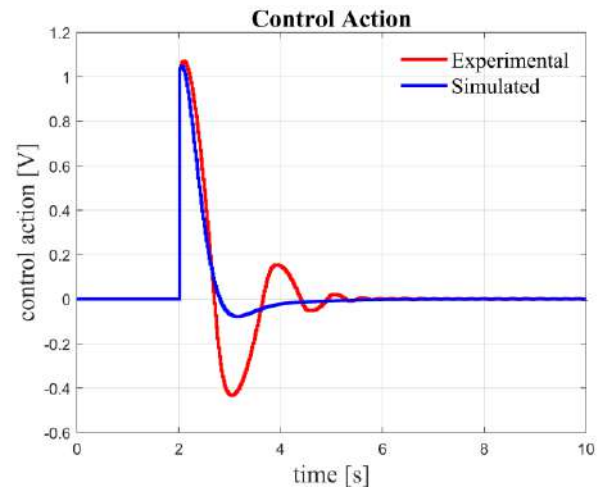


Fig. 6: Control actions for Case 1.

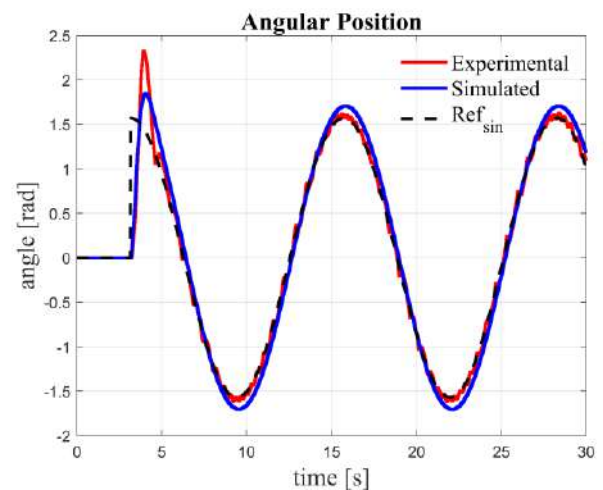


Fig.7: System's responses with sinusoidal reference signal from Case 2.

Table.4: Overshoot values for Case 2.

	Maximum value	Overshoot
Experimental	2.322	47.80%
Simulated	1.843	17.31%
Reference	1.571	

When the system follows the oscillatory characteristic of the reference signal, the experimental result presents a

trajectory error smaller than the simulated results. These values can be verified in Table 5.

Table.5: Trajectory errors for Case 2.

	Maximum amplitude	Trajectory error
Experimental	1.615	2.80%
Simulated	1.705	8.53%
Reference	1.571	

The angular position's errors for Case 2 are presented in Fig. 8, while the respective control actions are shown in Fig. 9.

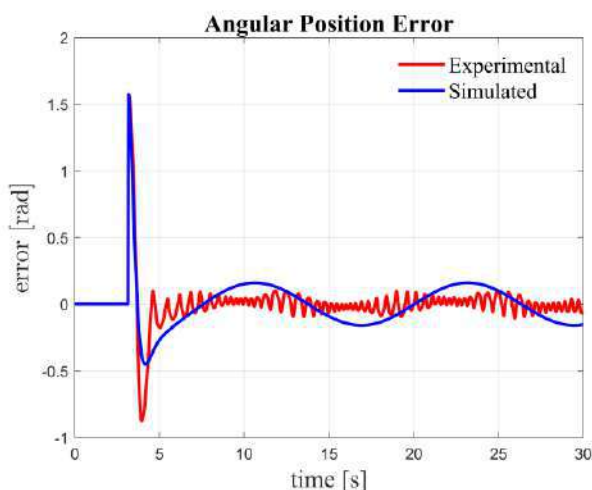


Fig. 8: Angular position's errors for Case 2.

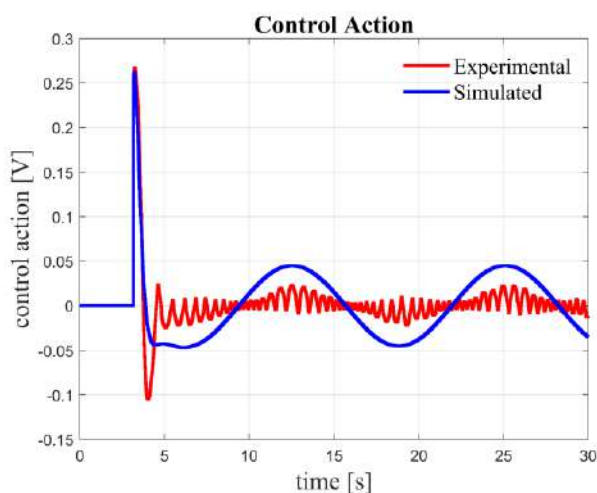


Fig. 9: Control actions for Case 2.

V. CONCLUSION

This work presented the details about the implementation of a discrete PI controller in a real experimental system, which has a set of a DC motor along with an arm (load), aiming to control the angular position of the motor's axis and load.

For the proposed methodology validation, the experimental results of the real system were compared with the simulation results, considering two distinct cases of reference signals (Case 1 and Case 2).

In Case 1, a step input was used and, although overshoot was noticed in all experiments, the proposed controller stabilized the arm (load), that is coupled on the motor's axis, in the desired position. The time indicators were similar in both simulation and real system experiments.

In Case 2, a sinusoidal reference signal was considered, the result from the real system presented a trajectory error smaller than the simulated experiment.

Based on the presented results in both of the analyzed cases, it can be conclude that the designed discrete PI controller was able to control the system's output in order to follow the desired references, leading the error practically to zero. In short, this work fulfilled its objective in the validation of the mathematical model precisely, so that other techniques based on this validated model can be applied.

In future works, we intend to implement other control strategies, as mentioned above, aiming the overshoot reduction and also analyze other performance metrics for the system in closed loop with the PI controller presented in this paper.

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Characterization of Mahua Methyl Ester in DI Diesel Engine

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Abstract— In this work mahua seeds were used to produce vegetable oil because of ease availability and low cost. By using catalytic transesterification vegetable oil extracted from mahua was converted into methyl ester. After that, the chemical and thermal properties of methyl ester was analysed as per ASTM standards. The mahua methyl ester and blends with diesel were analysed to find the performance, emission and combustion characteristics at standard injection pressure of 220bar in stationary Kirloskar AV1 engine. The emission characters like HC, CO and NO_x were analysed using AVL di gas analyser. The smoke was measured using AVL make Hatridge smoke meter. Combustion characteristics were analysed through AVL combustion analyser. From the results B25 methyl ester have the nearly similar performance, emission and combustion characteristics with diesel fuel.

Keywords— Biodiesel, DI diesel engine, Performance, Emission, Combustion.

I. INTRODUCTION

One of the main factors to concern the world economy and politics is the sustainability of petroleum resources, which is the significant source of global energy resource [1]. Though, the world energy demand is increasing faster caused by too much use of fossil fuels. Because of diminution of conventional petro fuel and ever-increasing environmental concern, alternative source like biodiesel has been developed [2, 3]. The history of biodiesel starting with the use of vegetable oils and it was investigated as early as the period when the diesel engine was developed [4]. Rudolf Diesel, the inventor of diesel engine, attempted peanut oil for fuel for his engine. As of early 1900s, vegetable oils were analysed, including castor oil, palm oil and cottonseed oil. Early studies confirmed sufficient performance of vegetable oil as suitable fuel for diesel engines. In the face of biodiesel in diesel engines, it produces some troubles in engine when utilized [5-7]. The neat and blended biodiesel have impact on the engine performance as well as emissions, as it has dissimilar thermal and chemical properties from diesel. Further research is necessitated to expose further regarding the properties of biodiesel produced from catalytic transesterification and their consequences on the combustion and the fuel injection system. Many researchers found that the biodiesel may have used in the diesel engines without any modification [8-10]. Even if numerous advantages can be attained with the use of

biodiesel, a small number of its intrinsic properties like density and viscosity are designate to improve. Later studies have exposed that increasing the biodiesel blend ratios and as a result of density and viscosity, can lead to poor atomization of the injected fuel with air [11]. The results are ever-increasing in the average droplet size of the sprayed fuel and the fuel breakup time. In this work, biodiesel was produced using catalytic transesterification from mahua oil and tested its blend in DI diesel engine.

II. MAHUA BIODIESEL PREPARATION AND PROPERTY ANALYSIS

The process of catalytic transesterification to synthesis biodiesel requires an alcohol and catalyst wherein, the triglycerides with larger molecules are broken into mono glyceride and esters. In the work, the extracted mahua seed oil was transesterified using potassium hydroxide and methanol to produce mahua methyl ester [12]. For synthesizing one litre of methyl ester 180ml of methanol and 8g of KOH was used for the conversion process. The formed glycerol has been drained out and the left out methyl ester was washed with distilled water to take away the impurities and the remaining glycerol. Afterwards, the mahua methyl ester is heated up to 90°C to remove the traces of water present in the final product. Finally, the fuel properties were analysed as per ASTM standard methods and tabulated in the Table 1. After the

catalytic transesterification the thermo physical properties of mahua methyl ester were analysed and compared with biodiesel standards. The mahua methyl ester properties reveal that the raw mahua seed oil has higher viscosity, which does not support its direct use in diesel engine.

Therefore, it is essential to transesterify the extracted mahua seed oil to reduce its viscosity, and get it to the tolerable biodiesel standard so as to create it possible for diesel engine operation. The schematic diagram of transesterification plant is shown in Figure 1.

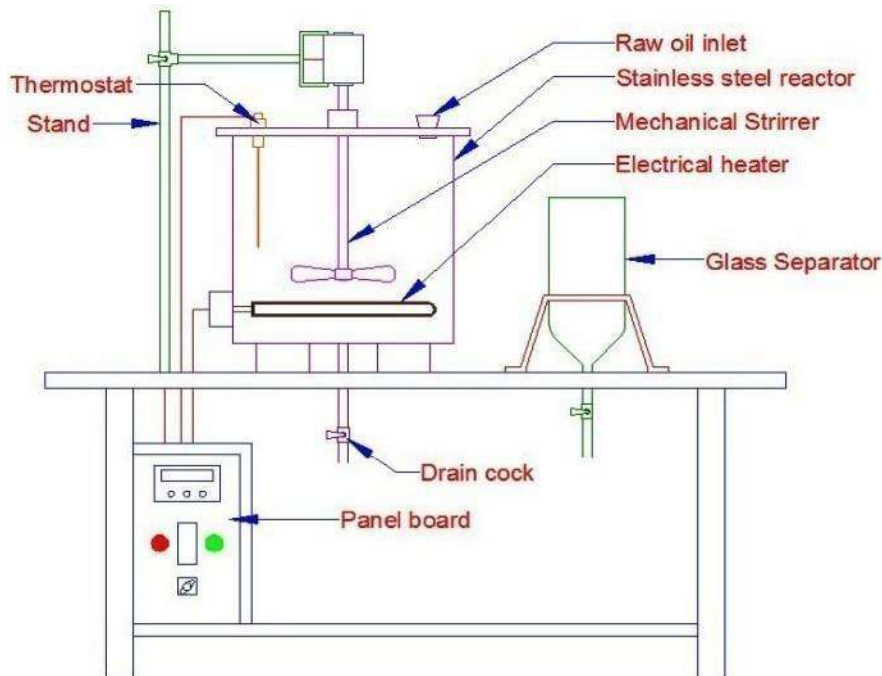


Fig.1: schematic diagram of transesterification plant

Properties	B100	B25	Diesel
Specific gravity	0.8614	0.8403	0.83
Kinematic viscosity in cst	4.23	3.71	3.6
Flash point	143°C	83°C	74°C
Fire point	153°C	89°C	84°C
Gross calorific value in KJ/kg	42220	42510	42700
Pour point	< -9°C	< -12°C	< -23°C
Density in kg/m3	871	831	822

III. EXPERIMENTAL SETUP

The experimental investigations were carried out in Kirloskar AV-I diesel engine. A stationary four stroke single cylinder water cooled engine with brake power of 3.7 kW at constant of 1500 rpm was employed in this work. The test engine was connected to an eddy current dynamometer with control systems. The test engine is also

furnished with crank angle encoder sensor and piezo electric type in-cylinder pressure sensor. AVL made Di-gas analyzer was employed to analysis the emissions like CO, HC and NOx from the exhaust gas. AVL Hatridge type smoke meter was employed to the measure the smoke density from the engine exhaust gas. The schematic view of the test engine was shown in the Figure 2.

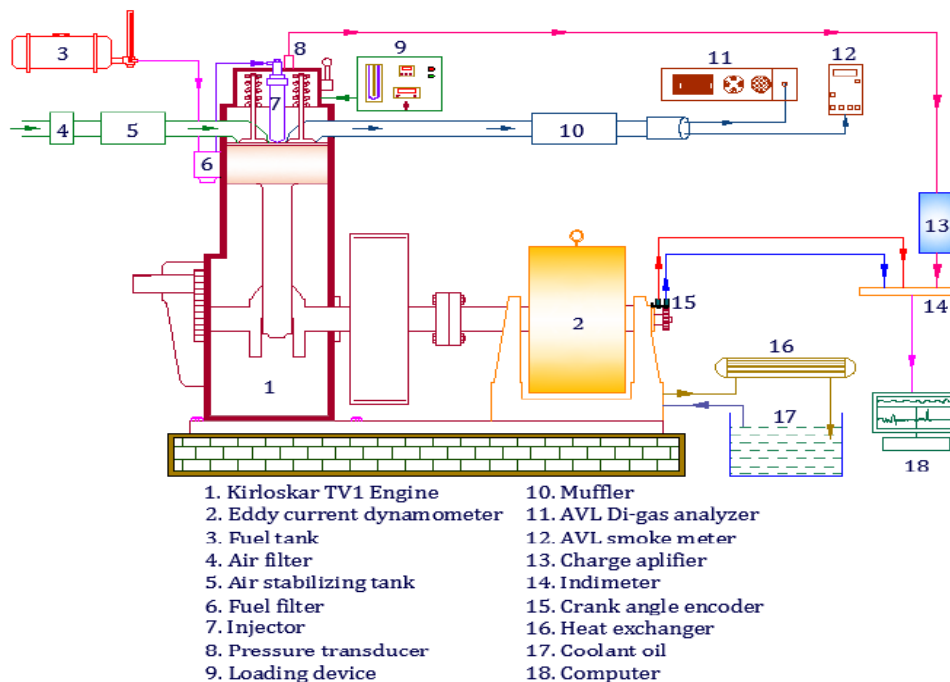


Fig.2: Schematic view of the test engine

IV. RESULTS AND DISCUSSION

The experiment is carried out in the single cylinder, four stroke, water cooled diesel engine. The experiments were conducted with neat diesel fuel and with mahua biodiesel and its biodiesel blends. Test engine was found smooth throughout the experiments with mahua biodiesel and its blends.

4.1 PERFORMANCE CHARACTERISTICS

Figure 3 shows the effect of mahua methyl ester on Brake thermal efficiency with respect to brake power. From the data obtained, it is found radical changes in brake thermal efficiency at different Brake powers among

mahua methyl ester and its blends. These radical changes happened because of difference in thermal and physical properties of mahua methyl ester and its blends with respect to diesel. Higher density and viscosity as compared to diesel fuels leads to the lower BTE in the case of neat mahua methyl ester (B100). It is clear from the figure, brake thermal efficiency increases with respect to increase of brake power. The brake thermal efficiency in the case of B100 is much higher than the neat diesel. In the case of B20, it shows the nearer value to the diesel fuel. The BTE was found to 23% and 25.3% in the cases of B20 and B100 mahua biodiesel blends.

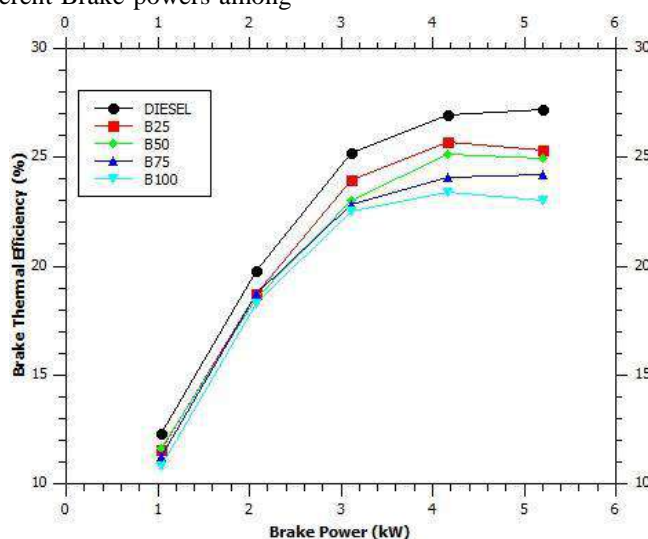


Fig.3: Brake thermal efficiency against brake power

4.2 EMISSION CHARACTERISTICS

Figure 4 shows the effect of mahua methyl ester on NO_x emission with brake power for various blends. NO_x emission is happened through chain reactions concerning nitrogen and oxygen present in the ambient air. These retorts depend particularly on temperature take place during combustion. So the diesel engines drive with the excess air. The oxides of nitrogen are a function of residence time and combustion temperature. In several

studies, it was seen that the NO_x emission varied with respect to the engine load and the comparable results were attained in this study also [13,14]. For the mahua biodiesel (B100) the NO_x was significantly lower than that of diesel. The NO_x showed lower when the mahua biodiesel blends were increased. The NO_x emission of mahua biodiesel blend (B25) biodiesel blend shows the nearer value with the diesel fuel.

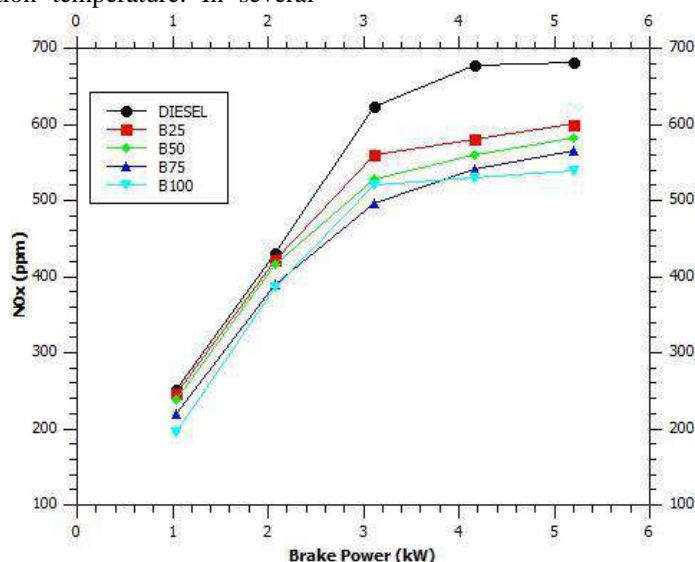


Fig.4: NO_x emission against brake power

Figure 5 revealed that there is a significant hike in the HC emission with blends of mahua biodiesel compared to diesel. The higher density and lower flash & fire point may be the reasons for this hike in HC emission in the cases of mahua biodiesel blend. The lower temperature in combustion chamber due to poor atomization prevents the condensation of the heaviest hydrocarbons in the sampling

line, advising suitable conditions for HC analysis. From the figure, it is clear that the HC emission for the case of mahua biodiesel (B100) higher than the all fuel blends. The HC emission was significantly increased with the increase the percentage of mahua biodiesel in diesel. The least HC emission was found in the case of B25 at full load condition.

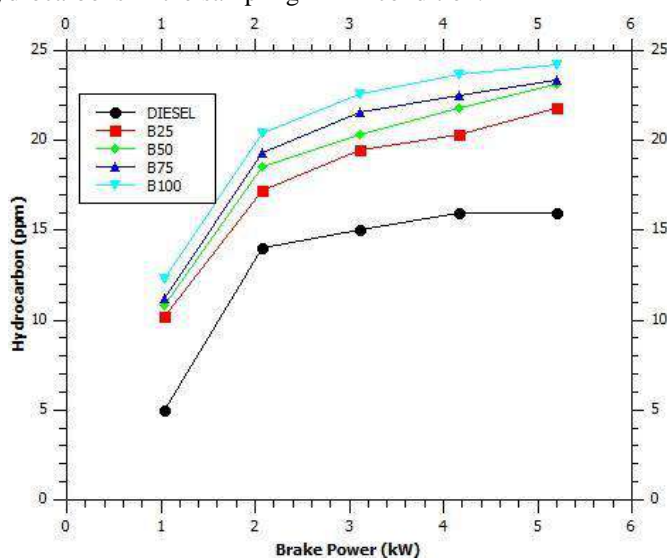


Fig.5: Hydrocarbon emission against brake power

Figure 6 revealed of the variation smoke density with brake power. The smoke density for mahua biodiesel and their blends are found higher than that of the diesel. Higher density and viscosity of the mahua biodiesel leads to poor and incomplete combustion of fuel, i.e. significant quantity of hydrocarbons present in the exhaust gases, which may results in higher smoke opacity. The smoke

emission was found 55HSU for B100 mahua biodiesel and it was 43HSU for diesel. Whereas smoke was found 48HSU for B25 mahua fuel blend which is nearer to diesel fuel when compared with other mahua biodiesel blends. As the higher density and lower calorific value of mahua diesel, larger fractions of the fuel carbon are not converted to CO, which results in soot formation.

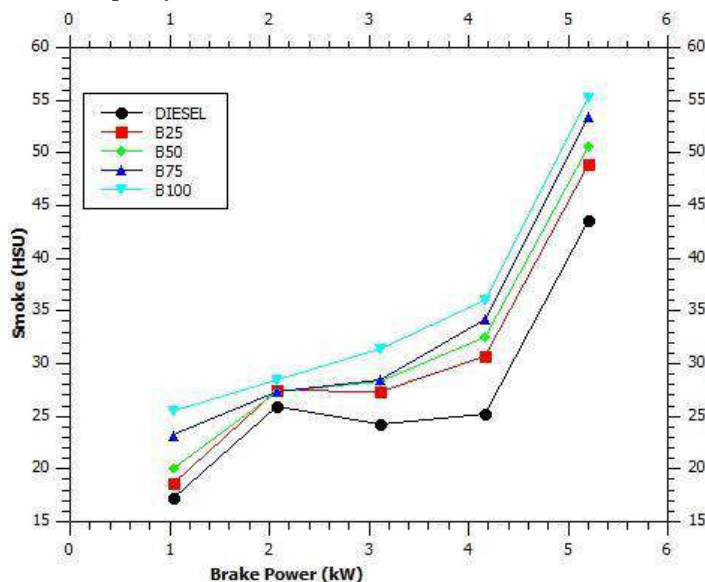


Fig.6: Smoke against brake power

4.3 COMBUSTION CHARACTERISTICS

Figure 7 shows the variant of in-cylinder pressure with engine crank angle. From the figure, it is reveal that peak in-cylinder pressure is significantly decreased with the increase of mahua biodiesel with diesel fuel. The in-cylinder pressure of a diesel engine probably depends on the quantity of fuel accrued in the fuel combustion delay

period and the rate of combustion in the premixed combustion phase [15]. The reason for the significantly decrease of in-cylinder pressure for mahua biodiesel and its blends may be due to poor evaporation and mixing. The peak in-cylinder pressure was 61bar in the neat diesel and whereas 58.3bar in the case of B100.

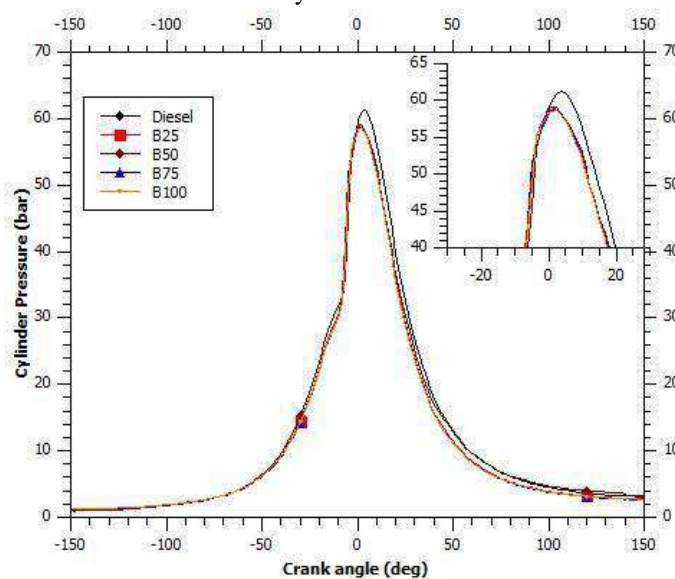


Fig.7: Cylinder pressure against crank angle

Figure 8 shows the variant of heat release rate (HRR) with engine crank angle. The peak HRR in the premixed combustion depends on the both physical and chemical delay periods, formation of air-fuel mixture and the rate of combustion [15]. From these results, it is understandable that the HRR of mahua biodiesel and its blends is lesser than that of diesel. This because of a longer

ignition delay exhibited by mahua biodiesel and its blends and tends the air-fuel blend to accrue in the combustion chamber. The poor atomization and lower calorific value of mahua biodiesel and its blends makes the heat release rate to decrease rapidly. The heat release rate of mahua biodiesel was found 117.3J/deg and it was 123.4 J/deg.

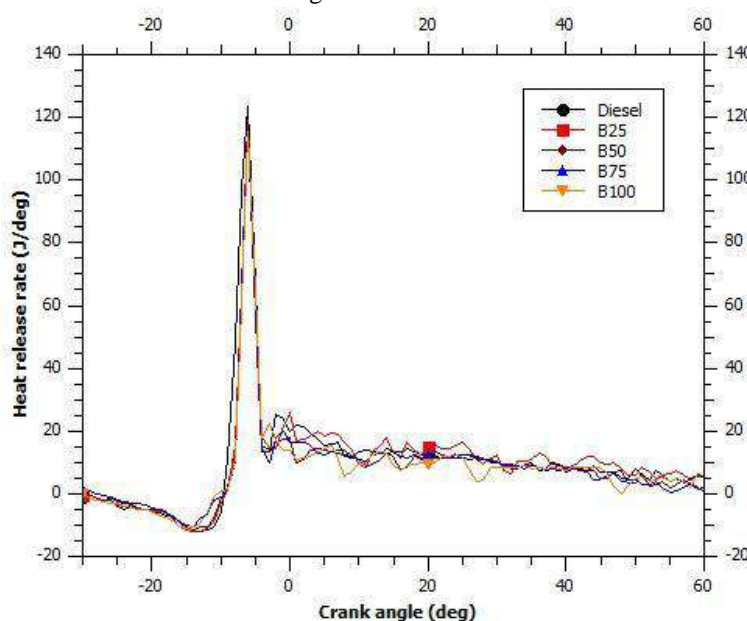


Fig.8: Heat release rate against crank angle

V. CONCLUSION

The mahua biodiesel and its blends are analysed in diesel engine and the performance, emission and combustion characteristics are assessed and compared with diesel fuel. From the above discussion, the following conclusions are been drawn.

- Brake thermal efficiency is found low for mahua biodiesel and its blends compared with diesel. For B25 mahua biodiesel blend had nearer BTE when compared with. Standard fuel.
- From emission results, it is found that mahua biodiesel blend increases HC, CO and smoke emissions.
- NO_x reduces considerably when compared to diesel.
- The present investigational results show that mahua methyl ester and its blends can be used as an alternative fuel in diesel engine.

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The military police in the municipality of Camboriú: An evaluation in the perspective of the social actors involved

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Abstract— *The State of Santa Catarina has presented, each year, higher rates of violence. Aiming to contain the increasing episodes of public insecurity, the State has invested more and more in this area of governmental action. In this sense, this article has as general objective to verify how the social actors involved with Public Security, acting in the Military Police, evaluate their activities carried out in the city of Camboriú, Santa Catarina. At the outset, the topic of violence in the country was summarized, starting with an understanding of the reality experienced in the State of Santa Catarina and in the city of Camboriú. The Public Security Institutions and the duties of the Military Police were also presented on the basis of the state constitution. The research methodology used was the Case Study and as a technique, the interview was open to the social actors involved directly and indirectly with the Public Safety in the city, as well as to the users of the public service of Public Security in Camboriú. Among the conclusions, highlight the lack of cash and investments in the Military Police of Santa Catarina.*

Keywords— *Violence, Camboriú, Public security, Public service, Military police.*

I. INTRODUCTION

To promote Public Security is to favor society a condition of preserved rights, especially in relation to the protection of life and the feeling of social well-being. The country has not reached satisfactory levels in the area of Public Security for almost two decades. Between 2001 and 2017, the federal government launched four national public security plans [1]. The last of them, the National Public Security Plan, launched in 2017, aims, among other actions, to reduce femicide, intentional homicides, integrated arms and drug trafficking and violence against women [1].

In the country, 58 thousand intentional homicides are registered per year, those with intent to kill. In addition, the lack of punishment for criminals reaches 92%, as only 8% of crimes are investigated, that is, the vast majority of crimes remain without due punishment. [2]

In comparison with the other states of the federation, Santa Catarina appears on the Map of Violence, in a study aimed at identifying the number of homicides by firearms

in Brazil, as a state of positive prominence in the area of Public Security, as it occupies the last position, 27th. [3]. However, being in this position among Brazilian states is far from meaning that the population of Santa Catarina feels safe and satisfied with the current state of public security in the state. According to data from the Santa Catarina Public Security Secretariat [4], there was a 9.7% increase in the homicide rate from 2016 to 2017, there were 981 homicides in 2017 against 894 in 2016, a significant increase from 87 lives lost to violence.

Given the concerned position occupied in the context of security, Santa Catarina needs to invest more in this area in order to expand services. And according to the Transparency Portal and in 2015, for example, have been around for 2.5 billion in the area of Public Security; In 2016, spending remained at the same level. Of the amounts spent on Public Security in 2016, 71.68% were earmarked for the payment of personnel and social charges, 25.47% for maintenance and services and 2.85% for other investments [5]. The state is seeking

to combat an enemy called public insecurity and only remains in a "positive" scale compared to other Brazilian states, as shown in Map of Violence of 2016, because it is increasingly investing in the state Public Safety.

The Military Police, as a military institution, acts only in the fight against stigmatized criminals, and in most cases, arrests the marginalized of society, and works for the containment of "dangerous classes" [6]. The state Civil Police face serious problems such as lack of staff and investments and the competitions held only serve to fill the existing gap left by police officers who ask for retirement.

In addition, the Military Police (PM) also suffers from a shortage of personnel. According to a survey conducted by the news *site* UOL, in 2017, the country had an average of 430 thousand military personnel, when this number should reach 600 thousand, that is, a deficit of 170 thousand Military Police. The report also states that twenty-five States of the Federation do not have the minimum number of Military Police officers required by state laws. The State of Santa Catarina has about 12 thousand military police, 8,084 less than expected, which is 19,962 soldiers, which means that it reaches only 59.5% of the ideal [7].

Therefore, in view of the lack of personnel and other problems, this research aimed at the performance of the Military Police of the State of Santa Catarina, with a specific focus on the municipality of Camboriú. The general objective was to verify how the social actors involved with Public Security evaluate the activities carried out in the city of Camboriú.

The first part of the research explores the theme of violence in the country, in the State of Santa Catarina and in the municipality of Camboriú, presenting and clarifying the need for a critical look at the issue of violence in the indicated places. The second analyzes the constitutional function envisaged for each of the Public Security forces, based on the constitution of the State of Santa Catarina. The changes in institutions through constitutional amendments were also highlighted. Em then was made a brief history of the establishment of the Military Police of the State of Santa Catarina, and its peculiarities with respect to hierarchy and discipline. Concrete data were also presented, provided by the corporation itself, on the current composition of the Military Police.

Then, through the methodology, the methods used to achieve the research objectives were revealed, namely, the Bibliographic and Case Study methods [8], being a qualitative-descriptive type of research. As a research technique, open interviews were carried out, applied to the actors directly linked to Public Security in the Municipality

of Camboriú and to the users of public services in the researched area, which allowed a later evaluation on the Public Security model offered to the population of Santa Catarina, who lives in that city. Region of the state.

Afterwards, the responses of the interviewees regarding Security issues in the city of Camboriú were presented and analyzed. Therefore, this part was composed of investigations and analysis of data obtained from the evaluation of municipal public security from the perspective of the actors involved (directly and indirectly).

II. VIOLENCE IN THE STATE OF SANTA CATARINA AND IN THE MUNICIPALITY OF CAMBORIÚ

Brazilian considers m Violence one of the main problems of the country, next to Health [9]. The data were released by Datafolha and refer to the year 2018. Health and Violence appear with 23% and 20% in the ranking of concern prepared by the newspaper. For their own training and social structure, which are present in the same context, the ruling classes, marginalized classes, different ethnic groups and beliefs [1 0], Brazil faces serious problems in the area of Public Security. Furthermore, in order to stem the tide of crime, it often uses police forces, instead of investing in education and generating decent jobs for the people. To give you an idea, in the 1980s, the country accounted for 8,710 homicides by firearm, and in 2014, this number rose to 44,861, that is, in less than four decades, the number of homicides in the country is five times higher. [3].

In Santa Catarina (SC), the reality is not much different. According to the Map of Violence of 2016, although the state's position has fallen in relation to homicides by firearms in comparison to the other states of the country (25th position in 2000 para 27 in 2014), SC grew in homicide rates for every 100 thousand inhabitants. In 2004, the percentage was 6.6% for every 100 thousand inhabitants, in 2016, after twelve years, this number doubled, and the proportion reached 13.7% for every 100 thousand inhabitants.

The capital of Santa Catarina occupied a prominent place in relation to homicide rates among Brazilian municipalities. Florianópolis was placed among the 200 cities that in 2006 had the highest homicide rates in the country. The survey also listed 200 municipalities with the highest number of homicides by firearms. In this list, four municipalities from Santa Catarina were present: Florianópolis in 54th position, Itajaí in 128th, Joinville in 139th and, finally, São José in 147th position. [1 1].

Um study published in the Journal of Public Security, held in six municipalities of Santa Catarina sought to identify the perceptions fear and crime in Santa Catarina, with the participation of 666 subjects. He discussed issues such as: fear of having the house broken into; fear of having your vehicle stolen; concern about drugs related to criminal incidents; concern with theft in the streets, among others. In this panorama, we concluded that citizens are concerned with security personnel and risks in various situations, especially in the circumstances of criminal order and, in an attempt to reduce exposure to threats, seek formula r strategies for the security, avoiding situations of greater risk. [1 2].

The survey results reveal yet, the dichotomy of Santa Catarina be posicionad a favorable situation compared to the other states of the federation and the reality experienced by the people of Santa Catarina to violence that, long ago, has been part of everyday life. The city of Camboriú is an example of this situation. Colonizada the second decade of the nineteenth century (1820), at p lish Balthazar Pinto Correa, has a population of 78,731 inhabitants, demographic 212.320 square kilometers of land area (2015) and density of 293.68 hab./km². [1 3]

Even without appearing among the Santa Catarina municipalities listed by the Map of Violence, the city has worrying rates. In 2012, it was considered by the State government as one of the five most violent cities in Santa Catarina due to the growing number of homicides, totaling thirty-six in the year evaluated. [1 4]

To the General Commander of the Military Police, Colonel Paulo Henrique Hemm, "The s laws are ineffective, the sist ema is bankrupt" and statistics of Pol e Militar cia show that out of every ten prisoners, eight are repeat offenders, of which the average time in prison is 294 days. The fact that many who are released soon are rearrested for other offenses and this hinders the motivation of the Military Police for the service, which are today, almost exclusively, exerting repressive function, and contrary to the precepts of mission PM, which is the carrying out of preventive work, aiming to prevent the occurrence of crimes, observes the colonel. [1 5].

The violence on the rise in the state of Santa Catarina is directly linked to the migration of gangs from states with high rates of crime, such as Rio de Janeiro and São Paulo. N the Monte Alegre district, in Camboriú (SC), a place with a high crime rate, and found that the neighborhood is a "breeding ground for crime that is not native". The data presented are about the state of Santa Catarina, and especially with respect to the city of

Camboriú, is of utmost importance to conducting studies and reflections on the role of military police in the city. [1 6].

III. PUBLIC SECURITY IN SANTA CATARINA

In the state of Santa Catarina, Segurity Public constitutes instituição four distinct s, n provided for the Article 105 of the State Constitution (1989) [1 7]:

Art.105 Public security, the duty of the State, the right and responsibility of all, is exercised for the preservation of public order and the safety of people and property, through the following bodies:

- I. Civil Police;
- II. Military Police;
- III. Military Fire Brigade;
- IV-General Institute of Expertise.

The Civil Police are directed by career delegates and have, in addition to the functions provided for in CRFB / 88, the duties included in the State Constitution for the execution of administrative traffic services, supervision of private security services, control of property and use of weapons, ammunition, explosives and other controlled products, in addition to the inspection of games and public entertainment. [1 7].

The Military Police is a permanent body, reserve and auxiliary force of the Army, organized based on hierarchy and discipline, commanded by an active officer of the last rank of the corporation, and subordinated to the State Governor [1 7]. Also in accordance with the Constitution of the State of Santa Catarina, the Military Police are responsible, within the limits of their competence, in addition to other duties established by law:

- a) To exercise ostensive policing related to the preservation of order and Public Security;
- b) Land, air, lake and river patrol radio, road patrol;
- c) Guarding and inspecting forests and water sources;
- d) Guarding and supervising urban traffic;
- e) The military judicial police, under the terms of federal law;
- f) The protection of the environment, and the guarantee of the exercise of police power by public bodies and entities, especially in the area

of agriculture, sanitation, environmental protection, use and occupation of land and cultural heritage;

g) Cooperate with civil defense bodies;

h) To act preventively as a deterrent and repressively, to restore public order. [17].

In the grounds of and recommends constitutional No. 33, enacted on June 13, 2003, the Military Firefighters Corps became an independent institution of the Military Police. However, the two institutions together form the group of state military personnel, and have identical backgrounds, since they constitute an auxiliary force and reserve of the army, organized based on discipline and hierarchy.

The CONSTITUTION the State of Santa Catarina also provides numerous activities to the Military Firefighters Corps. However, some activities stand out in the corporation, such as the completion of loss prevention or disaster services, fighting the fire, search and rescue of people and goods and pre-hospital care. [17].

Another body that achieved its independence, detaching itself from the Civil Police recently, was the General Institute of Experts (IGP), created on 01/31/2005, through the promulgation of Constitutional Amendment nº 39 that altered the Constitution of the State of Santa Catarina. The IGP received functional and administrative autonomy and became directly linked to the Public Security Secretariat. The IGP is responsible for carrying out criminal investigations, civil and criminal identification services, and research and development of studies in this area.

3.1 The Military Police of Santa Catarina

According to information obtained through the website of the Military Police of Santa Catarina, the corporation was created by Provincial Law No. 12, of 05 of May de 1835. Named first of Force Officer, served just the village of Our Lady of Exile, today Florianópolis. Possuía the mission to maintain public order and tranquility and, also, meet the requests of judicial and police authorities. He worked with the Brazilian Army, repelling external aggressions and defending the homeland's unity, such as the Farrapos War and the Paraguayan War.

Law No. 6,218, of 1983, provides for the status of the Military Police of the State of Santa Catarina. According to art. 14 of the aforementioned bylaws, hierarchy and discipline are the institutional basis of the corporation, and authority and responsibility grow with the hierarchical degree. Regarding the hierarchy, art. 16 of Law 6.218 / 93 explains that post is the rank of the Officer, conferred by

the Governor of the State act and confirmed in Letter Patent, and graduation is the degree hierarchical d the pr steely, given by Commander of the Military Police General. [18].

In order to provide further details, a table for vertical scheduling, rank or graduation according to Law No. 5,645, of November 30, 1979, is shown below:

Table 1 - Vertical Scaling - rank or

1. Oficiais superiores
Colonel PM
Lieutenant Colonel PM
Major PM
2. Intermediate officers
Captain PM
3. Official underlings
1st Lieutenant PM
2nd Lieutenant PM
4. Special squares
Aspirante-a-Oficial PM of the 3rd year
1st and 2nd year PM student at EsFO
5. Graduated squares
Warrant Officer PM.
1st Sergeant PM
2nd Sergeant PM
3rd Sergeant PM
PM cable
6. Graduated squares
PM soldier

With regard to the assignments provided for each of the military careers, the Military Police is based on the Internal Regulation and General Services R-1 (RISG), originally from the Ministry of Defense and the Brazilian Army. As provided in art. 1st, the RISG: [...] prescribes everything that relates to the internal life and the general services of the units considered to be troop bodies, establishing rules regarding the attributions, responsibilities and the exercise of the functions of its members. Following is the explanatory table with some of the attributions provided for in the regulatory provision:

Table 2 - Careers of the Military Police of Santa Catarina

Career	Assignments
1. Official Commanders	1. - Planning, coordination, execution and evaluation. - Educate their commanded soldiers militarily, guiding them towards the fulfillment of duty, always taking inspiration from justice, both to punish and to reward.
2.Subalterns	2. - Lieutenants, during the first two years of service in this post, must be classified as subordinate US officers , not being diverted to other functions, not even within the unit itself; however, they will compete for temporary substitutions that are theirs. 3. - The on-official-priming exercise the functions inherent to the junior officers with similar powers and duties, subject to the restrictions laid down in laws, regulations and specific instructions.
3.Aspirants-to-Officer (art. 110 RISG)	
Sergeants (art. 115 RISG)	- Sergeants are assistants to the Commander and SU officers in education, instruction, discipline and administration, and they are also responsible for ensuring the uninterrupted observance of current orders, earning the confidence of their bosses and the esteem and respect of their subordinates.
Cables (art. 128 RISG)	- Assist in the instruction of the troop element that competes or is entrusted to them.

	<ul style="list-style-type: none"> - Report to your direct Commander the occurrences that occur with the personnel in charge. - Command the troop element that regularly competes or is entrusted to them. - To remain in a position to replace, eventually, the 3rd Sgt, in the instruction and services. - Comply, strictly, with accident prevention rules in instruction and risky activities.
Soldier (art. 129 RISG)	<ul style="list-style-type: none"> - The soldier is the essential element of execution and he, like all soldiers, has, as primary attributes of his noble mission, the duty to: <ul style="list-style-type: none"> - Guide conduct by faithful compliance with regulatory orders and provisions. - Show yourself worthy of the uniform you wear. - Maintain respect and obedience to your bosses. - The cult of fraternal camaraderie towards the companions. - Dexterity in using the weaponry that is intended for you and the care with the material that is delivered to you. - The cleanliness of the body and the uniforms. - Dedication for service and love of unity. - Conscious submission to disciplinary rules.

Source: Internal Regulations and General Services, Ministry of Defense.

The Military Police of Santa Catarina, in addition to the ostensive policing known to all, also provides services through specialized units. They are: Environmental Military Police (BPMA), the Special

Assembly of the Mounted Military Police (GuEspMMon), also known as Cavalry, and the Special Operations Battalion (Bope), which acts in situations of high and extremely high risks, as in cases involving explosives. Ordinance 501, of October 25, 2005, made all Tactical Patrol Platoons (PPTs), which act directly in the day-to-day activities of the municipalities, subordinated to the techniques and doctrines of BOPE.

Aiming to draw a general picture of the Military Police of Santa Catarina, requested If the General Command someone but information important the corporation. According to data provided by the General Command of the Military Police of Santa Catarina (letter 616 / Cmdo -G / 2017), the institution currently has 11,000 active military officers, 671 in the career of officers, and 10,329 squares. Also according to the General Command (letter 616 / Cmdo -G / 2017), the Military Police is divided into 11 regions, has 34 Battalions, 107 Companies, 179 Platoons, and 235 Groups.

In the city of Camboriú, the Military Police is constituted by the 1st Military Police Company (Cia PM), subordinate to the 12th Military Police Battalion (BPM), based in Balneário Camboriú. In accordance with the information provided by the 1st Military Police Company (Official Letter 634 / CMDO / 17), the Military Police in the city of Camboriú has two officers and forty-nine squares. Of these, forty-one police officers make a stopover, in the form of ostensive patrol radio, mobile tactics and school safety net. In addition, the Military Police of s t and municipality have eleven vehicles, two motorcycles and a van.

IV. METHODOLOGY

The research aimed to verify how the social actors, involved with Public Security, evaluate the activities of the Military Police carried out in the city of Camboriú. To do so, he used the inductive research method, one that starts from particular data to infer a general truth, leading to "[...] conclusions whose content is much broader than the premises on which they were based" [8]. This is because, although it provides a brief explanation of the theme of violence in the country, in the State of Santa Catarina and in the municipality of Camboriú, based on the general understanding of Public Security in Santa Catarina, the specific analysis of the work developed by the Military Police was sought. From the State of Santa Catarina, based on the perspective of the actors involved in the municipality of Camboriú. [8].

The research method chosen was the Case Study, as it aims to understand the individual and collective

phenomena of the institution and the actors involved in the Public Security policy. Therefore, it was a qualitative-descriptive research, formalizing and at the same time preserving reality [19]. In this type of study, the researcher must carry out a relationship between phenomenon, fact or observed environment. [8]

In the theoretical framework, bibliographic research was used in order to conduct a literature review on the subject studied. For this, the researcher went through the bibliographic research phases of: identification of the topic to be studied, selection of material, preparation of records, analysis and interpretation of the selected material, and, finally, the writing, which is characterized by exteriorization and materialization bibliographic research. [8].

With regard to the research technique, open interviews were conducted, for which the researcher followed an established script of questions addressed to the actors directly involved with Public Security in the municipality. In addition, there was ten people in the population of Camboriú that have been requesting the service s service s of Public Safety d the city, through the registration of police reports.

In the open interview, the researcher leaves room for the interviewee to talk more about the subjects covered. Regarding the advantages of the interview technique, it is one of the most used procedures in field research, since it allows the collection of both qualitative and quantitative data, in addition to being an excellent instrument for understanding certain human behaviors. [19]. The interviews were conducted with two different groups. Group 01, social actors active in Public Security and in Group 02, residents of the municipality of Camboriú.

Group 01: Interview com squares of the Police Military and Official of the Police Military of Camboriú.

Group 0 2: Interview with ten people from the population of Camboriú who needed assistance from the Public Security service in the municipality.

With the application of these techniques, the research analyzed how the social actors involved with Public Security evaluate the activities carried out in the city of Camboriú. The n addition that, they were able to discuss the efficienc CFIA Public Policy applied to the area of public security in the city.

V. ANALYSIS OF PUBLIC SECURITY ACTIVITIES CARRIED OUT BY THE MILITARY POLICE IN CAMBORIÚ

5.1 Perception of the Squares and the Camboriú Military Police Officer

In this research item, two soldiers and an Officer, who commands the Military Police in Camboriú, were interviewed. The questions were addressed to the social actors working in Public Security, according to the role they play in the corporation. The soldiers, the plained - the following question: **What**

are the main difficulties encountered pe la Police Military in Camboriu?

Soldier 1: Currently, I see as the main difficulty, the demand for service due to our **low staff** (emphasis added). This makes our response time, our service to the population, very difficult. So I believe that, among some, today I can highlight this point [...].

Soldier 2: In my understanding, the biggest difficulty is the question of money, right? **Difficulty in defraying expenses** (emphasis added) such as vehicle maintenance, improvements to the barracks, improving equipment, improving the equipment of the police, boots, weaponry, so I think it is more financial.

The responses were not unanimous with regard to the main difficulty. While the first interviewee cited the lack of staff at the expense of the amount of service, the second interviewee highlighted the lack of resources for the materials used in the basic activities inherent to the position. It can be seen that the two problems are enfrentad the s jointly by officers of the corporation. The s issue s Wreath in valuing professionals and security conditions, including the population that is in situations of risk by the difficulty of care.

Following the work, we conducted an interview with the Military Police Officer in the city of Camboriú, who already holds the rank of Captain within the corporation, which demonstrates great experience, due to the length of service, of the professional in the area of security public.

P question first: **What are the main difficulties encountered pe la Military Police in Camboriu?**

Official PMSC: Well, dificu ldade we face, and I think all police es as currently facing, is the **lack of effective** (emphasis added). It is a national problem, right, due to lack of staff, all states have a very large *deficit*. So I think this is our biggest challenge here in Camboriú. I also think, even before I spoke, but I repeat, effective delivery of Pu Security service Republic also depends on that public awareness, the role of each within that system. In Camboriú we have a great need of the state police to mediate these conflicts, and we need perhaps this **change of culture** right, it would **by education** [...]. Another difficulty that we also encounter is that we are close to a city that is large, which is Balneário Camboriú, which concentrates a civil construction pole and [...] the great workforce, the labor force, lives in Camboriú, and we have a very large social liability, this is a difficulty for us [...]. Another thing which also hinders our work, we are not a metropolitan area [...] We have here u ma conturban urbação (concentration of various cities and their merger into a single metropolitan area. Michaelis, 2018), Balneario Camboriu, Camboriú, Itajaí, are very close cities, and there is no social responsibility with other cities that are in the vicinity [...]

The commander of the PM highlights the social issue as one of the main difficulties Ever Meet plotted in the city of Camboriú and the culture of conflict through police occurrences solution is, which creates a much higher demand for service. The valorization of education is a fundamental focus in order to favor human and citizen formation.

Another issue raised again by the Officer was the lack of staff. By indicating this problem as not only municipal, but national, the commander's speech meets the data presented through a survey carried out by the news *site* UOL, in 2017. According to the survey, the country has a *deficit* of 170,000 Military Police, with the State of Santa Catarina having only 59.5% of the predicted staff, which is 19,962 Military Police [7].

This deficit can be translated into numbers. If the city works with only 51 policemen, 2 officers and 49 squares, and if that represents 60% of what would be necessary, it means that at least 34 more policemen are missing in the municipality of Camboriú. This is a reality that contextualizes speech d both the official as the soldiers interviewed s about the lack of staff, and of course the needs of infrastructure investments.

Questão 02: How do you evaluate the Public Security in Camboriú's municipality?

Official PMSC: Public security in the municipality of Camboriú, as a whole, right, depends not only on police factors, so we see the efforts of the police, right, the entire public security system, which includes the judiciary, the Public Ministry and DEAP, we have a collective effort in this sense, but the social issue lacks the **presence of the State** (emphasis added) in some pockets that need a more social presence [...]. Another aspect that is also important is the **occupation of the soil**, ie, the uncontrolled growth of the city, is also an impediment when the people pay the public security service, you know, for all of us, is a very high demand of occurrence, a very large dependence on the State [...]. It is a factor that we identify here in Camboriú, also identified through the occurrences, and the geoprocessing that we have in the Military Police. In addition to these two factors that we identify here in the municipality, we also have the **feeling of impunity** in the laws, you know, we do not have effective incarceration, and this same incarceration that exists, it is also ineffective and does not resocialize (Act or effect to resocialize - (se). Classification given by the *online* dictionary, Michaelis, 2018). So, these three factors, I think are the main, negative ones, right, in terms of public security in the municipality of Camboriú.

From the answer, it was possible to make a direct correlation with the issues of the formation of social structures and their diversity. [10]. It is also possible to mention the thesis that the urban population, "left to their destination", builds houses that allow them to live together, sharing their anguish, feelings and precariousness. The author points out that this process began with the abolition of slavery when blacks were released to their own devices, with no money and study, left only occupy the hills in s major cities, starting the slums. [20].

Referring to the uncontrolled growth in the city can identify neighborhoods with major criminal incidents, in particular homicide crimes and drug trafficking, among them, the Monte Alegre and the Conde Vila Verde. In addition to the police, locals need the assistance of the State. According to the Weekly Bulletin of Public Security Indicators of Santa Catarina, Camboriú occupies the 8th place in the state in 2018, with 26 cases in the annual number of homicides, maintaining similar numbers in the last 3 years. [21].

Finally, the officer still describes a judicial system that does not effectively punish and that, when it does, leaves the person locked up in a crowded cell, transforming them into a worse individual. Of course, there are exceptions, but much of the Brazilian prison system does not recover the convict. He leaves, more disgusted and prepared to commit new crimes. That is, social reintegration does not happen.

5.2 Perception of the population using the public service of Public Security in the municipality of Camboriú

As we said, for this part of the research, ten people were interviewed, residing in the city of Camboriú, who directly used the public service of Public Security in 2017, through the registration of police reports. Two questions were asked and below are some answers.

How do you evaluate the work carried out by the Military Police in the municipality of Camboriú?

User 01: I rate it as being good.

User 02: I think it is a little precarious due to the amount of staff in the municipality, and also because of the delay in service when requested.

User 03: Good service, at least where I live there, right. There is a lot of cars, a lot of rounds, in the places where I go, always with security.

User 08: It's good. That is, like, more rounds, more blitz in some places, also help a lot. But, I think that in relation to the number of policemen that there are, and the number of residents in the city, it's good [...] Let's not say it's great, but it's good.

Table 3 - Assessment of respondents - Military Police

How do you evaluate the work carried out by the Military Police in the municipality of Camboriú?	QUANT.	%
Excellent / Good	5	50%
Well, however, it needs to improve	2	20%
Precarious, poor service	2	20%
Does not know how to evaluate	1	10%

Source: semi-open interview data

In view of the answers, it is possible to verify that the user positively evaluates the work of the Military Police in Camboriú, considering that 70% of the interviewees showed satisfaction with the service provided. However, it is clear that the citizen links good service to the constant presence of the Police, in other words, the police need to "appear",

they need to be seen. As a uniformed police, the presence of the Military Police is perceived through rounds and through *blitzes*. However, we also know how important the collaboration of society is, with appropriate attitudes and permeated by positive values for living together and respecting the other.

The deficit of police that the resident feels in his daily work on the streets in the face of the needs of the municipality makes it clear how much insecurity is present, generated by the evidenced crime.

The second question was: **How do you evaluate Public Security in the municipality of Camboriú?**

User 01: I rate it as being good.

User 02: I think we're very **precarious** even our security. Well, you *see* I went to lunch, I came back and the bike was no longer with the company. **I do n't feel safe** at all.

User 03: In general, I think security in the municipality is **good**. Seen of course, the furthest points of difficult access, but the center and the nearest neighborhoods, very good security. I feel safe.

User 05: I think it has improved a lot, both the education of the police, both the planning that they do at school with the kids ... **I think cool** is more united with the police in know r they are not "so ah armed, fear ", to know that they **are there to protect us**. And the only thing I hit most is a resource, a car resource, material, which is very outdated.

User 09: Shall we put it as a note? Look at me okay, the only thing that happened was this damage, otherwise're **ten for me**. I feel safe, I came from a place that was very dangerous (Rio Grande do Sul), for me **it's great**.

Table 3 - Assessment of respondents - Public Security in the municipality of Camboriú

How do you rate Public Safety in the municipality of Camboriú?	QUANT .	%
Good	7	70%
Precarious, deficient in some aspects	3	30%

Source: data from semi-open interviews

The answers to question 02 were cohesive in relation to the other assessments. A large part of the interviewed or so positive the Public Safety Camboriú's

municipality, pointing positive aspects such as education of police, planning and interaction with the community, small portion indicated negative aspects, among them, insecurity, delays in care, lack of resources and the lack of vehicles in more distant places to the detriment of central regions.

Negative factors also cited were complaints of objects by the *P oliciais M ilitares* interviewed, citing the precariousness of work equipment, due to the lack of investments and the small number of police officers, which causes therefore lack vehicles in places furthest from the city.

VI. FINAL CONSIDERATIONS

This article made an analysis of the Public Security activities carried out by the Military Police in Camboriú from the perspective of the social actors involved. In the research, the general objective can be translated by the following question: how do the social actors involved with Public Security evaluate the activities carried out in the city of Camboriú?

The soldiers interviewed expressed that there is a lack of police and resources to maintain the services offered by the PM in the municipality of Camboriú. The officer responsible for the battalion in the city confirms the lack of personnel, but also puts other factors that hinder the preventive action of the police. Among them, poverty, people's education and disorderly urban occupation in the region. In addition, PM of the command in the city reminded that there is a sense of impunity, since many prisoners returns m quickly to society.

The speeches of the interviewed population were in line with what the members of the PM said, as they identify the lack of police officers, the delay in handling cases, the absence of rounds and blitz in the city. Some went so far as to say that Public Security is precarious in view of the needs of the municipality, demonstrating the insecurity of the population.

At the end of this article, it is clear that public security problems in municipalities are much more complex than they appear. They will not be solved just with the increase of police on the streets and financial resources, as I need to invest heavily in the social sphere with very clear Public Policies in this regard. This involves basic and professional education, income for poor families and a discussion about drug use in the country. In addition, it is necessary to review the functioning of the penitentiary system that needs to favor human formation, enabling resocialization. These are measures that also involve a greater financial investment in

Public Security in order to guarantee resources and professionals.

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The use of therapeutic cushion in the post-operative of mastectomy

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Abstract— Breast cancer is a neoplasm caused by the multiplication of abnormal breast cells with the capacity to evolve in various ways, some of which develop quickly while others develop more slowly according to the specific characteristics of each tumor. Mastectomy is one of the forms of treatment of breast cancer, being a surgery that can be performed in a total, radical modified or prophylactic way, for oncological or preventive reasons. Objective: to verify if the use of the therapeutic pillow offered through Facimed's extension project "Heart pillow - sewing love" in the mastectomy postoperative period showed the result of providing the physical and psychological comfort initially estimated in the extension project. The methodology is a cross-sectional, quantitative descriptive field survey that interviewed 23 participants who received the pillow during the execution of the extension project. Results: of the 23 participants, 21 (91.30%) are female, 15 (65.21%) married, with a predominance of white in 12 (52.17%). The mean age of the patients was 54 years old, with the age range of 42 to 59 years old prevailing in 12 (52.17%) patients. Regarding the type of surgical procedure performed, bilateral total mastectomy prevailed in 12 (52.17%) of the cases, followed by 7 (30.43%) of partial mastectomy and 4 (17.43%) of breast reconstruction, being the breast cancer was the main reason for performing the procedures in 21 (91.30%) cases. It is concluded that the therapeutic pillow provided by the extension project presented realistic benefits to patients undergoing mastectomy surgery and breast reconstruction, assisting in the postoperative recovery of patients, preventing complications resulting from the surgical procedure, in addition to strengthening care bonds between nursing staff and patients.

Keywords— Mastectomy, Breast cancer, Heart pad.

O uso da almofada terapêutica no pós-operatório de mastectomia

Resumo— O câncer de mama é uma neoplasia causada pela multiplicação de células anormais da mama com capacidade de evolução de várias formas, uns se desenvolvem rápido enquanto outros mais lentamente de acordo com as características específicas de cada tumor. A mastectomia é uma das formas de tratamento do câncer de mama, sendo uma cirurgia que pode ser realizada de forma total, radical modificada ou profilática, por motivos oncológicos ou preventivos. Objetivo: verificar se o uso da almofada terapêutica ofertada por intermédio do projeto de extensão da Facimed "Almofada do coração – costurando amor" no pós-operatório de mastectomia apresentou o resultado de proporcionar o conforto físico e psicológico estimados inicialmente no projeto de extensão. A metodologia trata-se de uma pesquisa de campo de cunho transversal, descritivo quantitativo que entrevistou 23 participantes que receberam a almofada durante a execução do projeto de extensão. Resultados: dos 23 participantes 21 (91,30%) são do sexo feminino, 15 (65,21%) casadas com predomínio da cor branca em 12 (52,17%). A média de idade das pacientes foram de 54 anos prevalecendo a faixa etária de 42 a 59 anos em 12

(52,17%) pacientes. Em relação ao tipo de procedimento cirúrgico realizado a mastectomia total bilateral prevaleceu em 12 (52,17%) dos casos, seguida de 7 (30,43%) de mastectomia parcial e 4 (17,43%) de reconstrução mamária, sendo o câncer de mama o maior motivo para a realização dos procedimentos em 21 (91,30%) dos casos. Conclui-se que a almofada terapêutica fornecida pelo projeto de extensão apresentou benefícios realísticos aos pacientes submetidos a cirurgia de mastectomia e reconstrução da mama, auxiliando na recuperação pós-operatória dos pacientes, prevenindo complicações decorrentes do procedimento cirúrgico, além de estreitar os laços de cuidado entre equipe de enfermagem e pacientes.

Palavras chaves— Mastectomia, Câncer de mama, Almofada do coração.

I. INTRODUCTION

Breast cancer is a neoplasm caused by the multiplication of abnormal breast cells with the ability to evolve in various ways, some of which develop quickly while others develop more slowly according to the specific characteristics of each tumor (NEUMAYER AC et al., 2018; INCA, 2019a). Currently, breast carcinoma is a serious public health problem and is the most common malignant tumor in women in most parts of the world (INCA, 2019b). According to the world statistics, in 2018 breast cancer affected 2.1 million patients. It is estimated that in Brazil there will be 66,280 new cases in each year of the 2020-2022 triennium. In Rondônia, the estimated breast cancer incidence for the year 2020 is 220 new cases, with an estimated adjusted rate of 29.30 cases for every 100 thousand women (INCA, 2019).

In Brazil, in 2017 there were 16,927 breast cancer death records, 16,724 women and 203 men (INCA, 2020c). The care modalities for breast cancer treatment occur according to staging, they can be local considering surgery and radiotherapy and systemic treatment including chemotherapy, hormone therapy and biological therapy (INCA, 2019b).

Mastectomy is a method of treating breast cancer. For cancer or preventive reasons, surgery can be performed in a total, radical modified or preventive manner. The method of surgery and the type of surgery depend on the classification and clinical stage of the cancer (process of determining the location and extent of cancer in the human body), as the procedure aims to eliminate the presence of cancer. In the postoperative period of mastectomy, complications such as hematoma, edema, infection and accumulation of blood secretion can occur after the drain is removed. Trauma can cause phantom breast sensations, numbness, tingling or burning and can last for months or years after surgery. However, patients facing mastectomy still face physical, psychological and sociopsychological problems related to the diagnosis of cancer and the mutilation or alteration of the breasts (SMELTZER e BARE, 2002; SILVA et al., 2007; FARIA, FREITAS-JUNIOR & SILVA, 2013; SANTOS et al., 2017).

Having a mastectomy affects the psychological structure of women, causing emotions never experienced, feelings of shame, rejection and inferiority accompanied by fear and nervousness (NASCIMENTO, 2015). In the postoperative period, patients experience varying degrees of pain intensity and discomfort in the chest wall, in the affected arm and in the breast. In this sense, moderate elevation of the limb is a means of relieving pain, reducing tension on the surgical incision, avoiding venous retention of the affected limb (SMELTZER and BARE, 2002; HERMES & LAMARCA, 2013).

The “Heart Pillow Project” started in the United States by a breast cancer specialist at the Erlanger Breast Resource Center in Chattanooga, Tennessee, after undergoing surgery in 2002, looked for various ways to obtain comfort and postoperative pain relief feeling the need to support the arm to relieve pain and numbness, reaching the shape of the heart cushion. The project arrived in Brazil in 2010 through Ms. Ondina Almida Posiadlo active member of the Female Missionary Society of the Church of God in Brazil, after being inspired and participating in the work of the group of volunteers on a visit to Germany (CRP, 2018).

The extension project “Heart Pillow - Sewing Love” was developed at Facimed by the Academic Nursing League in Oncology and Hematology (LAEOH). In the development of the actions of the project, heart-shaped pillows were made in 100% cotton fabric with antiallergic filling, standard size and offered to patients undergoing mastectomy surgery, in order to provide physical and psychological comfort during the postoperative period together guidance on how to properly use the pillow and its benefits.

The pillows are made in order to help patients who have undergone mastectomy, are already being used by thousands of patients worldwide. They are of sufficient size and weight to help the patient feel comfortable after surgery. They are designed to be placed under the arm to rest and support the upper limb, thus reducing the pain in the surgical incision and the lymphedema caused by the surgery. The pillow can be used during sleep as an armrest,

and can also be placed under the car's seat belt to avoid possible trauma in the surgical incision.

By participating in activities at the Academic Nursing League in Oncology and Hematology at FACIMED, it was possible to live with patients in the mastectomy postoperative period who reported breast loss as something difficult and painful for women, due to issues related to both physical pain as for the psychological, there is no division of this process of significant changes, because the body and the mind are interconnected.

The objective of the research is to verify if the use of the therapeutic pillow offered through the Facimed extension project "Heart pillow - sewing love" in the post-operative mastectomy presented the result of providing the physical and psychological comfort initially estimated in the project. extension.

II. MATERIALS AND METHODS

The study was submitted to the ethics and research committee - CEP, of the educational institution of Cacoal - FACIMED - Faculty of Biomedical Sciences of Cacoal, following the recommendations of Resolution No. 466, of December 12, 2012 and Resolution No. 510, of April 7, 2016 from the CNS- National Health Council and after its approval received an opinion consubstantiating with the number 4,100,187 and CAEE n° 32889620.6.0000.5298.

Cross-sectional, quantitative descriptive field research. The collection instrument was a questionnaire prepared by the researcher based on the research objectives. Data collection was carried out between June and July 2020 and comprised a sample of 23 participants according to the inclusion criteria: patients who underwent surgical procedures for total or partial mastectomy and received the cushion for the extension project; The informed consent form - TCLE was authorized through videos and / or signed by the project participants.

III. RESULTS AND DISCUSSION

The "Cushion of the heart - sewing love" extension project was developed on the premises of the Regional Hospital of Cacoal during the months of September 2019 to March 2020 where on Wednesdays the academic always entered the surgical clinic and patients were given pillows of heart-shaped fabric and folders guiding the way of use and the benefits provided. The good receptivity of the information and the acceptance of the pillow by the

patients provided the academic to realize the importance of the individualized look to the condition of each patient.

From the conclusion of the project, the analysis of the records was carried out, thus the initiative to verify the result of the actions carried out under the eyes of the patients who were contemplated with the pillows.

Of the 23 participants, 21 (91.30%) are female, 15 (65.21%) married with a predominance of white in 12 (52.17%) followed by 8 (34.79%) brown and 3 (13, 04%) black. The mean age of the patients was 54 years old and the median was 52 years old, with a predominance of the 42-59 year old age group with 12 (52.17%) of the participants.

According to Borges et al., (2016) & Azevedo et al., (2017) the highest incidence of patients undergoing breast cancer treatment is married (53.0%), with the white color having the highest percentage (56.8%) of breast cancer mortality in females with 56.8% of cases and the average age at which women are diagnosed with breast cancer is 56 years, which confirms that women over 50 have higher risk of developing breast cancer (AZEVEDO et al., 2017).

Table 01 - Distribution of the type of procedure, location and reason for the mastectomy performed at the HRC during the execution of the Heart Pillow Project. Cacoal / RO, 2020.

Variables	N	%
Type of mastectomy		
Total	12	52,17
Partial	7	30,43
Breast reconstruction	4	17,40
Procedure location		
Unilateral	11	47,83
Bilateral	12	52,17
Reason for surgery		
Cancer	21	91,30
Gynecomastia	2	8,70
Used the pad in the postoperative period		
Yes	23	100,00
No	0	0

Source: MEDEIROS & SOARES, 2020.

Regarding the type of surgical procedure performed, bilateral total mastectomy prevailed in 12 (52.17%) of the cases, followed by 7 (30.43%) of partial mastectomy and 4

(17.43%) of breast reconstruction, being the breast cancer was the main reason for performing the procedures in 21 (91.30%) cases. Of the interviewees, 23 (100%) reported having used the pillow in the postoperative period as indicated and received guidelines.

Mastectomy is a surgical procedure used for partial or total removal of the mammary glands in order to provide improvement in the woman's clinical condition and prevent the evolution of the disease or metastases to other areas of the body (MAJEWSKI et al, 2011). According to Moreira and Canavaro (2012) mastectomy is a breast-conserving surgery, that is, it is removed to avoid worsening of breast cancer.

Even with breast reconstruction, patients may suffer impacts on the quality of life, on physical aspects and on the level of independence, that is, from the reconstruction, there may be noticeable effects of anatomical manipulation and cause permanent and physical discomfort in the mobility of the breast and limbs et al., (2013).

Research carried out at the cancer center of Cacoal-RO showed that about 12% of the population that undergoes cancer treatment at the institution are carriers of breast cancer (FARIA, GUDE & LIMA, 2020). According to the INCA (2020) the incidence of female breast cancer in the year 2020 is 29.7% and possible changes over the years may occur with the increase in cases.

Breast cancer is more prevalent in women worldwide, tends to grow constantly, where the mortality rate is lower in women under 40 years of age, and over 60 years of age the risk is 10 times higher (BRASIL, 2020a).

The breast self-examination should be inserted regardless of the age group in the daily lives of women throughout the year, thus, in order to prevent future neoplasms (FARIA, GUDE & LIMA, 2020). However, there are controversies about the effectiveness of the self-examination, for the Ministry of Health and the Brazilian Society of Mastology, the self-examination of the breasts has already been widely used and recommended, as it helps the woman to touch and get to know her body, but it does not replace an evaluation breast clinic. For more than ten years, self-examination is no longer recommended in developed countries because it does not detect tumors below 1 cm. When there is no change in self-palpation, the concern is that the woman will stop seeking medical attention and undergo the examination. Failure in screening and the delay between confirmation and treatment can lead to death (SBM, 2019).

The mammography exam is recommended for women over 35 years of age who are at high risk for breast cancer since the exam allows the visualization of unnoticeable

changes. From the age of 40, the general recommendation is the clinical examination of the breasts and the performance of mammography for women between 50 and 69 years old, with a maximum interval of two years between examinations. (SILVA & RIUL, 2012; BRASIL, 2014; BRASIL, 2020b).

In study 2 (8.70%) male patients underwent mastectomy due to gynecomastia, which is the benign growth of the male breast. Gynecomastia undergoes hormonal changes of estrogen and androgen and the appearance of secondary ducts and stromal hyperplasia, which must be differentiated from the increase in volume caused by the accumulation of fat called lipomas or pseudogynecomastia (CANHAÇO, ELIAS & NAZÁRIO, 2015). There are controversies about the relationship between male breast cancer and gynecomastia, vary in 2% to 35% of patients and idiopathic causes are the reason for most cases. Surgery is the main method of treatment when there is no spontaneous regression or worsening of psychosocial disease. The second main reason is the use of drugs that trigger gynecomastia: risperidone, phenothiazine, selective serotonin reuptake inhibitor, methyl dopa, tricyclic antidepressants, marijuana, heroin, saquinavir, minocycline, finasteride, domperidone and others (MEDEIROS, 2012; CANHAÇO, ELIAS & NAZÁRIO, 2015).

Table 02 - Distribution of the variables time and form of use of the pillow, presence of complications and opinion of the participants about the Pillow of the Heart - Sewing Love project developed at HRC. Cacoal / RO, 2020.

Variables	N	%
Pad use time		
<30 days	3	13,05
31 - 60 days	7	30,43
> 60 days	13	56,52
Presence of lymphatic edema in		
Yes	4	17,39
No	19	82,61
Using the pillow at night while		
Yes	23	100,00
No	0	0
Did the use help to rest the		
Yes	23	100
No	0	0
Use during transportation		
Yes	22	95,65
No	1	4,35
Presence of complication in the		
Yes	0	0
No	23	100
Pain relief at the surgery site		
Yes	23	100
No	0	0

Feeling when receiving the		
Sad	0	0
Happy	17	73,91
Afraid	0	0
Watch out	6	26,09
Approval of pad use		
Yes	23	100
No	0	0
Information on complications of		
Yes	13	56,52
No	10	43,48
Project classification		
Very important	15	65,21
Required	8	34,79
Not necessary	0	0
Bad	0	0
Indicating the pillow to other		
Yes	23	100
No	0	0

Source: MEDEIROS & SOARES, 2020.

Upon receiving the diagnosis of breast cancer, the woman experiences several feelings of mourning according to her intensity of pain when facing breast cancer, both patients and their families suffer from fear, anger, pain and anxiety from diagnosis to treatment, causing a significant impact on people's lives (LORENZ & LOHMANN, 2018). Based on the results, it was found that 23 (100%) of the participants used the pillow, denying the occurrence of complications in the postoperative period, stating that the pillow helped to relieve pain at the surgery site and decrease tension and tingling in the arm and shoulder. used it at night during sleep and stated that the use helped to rest the shoulder / arm improving the quality of sleep and rest. Regarding the time of use, 13 (56.52%) said they had used it for more than 60 days and 19 (82.61%) replied that in the postoperative period, the upper limbs affected by the surgery did not develop lymphatic edema and 22 (95.65%) reported using the cushion during transportation by car.

According to Rossi (2016), the correct use of the pillow provides a reduction in pain caused by mastectomy, it also provides physical and psychological support. The time of using the pillow varies from patient to patient, and can exceed 150 days. The incidence of post-mastectomy pain syndrome is high, affecting 20% to 50% of patients. Recovery is quick after surgery and may require hospitalization for 1 to 2 days, depending on the type of surgery (bilateral or unilateral). The recovery period of the treated patient is very important, depending on the individual characteristics, the severity of the disease and the treatment received. The nursing team must pay attention to keep the arms of mastectomized patients about

20 cm away from the body and support them by installing them above the center of the cushion to reduce edema and tension (COUCEIRO; MENEZES & VALENCA, 2009; RIBEIRO & RIBEIRO, 2018).

The characteristics of the surgery can bring functional complications to the shoulder and arm joint on the same side of the breast to be treated. The more extensive the procedure, the greater the chance of disease (VELLOSO; BARRA & DIAS, 2009; GÓIS et al., 2012). The pain may start immediately after the operation and last for a long time, and may even cause dysfunction. These complications can cause discomfort during sleep and while driving, changes in posture and decreased ability to do housework, which can lead to distress and severe dysfunction (AMARAL, 2010).

Few patients and health professionals know the project Cushion of the Heart - Sewing Love. The pillows were designed to be placed under the arm to facilitate your rest, reduce the pain of the surgical incision, decrease the lymphatic edema caused by the surgery, reduce the pressure on the shoulders and support the patient's arm even during sleep (CRP, 2018). Therefore, the information found in this study becomes relevant mainly to nursing professionals who will be promoting care and guidance to patients who need to undergo mastectomy surgery.

About 17 (73.91%) of the patients who received the pillow reported feeling happy and 23 (100%) said they approved the project initiative for the use of the pillow in the postoperative period, 15 (65.21%) rated the extension project developed at the Hospital Regional de Cacoal as "very important" and 23 (100%) of the patients answered that they would recommend the pillow to other people who were in the same surgical condition.

Another important point to be highlighted is that 13 (56.52%) of the interviewees answered that, before the procedure, they did not receive information about possible complications resulting from mastectomy. The most common complications in mastectomy surgeries are: appearance of edema, seroma, dehiscence, limited range of motion, infection, adherence, inflammation at the place where the drain is inserted and cellulite (PANOBIANCO et al., 2009; NASCIMENTO et al. , 2012; CRUZ et al., 2017).

It is important to emphasize the role of nursing in preventing lymphedema, such as surgical dressings and suction care. Protective care for the area to be exposed during radiation therapy; educational activities related to arm care and exercises on the same side of the operation

(PANOBIANCO et al., 2009; NASCIMENTO et al., 2012; CRUZ et al., 2017).

IV. FINAL CONSIDERATIONS

Based on the research data, it can be concluded that the therapeutic pillow used by Facimed's extension project "Heart pillow - sewing love" developed realistic benefits for patients undergoing mastectomy and breast reconstruction surgery, helping in postoperative recovery of patients, preventing complications resulting from the surgical procedure, in addition to strengthening the bonds of care between the nursing team and patients.

The results obtained are classified as satisfactory based on the opinion of the patients who used the pillow, reporting that they did not develop pain, tension, numbness and lymphatic edema in the upper limbs, inferring that the use of the pillow provided the same physical comfort and psychological, therefore, they would indicate the use of the pillow to other people who performed the same procedures and by demonstrating the feeling of happiness and care when receiving the pillow during the post-surgical hospitalization period.

All patients participating in the Facimed extension project "Cushion of the heart - sewing love" demonstrated satisfaction and declared and considered an important initiative by the nursing student.

The nurse's role goes beyond the scope of planning, organizing, coordinating, executing and evaluating, since "assisted nursing" is to put oneself in the other's place, it is to promote physical, psychological and social well-being with a humanized and individualized look for each patient it is doing for the other everything that he cannot do for himself. However, the nurse promotes the participation of self-care activities, teaching the importance of paying attention to the surgical incision and suction of the drain to prevent the accumulation of bloody secretion, infections, hematoma, edema and lymphedema. However, instructing them to perform normal home activities promoting a better quality of life and a sense of normality on the part of patients.

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Nursing Assistance to Children with Fallot Tetralogy: The Blue Baby Syndrome

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Abstract— *Objective: Congenital heart diseases are responsible for an important number of deaths of children before the first year of life. Tetralogy of Fallot, as one of the potential and frequent congenital heart diseases, can often undergo correction, if it is readily recognized, and it is up to the teams closest to the NB to be attentive to symptoms. As a representative of this care, the nursing team stands out, with a high level of theoretical and technical capacity, as well as the potential for the formation of bonds with patients and families, facilitating the recognition of illness and work focused on their interventions. The present study aimed to work and know the pathophysiological process of tetralogy, as well as therapeutic processes and the nursing action in this regard. Methods: The methodology has as its nature the bibliographic review, enabling the finding of many materials and discussions on the subject. Results: The results present tetralogy as an important alteration, which can be observed through signs such as irritability, frequent crying, difficulty breathing when being breastfed, fingertips and cyanotic skin, also highlight that nurses can act so that the individual can present better responses to the disease and treatment and that these care begin even in prenatal care and extends until after birth. Conclusion: It is necessary to emphasize that tetralogy presents varying levels of commitment and this fact will directly determine the therapeutic process and approach to be adopted.*

Keywords— *Fallot tetralogy, blue baby syndrome; nursing care.*

I. INTRODUCTION

According to the World Health Organisation (WHO), the existence of congenital cardiopathies varies between 0.8% in developed countries and 1,2% in poorer countries. Every year in Brazil, about 29,8 thousand cardiopathies are born, 80% of this value, which corresponds to 23,8 thousand children, will need to undergo surgery, and even 50% of this total, will have to perform the surgical procedure before the first year of life (BRASIL, 2017).

In line with what the WHO presents, in Brazil, cardiovascular diseases cause about 16.7 million deaths annually, with increases for the year 2020 of competing as the primary reason for impossibility and mortality (CASAGRANDE, 2012).

Tetralogy of Fallot is one of the most common aspects of congenital heart disease, characterizing 50% of these heart diseases. It is described by a tetrad: which presents as a defect of the interventricular septum, a dextroposition of the aorta, which obstructs the passage of blood flow from the right ventricle and a ventricular hypertrophy located on the right (RIBEIRO et al, 2010).

In the accomplishment of the therapeutic conduct, the elaborated and competent nursing care is essential and essential, through the implementation of the stages of the Systematization of Nursing Care (SNC), according to the COFEN Resolution - 272/2002, where it mentions that the institutionalization of THE as learning of a work process appropriate to community needs and as a care example to

be placed in all areas in which the nurse develops such care (BARBOSA, LEME and GARCIA, 2009).

It is extremely important that the nursing team has experience on the theme to conduct their procedures and explain them to the companion, in a way understandable for their understanding, attending not only a characteristic and disciplined care to the child, but also an emotional contribution to her and her family members (ROSA et al., 2010).

In this sense, the present study aims to understand the history of cardiac pathology, in order to describe cardiovascular anatomy and physiology, presenting literary data on causes, signs, symptoms, risk factors, diagnosis, treatment and nursing care. children with Tetralogy of Fallot.

The article is prepared in sessions, which include the theoretical framework where the literature of determination is treated tetralogy of Fallot, the blue baby syndrome in its general context aimed at the child and the family member, the following sessions will treat the method used for the preparation of the article and the results and discussions as a product of the entire written text finally, the final considerations, ending the central idea and reaffirming the most relevant points found throughout this production.

II. NURSING CARE FOR CHILDREN WITH CONGENITAL HEART DISEASE

Soon after birth it is possible to observe congenital cardiac imperfections, such as in structure and/or circulatory function. Malformations may arise from multifactorial communication, which is related to environmental and genetic aspects (SILVA et al, 2015).

For every 1000 newborns (NB), about one to two have a theoretically fatal cardiac imperfection, in general systemic blood flow and pulmonary need an arterial duct (MAGALHÃES, QUEIROZ AND CHAVES, 2016).

This cardiac malformation is manifested as one of the most severe at birth, indicating a high mortality rate in the world. It is assumed globally that about 130 million newborns are included in this diagnosis annually. In Brazil, data estimate the occurrence of two to ten cases per 1,000 live births (LIMA, SILVA E SEQUEIRA, 2018).

The nursing care offered to children with congenital heart disease should be defined and performed as soon as they are suspicious of the diagnosis of malformation. For the elaboration of the care plan, it is necessary to have a careful investigation to collect information, especially for the evaluation of cardiac

function and identification of specific signs and symptoms of complications of congenital heart disease (ALMEIDA, 2013).

After performing the medical diagnosis of congenital heart disease, the nursing care provided should be adjusted and performed as soon as possible, to ensure that the child remains stable or hemodynamically stabilized (SILVA, et al 2015).

Nursing care in heart disease is differentiated and specific, since children with congenital heart disease have multiple care needs, which are more or less complex, which indicate the maintenance and monitoring of cardiac output function, fluid and sodium accumulation, tissue oxygenation, oxygen consumption and cardiac needs. Thus, nurses are guided by the nursing process, which is the process of systematized and correlated practices, with child care as their main objective (SILVA et al, 2014).

It is necessary, therefore, to promote permanent nursing education actions, either through their qualification or in the improvement of care technologies that need to be used in nursing conducts, in order to support that clinical opinion directs the nursing team to the benefit of this screening technology (FERREIRA, et al 2016).

The nursing team needs to take care of patients with congenital heart disease by providing individualized assistance, offering them well-being, confidence, quality, comfort and always clarifying their uncertainties (BRASIL, 2017).

2.1 TETRALOGY OF FALLOT

During childhood, the congenital malformations found are the most common causes of emergencies in pediatric cardiology. Some causes that increase the risk of heart disease are: chronic diseases, such as poorly controlled phenylketonuria or diabetes, family history that includes (first-degree relative) maternal factors, alcohol consumption, exposure to environmental toxins and infections as well can significantly increase the likelihood of a cardiac anomaly (LOW et al, 2019).

Fallot's tetralogy refers to an anomaly that causes a lack of blood oxygenation, where the blood is unable to reach the lungs in sufficient portion to return oxygenated to the atrium and left ventricle due to interventricular communicability. This occurs most of the time in childhood, characterized by cyanosis that presents itself by the color of the blue-purple skin and for this reason they are also known as "blue babies" (RIBEIRO et al, 2019).

During the development of the embryo, the heart undergoes several transformations at the physiological

level ranging from folding to septal formation, through cell multiplication, where it passes from the initial formation model, this being the formation based on tubules and receives the final shape that are the 4 chambers, atria and ventricles. When in the fifth week of formation occurs the septation of the arterious trunk, whose main purpose is to separate the aortic canal and the pulmonary canal (SADLER, 2019).

Cells that are located in the neural crest and that are of origin of the rombencephalus move to the exit of the heart, thus will help in the elaboration of the crests of the arterious trunk. All these processes already mentioned are regulated and organized by the second cardiac field, thus the alterations that encompass the second field and the heart cells of the neural crest trigger the onset of malformations (MOORE, 2016; SADLER, 2019).

Fallot's tetralogy is one of the most frequent variables of congenital cyanotic heart disease, formed by four malformations, thus being called "tetralogy". They are situated: a communicability of the interventricular septum, when there is an orifice between the two chambers of the heart, of the ventricles (left and right), displacement of the aorta that means a squalid to the right of the aorta when moving from the heart, a blockage of blood flow from the right ventricle, there is an impasse in the passage of poor oxygen blood to the lungs and right ventricular hypertrophy due to the excessive work of the right ventricle, the mass of the muscle, especially in consistency (NASCIMENTO et al, 2017).

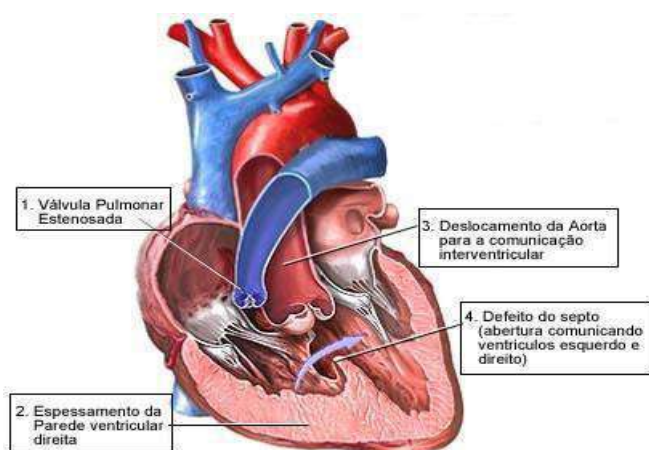


Fig.1: Four components present in Fallot Tetralogy

Source: FERREIRA, 2019.

According to WHO data, every year on average 130 million children are born worldwide with a certain type of congenital heart disease. In the case of Brazil, of the six million children who are born annually, around

23,000 have the problem, but only 13,000 will undergo a surgical process, especially due to the absence of previous diagnosis. Thus, 6.0% die before the first year of life (FIGUEIREDO et al, 2014).

At the moment, the etiology of Tetralogy of Fallot has not been unseen, but it is currently known that some conditions and conjunctures during the pregnancy period may corroborate the onset of the disease, such as: poor diet, alcohol consumption, late pregnancy over 40 years and diseases such as diabetes mellitus, measles, rubella and other viral diseases (HUBER et al, 2010).

Regarding the diagnosis of malformation, prenatal care is extremely important, and the nursing team is competent and multiprofessional, guidance on the importance of vaccines, good eating habits and clarification of doubts, whatever they may be. Diagnosis may occur by fetal echocardiography in the prepartum or by electrocardiogram, chest X-ray, cardiac catheterization and measurement of oxygen level in the postpartum period. If the problem is not repaired, it can lead to serious complications for the individual, including early death, factors that reinforce the need for well-performed prenatal care (RIBEIRO et al, 2019).

Symptoms can vary according to the degree of impairment of Tetralogy, however the most prevalent are bluish skin, rapid breathing especially when breastfeeding, darkened nails on the feet and hands, difficulty in weight gain, easy irritability and constant crying (FERREIRA, 2019).

The therapy offered to the child with the pathology is directly related to the clinical and morphological particularities of heart disease, thus emerging several ways of conduct, ranging from a clinical-drug follow-up to the surgical process, separating it into palliative or permanent (COSTA, MARRAS AND FURLAN, 2016).

III. METHODS

To achieve the objectives of the research, the bibliographic survey was carried out in the following electronic media: Scielo, LILACS, CAPES portal, Medline, Fiocruz, Paho, Wholis, BDENF and VHL and VHL-Psi, in May and August 2020, publications containing relevant information regarding the theme in question. The following words: Fallot tetralogy, nursing care, blue baby syndrome were used as descriptors for international databases. For the national data base, the following terms were used: Tetralogy of Fallot, nursing care. The inclusion criteria regarding materials of use were

articles, books, magazines and websites that addressed the theme.

Thirty-seven articles on the theme were analyzed and 21 articles were selected for the development of the research. The selection criterion has as a preponderant factor the current and relevant publications on the subject.

IV. RESULTS AND DISCUSSION

The authors Magalhães, Queiroz and Chaves (2016) and Lima, Silva and Sequeira (2018), have data that converge and complement each other, when discussing information about tetralogy of Fallot, the first three authors cited, highlight the important finding that determines that in every 1000 live births, 2 have probably fatal cardiac alterations, the other trio of authors present the malformations as severe complications that occur worldwide and with very high potential to cause death.

Turning the look more carefully to the Tetralogy of Fallot, Low et al. (2019), highlights that malformations are most often the main causes of pediatric emergencies, highlighting that the risk of malformations occurring occurs mainly related to past maternal diseases, exposure to toxins and alcohol abuse during pregnancy.

Reinforcing the idea of the author previously cited, Ribeiro et al. (2019) point out the need for the immediate beginning of prenatal care, allocated the possibilities of actions within this process that have a great potential for the prevention of complications in fetal formation, actions ranging from basic care such as vaccination to simple guidance for care for the newborn.

The malformation itself is well worked out in Sadler's view (2019), where he highlights the anatomophysiological process of the development of the alteration, punctuating the formation of the septa, and the 4 chambers, also determining that it is in the fifth embryonic week that the septation of the arterious trunk occurs, which performs the function of separating the aortic canal and the pulmonary canal.

Ferreira (2019), points out that the main symptoms consist of frequent crying, associated with irritability, cyanotic skin, being present also in the extremities of the upper and lower limbs, difficulty in weight gain and breathing above normal, especially during breastfeeding.

When it comes to assistance and care provided to the individual, the nursing team gains special prominence, mainly because it is the professional category that is directly linked to the patient and family, it is the competence of this team, the care in a systematic way,

seeking to reduce complications and promote better development.

Silva et al (2014), points out that nursing has a differentiated provision of care, since the child with tetralogy has special needs and multiple orders, which consist of monitoring cardiac output, adequacy of oxygen supply and other needs at cardiological levels. Ferreira et al (2016), warns of the need for permanent education, whether in the improvement and acquisition of knowledge or in the adaptation to technological supports.

Therefore, nursing competes, the clinical and judicious look towards the patient and the family, from the beginning of the gestational process to birth, ensuring individualized care, well-being, trust and quality in the acceptance of the demands expressed.

V. CONCLUSION

The materials worked present in a very clear way the whole system that surrounds congenital heart diseases, diseases that affect a large number of newborns and that due to the failures of the diagnostic processes, can cause death before the first year of life of the individual.

The cardiopathy approached is an important problem worldwide and nationally, requiring trained and qualified professionals to work directly with this cause. Nursing is, therefore, the profession seen as complete to meet this demand, this is due to the fact that nurses can be close to the patient in the whole process that involves the diagnosis of the disease and even the therapeutic process, through systematized actions, offer better care to children and their families.

In the care of children with congenital heart disease, nurses need to perform a lepid nursing diagnosis to avoid complications and even a possible death, certainly their role is paramount in the diagnosis of congenital heart disease, the care of this professional begins in prenatal care, accompanied throughout pregnancy and prologing from birth to child development.

It is essential to highlight that this alteration does not present a defined exact cause, it is known, therefore, that simple processes such as adequate prenatal care, non-use of alcohol and other drugs, contribute positively to the non-emergence of such complication, not meaning that such measures are preventive, but that they can minimize the possibility of the emergence of tetralogy.

This is said, it is up to the teams working in the monitoring of the mother and child binomial, to be attentive to the signs and symptoms that the children may present, so that with their work instruments and their previous knowledge

can conduct and direct the most appropriate therapy, avoiding premature deaths and contributing to a better quality of life of these children.

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Renewable Energies as Experimental Practices in Physics Teaching of Youth and Adult Education

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Abstract – Energy sources for electricity generation have been the focus of numerous researches, driven by the increase in environmental concerns, seeking to minimize the environmental impacts generated by fossil fuels. This paper presents renewable energies as experimental practices in teaching physics of Youth and Adult Education (YAE) modality at the Teacher Nelson Alves Ferreira State School, located in the city of Manaus/AM, showing the interdisciplinarity between the concepts applied to physics, the development of experimental practices involving renewable energies (solar, wind, hydroelectric and geothermal) and their application in the physics program content. It is observed that the teaching of physics at YAE is scarce, where the teacher finds the cause of the difficulties in the student's learning, in the education system that does not offer him the necessary conditions to prepare his classes, and the student, in turn, attributes unsatisfactory learning to the teacher, to the school, to the abstract content, to his disinterest with the discipline and sometimes to his professional work. Environmental education is increasingly becoming an instrument of social transformation for discussion in different areas and contexts, where interdisciplinarity is indispensable for the implementation of an intelligent process of curriculum construction in the classroom. The educator/student relationship is achieved by building knowledge, linking renewable energies to the teaching of physics.

Keywords – Youth and Adult Education, Environmental Education, Physics teaching, Renewable energy.

I. INTRODUCTION

The general objective of this work is to present renewable energies as experimental practices in physics teaching of Youth and Adult Education (YAE) modality at the Teacher Nelson Alves Ferreira State School, located in the city of Manaus/AM, showing the interdisciplinarity between the concepts applied to physics, the development of experimental practices involving renewable energies (solar, wind, hydroelectric and geothermal) and their application in the physics program content. Teaching is a complex task that involves more than the specific knowledge of the teacher, it involves mastering the pedagogical field and this is constituted as the teacher experiences the teaching and learning processes in a relationship of collective construction in which it presents as a subject for formation and for forming [1]. The problems are presented by the difficulties of the teaching-learning process of physics at YAE, the lack of laboratory practices for carrying out the experiments, the scarcity of information involving environmental education, the lack of

knowledge about fossil fuels and renewable energies. The construction of three-dimensional teaching models provides the teacher with an important tool that facilitates learning, complementing theoretical and practical content, often not found in textbooks. In addition to the visual aspect, such material allows manipulation and a better understanding of the content covered [2]. The solution of environmental problems, with sustainability, requires multiple actions in the educational area, ranging from the theoretical and conceptual position to its practice. This means, above all, it matters which education and sustainability project and for what purpose, and where each of us places ourselves in social processes and in favor of what [3]. This work allows the student, in addition to the acquisition of knowledge, to develop skills that allow new discoveries, applied to a constructive, perceptive, interactive and participatory methodological process. Renewable natural resources can be understood as those that are perpetuated naturally, for example, the sun, plants, soil and animal life; nonrenewable natural resources are

those that do not perpetuate and are limited in quantity on the planet, for example, minerals and fossil fuels [4]. Questions related to physics practices are necessary to improve teaching and learning and to inspire future students who will come to the public educational institution. As the importance of knowing and understanding the students' difficulties in absorbing the contents applied in the classroom is verified, in the face of an outdated pedagogical practice, it provides a series of possibilities and studies to find suitable solutions for teaching physics, and a of them applied in this work, are the experimental practices involving renewable energies.

II. YOUTH AND ADULT EDUCATION

Youth and adult education (YAE), a new name for supplementary education, is characterized as a flexible pedagogical proposal that considers individual differences and students' informal knowledge, acquired from daily experiences and in the world of work. It is a different form of regular education in its structure, while its methodology, duration and structure itself [5]. In reality, the regulatory role of education is highlighted, since, under the imperative of maintaining social order, educational programs are part of the logic of providing the poorest with some forms of alleged social inclusion [6]. The motivation of YAE students in the search for education, in research, showed that the need to increase family income was the main reason that made students stop their studies and the demand of the job market makes these people who abandoned their studies return to school for better training and, consequently, higher remuneration [7]. Such problems are pointed out from the perspective of YAE coverage in the national territory, which is deficient and unequal, due to problems related to territorial criteria of distribution, income, gender, ethnicity or generation [8].

III. ENVIRONMENTAL EDUCATION

Everyone has the right to an ecologically balanced environment, a common use of the people and essential to a healthy quality of life, imposing on the public authorities and the community the duty to defend and preserve it for present and future generations [9]. The environment is related to life on Earth, encompassing all living and non-living elements, such as water, climate, vegetation, soil, air, animals, humans etc. Therefore, the importance of preserving the environment, so that an environmental imbalance does not occur and we suffer from such future impacts. Environmental education is understood as the processes through which the individual and the community build social values, knowledge, skills, attitudes and competences aimed at the conservation of the

environment, a common use of the people, essential to a healthy quality of life and its sustainability [10]. Environmental education is an essential and permanent component of national education, and must be present, in an articulated manner, at all levels and modalities of the educational process, in a formal and non-formal character [11].

IV. PHYSICS TEACHING

Teaching physics means seeking scientific understanding of the natural and general behaviors of the world around us, from elementary particles to the universe as a whole, with the support of scientific method and logic, with mathematics as a natural language. The application of physics for human benefit has contributed in an invaluable way to the development of all modern technology [12]. The demarcation, constitution and definition of a specific research field, directed and dedicated to the systematic study of the phenomena arising from the interactions between teacher, students and knowledge about physics, reflects a process of definition, substitution and evolution from a training perspective physics teaching [13]. The use of teaching methodology by projects in physics teaching in science education is defended as a viable possibility of introducing concepts, notions and physical principles, especially at fundamental levels where, often, science teachers do not have specific training in physics, and yet, teaching by projects can be an alternative to diversify the evaluation of science learning aiming at achieving a more formative process, continued and aligned with public policies [14].

V. RENEWABLE ENERGY

Worldwide, the most used energy source for the production of electric energy comes from fossil and non-renewable sources such as oil, coal and natural gas. The large dependencies on non-renewable sources of energy have caused, in addition to the permanent concern with their depletion, the emission of toxic and polluting gases and particulate matter. Of the gases released into the atmosphere, the most worrisome from a global point of view are greenhouse gases, especially carbon dioxide [15]. Currently, natural and renewable resources have been the focus of numerous researches, driven by increasing concerns about the environment, due to ecological problems and global warming, generated by the use of fossil fuels. The correct use of renewable sources is an excellent way to replace "dirty energies" and avoid damage to the planet [16]. The use of energy always generates some kind of environmental impact, be it renewable or non-renewable, of small or large proportion.

However, these impacts can be minimized when associated with integrated resource planning, as they aim at a more sustainable world, promoting political and economic measures [17].

VI. METHODS AND DISCUSSIONS

A very obvious finding is that there is an abyss in the training of teachers separating natural sciences from human sciences and that does not allow the necessary interdisciplinarity and consistent with the aim of integrating knowledge at all levels [18]. To prepare this work, it was necessary to apply a questionnaire, which involved the participation of 10 teachers and 80 students from YAE. The school surveyed (Fig. 1), has four high school classes focused on the YAE modality with a maximum capacity of 40 students per classroom. Statistical data were collected from the school's academic control and archive coordination. Table 1, shows the situation of students in the years 2015 to 2020, with the number of students enrolled, approved, failing and dropping out and detailed by year, where there is an overcrowding and a high rate of dropout students in 2019 (Fig. 2). Climate change, global warming and the greenhouse effect, were the main consequences generated by the environmental impacts caused by fires and pollution in the teaching and student conceptions (Fig. 3). The main greenhouse gases – CH_4 (Methane), N_2O (Nitrous Oxide), CO_2 (Carbon Dioxide) and O_3 (Ozone) – absorb part of the energy radiated by the Earth, generating a greater amount of heat that is retained in the atmosphere, resulting in an increase in temperature. The Amazon is a hot and humid region, and yet, it has a hydrography that occupies 45% of the national territory, therefore, for the state of Amazonas, teachers and students pointed out that the main alternative sources are in solar energy (46%) and hydroelectric (34%) for electricity generation (Fig.4). The interdisciplinarity between physics teaching and renewable energies led to experimental practices to be taught in classrooms, where four practices involving solar, wind, hydroelectric and geothermal energies were carried out. Practice 1 (solar energy), aimed at adapting a photovoltaic plate, instead of batteries, in a remote control cart, the following materials were used: remote control cart; photovoltaic plates; wires; soldering iron; solder; multimeter; measuring tape, being applied in the study of kinematics (acceleration and speed) (Fig. 5). Practice 2 (wind energy), resulted in the construction of a wind turbine, the following materials were used: wind engine; computer cooler propellers; pipe; rechargable battery; protoboard; multimeter; resistors and capacitors, being applied in studies of resistor and capacitor associations (Fig. 6). Practice 3 (hydroelectric

energy), aimed at the implementation of a hydroelectric plant, the following materials were used: tap, hydrogenerator, resistors, capacitors, diodes, LEDs, transformers, protoboard, wires and multimeter, being applied in the study of electrical circuits with diodes and LEDs, hydrogenerators and transformers (Fig. 7). Practice 4 (geothermal energy), resulted in the construction of a geothermal plant, the following materials were used: soda can; other cans; propeller; wind engine; alcohol; wires, phosphorus; protoboard; resistors; LEDs; rechargable battery; multimeter and oscilloscope, being applied in the study of calorimetry (sensitive heat and latent heat), temperature changes (Celsius, Fahrenheit and Kelvin), density and buoyancy (Fig. 8). Finally, a conceptual research was carried out for students and teachers regarding the practices developed in the classroom, where most participants found them excellent.

VII. FIGURES AND TABLES



Fig. 1: Teacher Nelson Alves Ferreira State School.

Table.1: General data of students

ANO	MATRÍCULAS	ESTUDANDO	APROVADOS	REPROVADOS	DESISTÊNCIAS
2015	124	-	88	6	30
2016	113	-	75	9	29
2017	121	-	83	2	36
2018	158	-	80	42	36
2019	181	-	90	3	88
2020	141	141	-	-	-
TOTAL	838	141	416	62	219

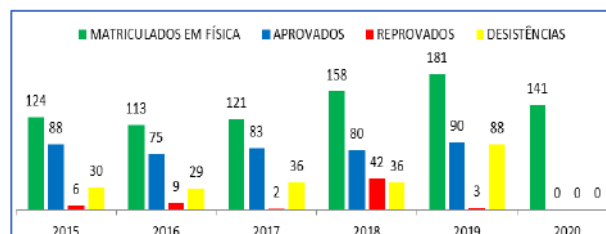


Fig. 2: Statistical data of students.

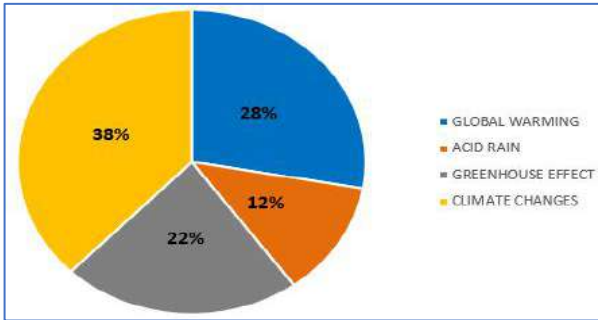


Fig. 3: Consequences of environmental impacts to teachers and students conceptions.

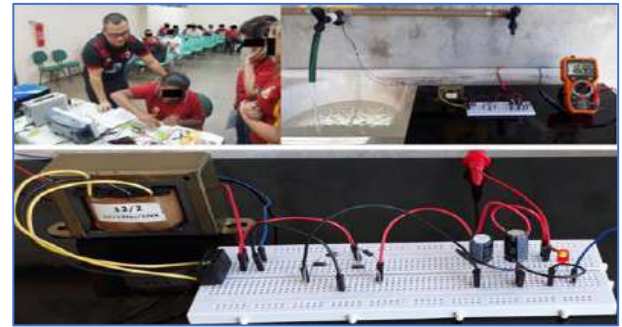


Fig. 7: Hydropower practice.

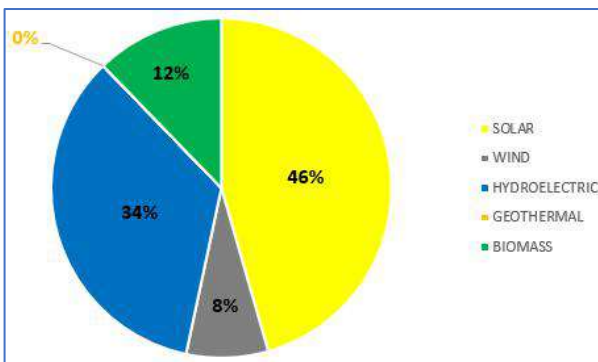


Fig. 4: Renewable energies that stand out in the state of Amazonas in the conceptions of teachers and students.



Fig. 8: Geothermal energy practice.

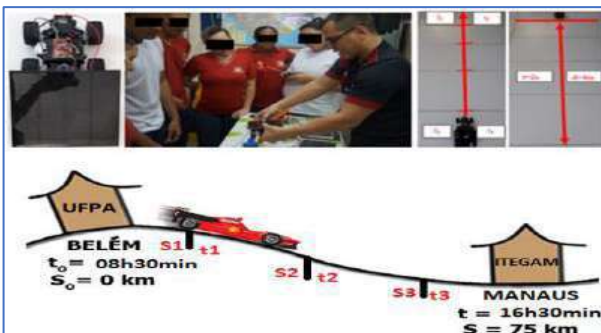


Fig. 5: Practice of solar energy.

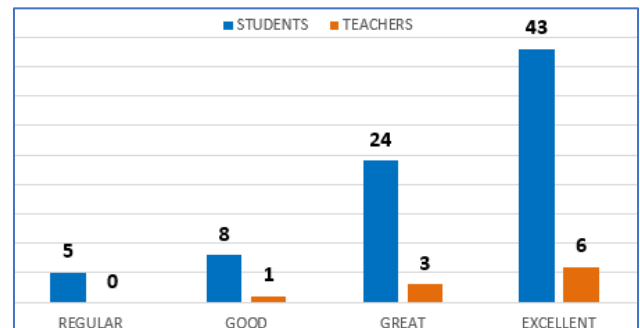


Fig. 9: Concepts of teachers and students regarding experimental practices carried out at school.



Fig. 6: Wind energy practice.

VIII. CONCLUSION

In view of the work exposed, we realize the importance of interdisciplinarity in the educational context involving young people and adults. Although most public schools do not have laboratories for carrying out physical practices and experiments, teachers can adopt environmental themes and their applicability in physics as a study methodology. Therefore, renewable energy was adopted as a method, as experimental practices in physics teaching of YAE, where students and teachers were the target audiences. These practices enabled the development of educational and environmental projects, where the construction of

knowledge started from the theoretical foundations related to YAE, environmental education, teaching physics and renewable energies, up to their respective experimental practices applied by solar, wind, hydroelectric and geothermal, being addressed in the school physics syllabus. However, these practices aroused students' common and critical sense in relation to the subjects studied in the classroom, where motivation and interest in wanting to learn was evident during the course of each experiment.

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Fuzzy logic applied to the decision support measures of the plastic packaging production management system

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Abstract — Currently the automation through decision support systems, plays a key role within the production chain, from small to large companies, this study proposes a fuzzy inference model, in the support in decision making measures of the production management system of a given plastic packaging plant. Analyzing the distinctions in a forceful way of each step that end up influencing the process, and aiming to adapt to customer requests. Using as principle for the proposed system the adequacy of work shifts using the maximum production that the plant has. The MatLab software was used to treat the data, thus adjusting the variables, which were selected due to their degree of influence on the cycle because they are variables that determine the order of the product's manufacture, are they: delivery time, quantity required, manufacturing process and the quantity of shifts that will be needed to produce a particular product, observing with the use of this tool an improvement in shift management, which reduced unnecessary costs, and a good understanding in the production cycle in relation to the characteristics of orders.

Keywords— Fuzzy logic, production cycle and shift adaptation.

I. INTRODUCTION

In a company that does not define a means of managing the production system, makes the development of numerous tasks occur in a complicated way slowing down the process, experts in the area often follow by processing a continuous end of many variants opposite, among them, the implementation of certain times, reception of priority buyers, preservation of reduced collections, supervision of the repeated seasonal of actors in the production cycle.

In this configuration, determining a schedule in production acts as a strategic contractor, since planners need to evaluate numerous variables that may compromise the process both in the procurement part and in production itself.

With all the requirements given to the work in an accurate operation are commonly put by a predetermined collectivity of rules, in which the cases of a certain degree of complexity (SLACK *et al.*, 2018).

Based on this base system is proposed to develop a fuzzy inference model, as a new means of approach to act in order to sequence the production in a plastic packaging plant. That is, adopt a condition that is linked to the margin of subsidies of the entire collection of this arrangement, varying the existing procedure to produce and making it simpler to manage.

To which it refers, the sequencing and data when decisions involving certain activities need to be taken on the order in which the tasks should be performed, regardless of whether they are finite or infinite loading (PENOF *et al.*, 2017).

Diffuse or cloudy logic or as initially spoken fuzzy, is a technique that aggregates the field of artificial intelligence, employing qualitative thoughts for classification of variables and approximate, unfinished or uncertain information to make decisions.

The composition of the model is obtained by a base of linguistic precepts, demarcation of the maximum and minimum perimeters of fuzzy sets, meaning the interfaces of inputs and outputs and the mechanism created of

inference. Note that it is a logical principle that seeks to help formalize the approximation of reasoning, reproducing through techniques the human capacity to deal with imprecise understanding (ZADEH, 1988).

Diffuse reasoning, or the so-called approximation of reasoning, refers to the technique of inference as a summarized set of known rules and facts. Where these rules make up a characterization of knowledge of the fuzzy system and are employed to present the interdependence of the model in the input and output.

We human beings are able to reason with these circumstances, using the experiences lived in the day-to-day of our common sense and point of view. Now solving problems with high degrees of complexity for a computerized system is much more problematic, since they are more exposed to risks of failure (SANTOS, 2003).

II. LITERATURE REVIEW

2.1 Fuzzy Systems

Nebulous logic is based on fuzzy sets, first published in 1965 where it was named by Lofti Asker Zadeh (NOGUEIRA E NASCIMENTO, 2017), professor at Berkeley, University of California, using the treatment of dubious information, such as imprecise data, ambiguity, uncertainty, which are attributions of the way of thinking, thus implementing the vague concepts that had already had its first steps with the Polish Jan Lukasiewicz (1878-1956).

As fuzzy logic is momentarily applied in modeling systems that exhibit a high complexity index, human thought is simulated and replicated through linguistic variables and can use comparative, qualitative or quantitative techniques among others in the measures for each decision to be made. (MUÑOS E MIRANDA, 2016).

Diffuse logic differs from existing ones in that its focus is on the phenomenon of improbability. In this case the fuzzy conceptualization operates in a way that can be perceived as a circumstance in which it is not admissible to easily contest "yes" or "no". Where to articulate something between "right" and "wrong," such as "maybe" or "almost," becomes substantially more appropriate.

In fuzzy we work with linguistic and non-numerical variables like the previous one, that means that the numerical variables have to be transformed by the developer or program into linguistic variables and make the calculations from there.

Figure 1 presents the Implementation of steps in Fuzzy Logic (JUNGES, 2006).

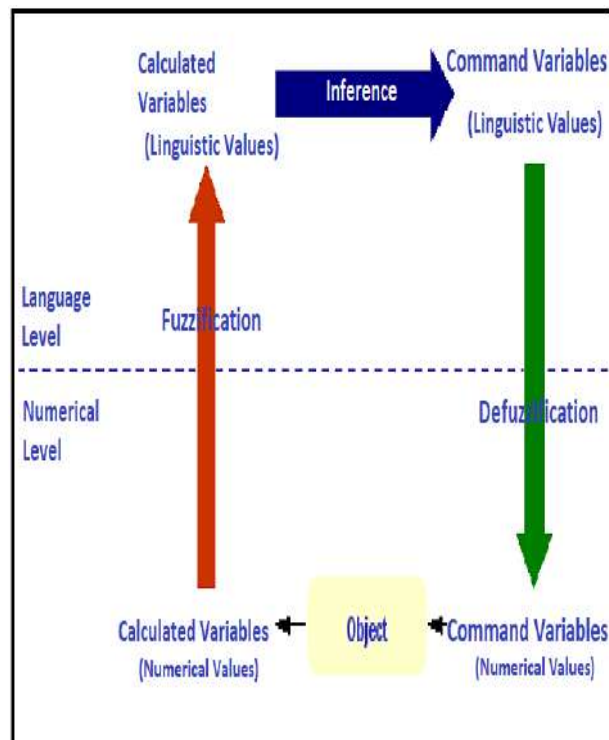


Fig. 1: Implementation of steps in Fuzzy logic

Fuzzy logic allows computers to understand in an orderly way the diffuse variables of human understanding, transforming them into values that can be read more easily by machines, due to their great ability with verbal expressions (DAMBROSIO, 2017).

2.2 Production Planning and Control

Production Planning and Control, commonly known as PCP, is a process applied to the management of production exercises and is an essential component in the administrative composition of a manufacturing system, as a definitive element of manufacturing integration.

PCP is a key element in the company's strategy to meet the needs of consumers with quality and reliability (PAN *et al.*, 2014).

By combining the data from the company's production resource management system that works with the planning, scheduling and control functions, in addition to defining the quantities that will be used to produce, along with the factory sketch to efficiently use the input process flow, and recognizing each production process and workforce determination, whether man or machine for the processing of raw materials, a production map will be created, called PMP - Master Production Plan. Currently, there are agencies focused on the PCP, dedicated to greater operational activity in daily production. In Figure 2 is

shown the schematic representation of the planning and control of production (QUITÉRIO, 2010).

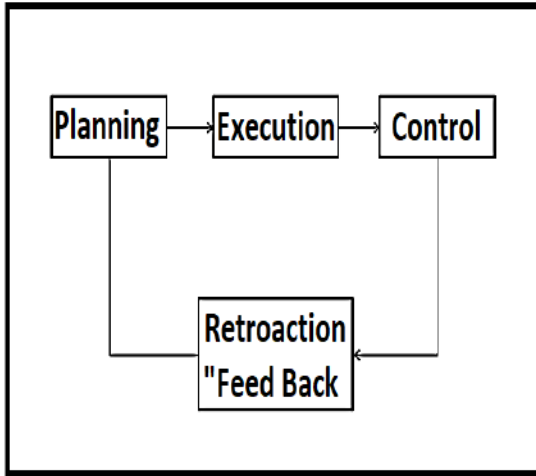


Fig. 2: Schematic Representation of Production Planning and Control.

According to OLIVEIRA *et al.* (2015), a better decision that brings benefits in quality, even if it causes an increase in costs, is still admissible.

Those who do not plan, program and control what they produce may have problems to achieve the productivity rates and quality ratings required by the market, thus being condemned to consequent extinction.

III. MODELING SYSTEM

The possibility of creating automatic rules for the input variables, together with the generation of probable combinations by means of the pertinence functions and the variables, enable the usefulness of this model. To develop the model, Matlab was used as a tool through the Fuzzy Logic Toolbox - (2016a). It is important to emphasize that in this environment you can not create rules automatically, on the other hand you can with your help, legitimize the results offered by the model and check the performance.

Taking into account all the factors mentioned in the literature review, numerous data are mapped within the plant, as well as others with a degree of relevance to better define a new approach in the production cycle adapting to customer orders. Collecting the information from the experts in the areas implicit in this process, certain criteria were established where each one is part of the combinatorial analysis of indicators, which are developed in such a way as to arrive at the measures to be taken by the experts for the specific purposes. Based on this line of reasoning, it was defined which variables will be part of the model composition taking into account its numerical range and linguistic value, making it clear that there are

other variables that influence the production, but for the model presented only three were chosen due to their degree of importance in the process, the remaining variables were considered as met, in Table 1 linguistic variables of input and output, you can see where it will originate from the functions of relevance to the model that follows:

Table 1: Input and output language variables

Variables	Number Range	Linguistic Value
Entries:		
Deadline for Delivery	[0 100]	(short, medium, long,)
Required Quantity	[0 100]	(small, medium, large)
Production Process	[0 100]	(low, medium, high)
Outputs:		
Number of shifts required	[0 100]	(1 Shift, 2 Shifts, 3 Shifts)

In Figure 3 necessary shifts, a help system is implemented in the Graphic User Interface area.

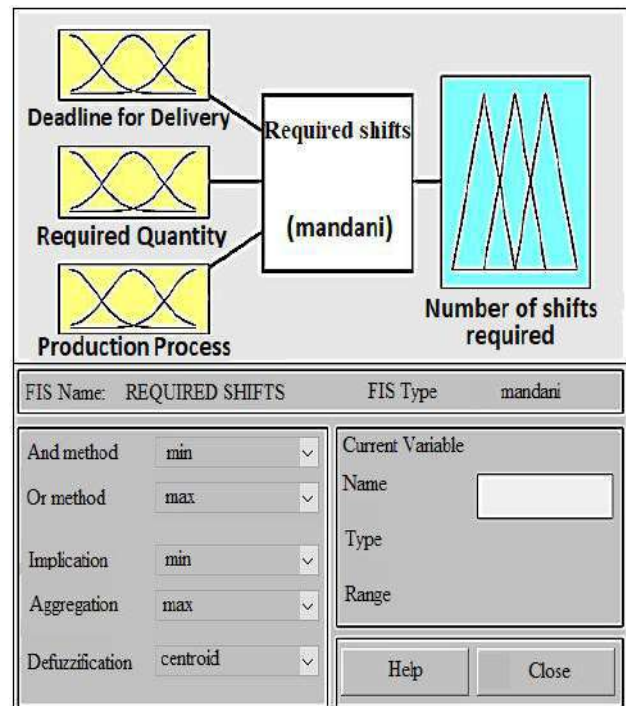


Fig. 3: Required shifts

3.1 Input and Output Variables

Regarding the description of the variables, they represent the knowledge of the specialist in fuzzy inference, being denominated as input and output variables of the system, corresponding in linguistic terms that represent mode of inaccuracy. Thus, the variables of the proposed system are:

a) **Delivery Time** – This linguistic variable respects the delivery time of the finished product, agreed between the company and a particular customer.

This estimate of the delivery time is continuously updated by the professionals of the commercial area and production planning, a measure considered to be suitable, because it is necessary at the time of negotiation to know if what is being proposed will in fact be able to be done in a timely manner. Its linguistic values are:

Short - Corresponds to the period of 1 to 30 days.

Medium - Corresponds to the period of 35 to 65 days.

Long - Corresponds to the term of 70 to 100 days.

The fuzzification of this variable is trapezoidal at the ends and triangular in the central part of the chart as Figure 4 delivery time.

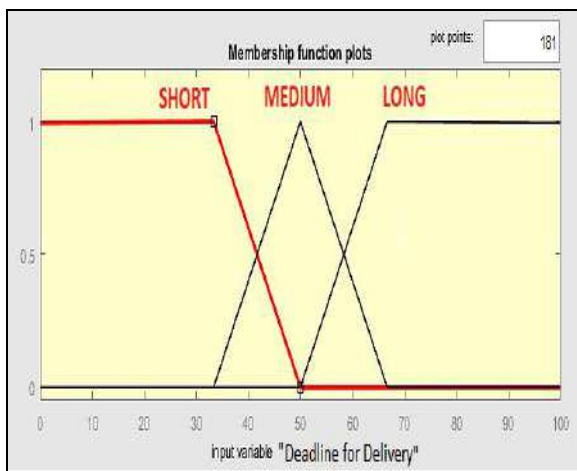


Fig. 4: Delivery time

b) **Quantity Required** - Briefly, nothing more is than the quantity that the customer requested of too much product, this variable is responsible for directing the process, so that it is determined what will be necessary of inputs the factory have, to be able to meet the request of customers. Its linguistic values are:

Small - It corresponds to a quantity of 1 to 300 units.

Medium - Corresponds to a quantity of 350 to 650 units.

Large - It corresponds to the quantity of 700 to 1000 units.

The relevance of this variable is also considered high in the aid of the shifts with the fuzzification also according to the parameters of the first variable described as Figure 5 required quantity.

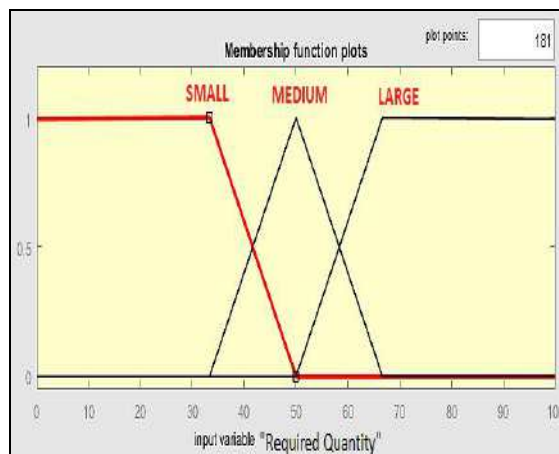


Fig. 5: Required quantity

c) **Production Process** - is a linguistic variable that in the developed model, corresponds to the period for the execution of a certain product, that is, it is the time that it takes for a given part to be manufactured.

This product processing time will always be mapped together with those who know the processes and the data that will be obtained to define this parameter should be based on the model in Table 3.2 percentage of inference of the manufacturing steps, which defines the phases of the manufacturing process with its certain percentage of inference in the process, which in other words originates the margin that each step adds labor in the service that follows.

Table 2: Inference percentages of production steps

Process Steps	% Percentage of Inference
Raw Material Addition	20%
Extrusion	20%
Treatment	10%
Winding 01	15%
Cutting and Welding	10%
Winding 02	15%

Printing	10%
Total Cycle	100%

Its linguistic values are:

Low - Corresponds to the time from 1 to 720 hours.

Medium - Corresponds to the time from 840 to 1560 hours.

High - Corresponds to the time from 1680 to 2400 hours.

Figure 4.4 shows the trapezoidal membership function representing the production process.

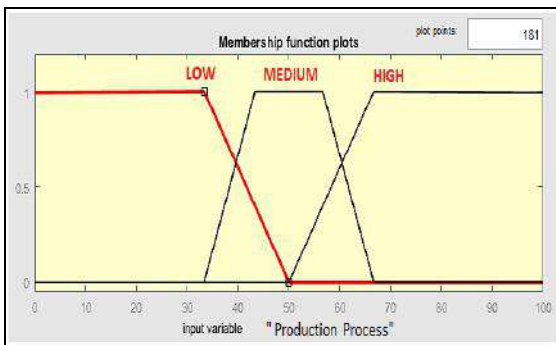


Fig. 6: Production process

d) **Number of Required Shifts** - This linguistic variable of exit of the proposed model, will be responsible for defining the amount of labor, that is, based on this exit will be generated a sequencing in the manufacture that caused with the use of up to one or more shifts always using the maximum production. In this new scenario we will have a new concept of sequencing.

The objective of this output is to be established in a dynamic way, a model that can warn the orderly priorities of new shifts that will be needed to not compromise the delivery time.

Figure 7 shows the number of necessary shifts, representing the trapezoidal pertinence function.

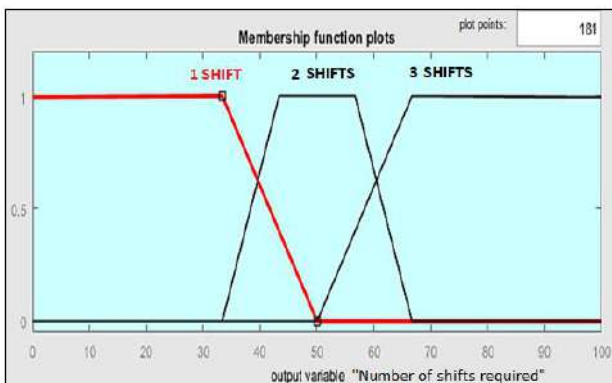


Fig. 7: Number of shifts required

3.2 Rules Basis

To build the knowledge base of the model and its rules of inference, many analyses were needed with the experts of the organization. In this way, one can add information to the system so that it can respond to all possible situations.

It was adopted in the system the inference machine using the Mamdani method and the logical operation "and" (intersection).

In the defuzzifier stage, the most commonly used method was the area center or centroid, which is based on the calculation of the center of gravity of the association function, responsible for calculating the area of the curve of the output linguistic variable, determined by the inference machine, and finding the matching indicator that divides this area in half.

Then the 3 input variables of the suggested model are defined, where the first input variable Delivery Time has 3 pertinences, the second variable Quantity Required also contains 3 pertinences, and the third variable Production Process, has 3 pertinences, consequently generating the mathematical formulation $3^3 = 27$, according to Figure 8 combinatorial analysis.

Deadline for Delivery	Required Quantity	PRODUCTION Process	Number of shifts required
short	small	low	1
short	small	medium	1
short	small	high	2
medium	small	low	1
medium	small	medium	1
medium	small	high	2
long	small	low	1
long	small	medium	1
long	small	high	1
9 combinações			
Deadline for Delivery	Required Quantity	PRODUCTION Process	Number of shifts required
short	medium	low	1
short	medium	medium	2
short	medium	high	3
medium	medium	low	1
medium	medium	medium	2
medium	medium	high	3
long	medium	low	1
long	medium	medium	1
long	medium	high	2
9 combinações			
Deadline for Delivery	Required Quantity	PRODUCTION Process	Number of shifts required
short	large	low	2
short	large	medium	3
short	large	high	3
medium	large	low	2
medium	large	medium	3
medium	large	high	3
long	large	low	1
long	large	medium	1
long	large	high	2
9 combinações			

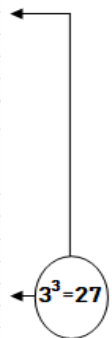


Fig. 8: Combinatorial analysis

The demonstration of the main Inference Rules Base of linguistic variables resulted in 27 combinations as previously discussed, where part of it can be observed in Figure 9 rules of inference of linguistic variables.

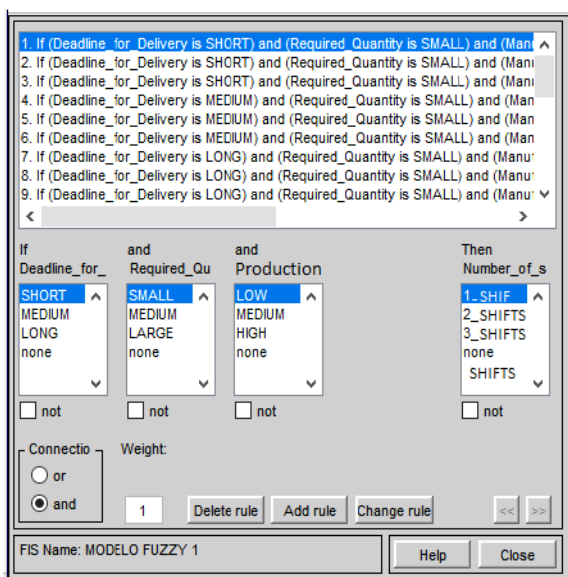


Fig. 9: Rules for inference of linguistic variables

The rule viewer allows all diffuse inference processes to be interpreted simultaneously, and also shows how adherence to some functions affects the overall outcome, showing how each rule and its results work.

The input parameters are derived from a common analysis by researchers and experts in the organization to test the decision model. The values are evaluated based on the actions expected in the production environment, including previous process data.

Once we know the delivery time, the quantity required and the manufacturing process, we will determine the amount of labor to be applied in the process.

The model parameters are shown below:

[System]

Name='NECESSARY_SHIFTS01'

Type='mamdani'

Version=2.0

NumInputs=3

NumOutputs=1

NumRules=27

AndMethod='min'

OrMethod='max'

ImpMethod='min'

AggMethod='max'

DefuzzMethod='centroid'

[Input1]

Name='DELIVERY PERIOD'

Range=[0 100]

NumMFs=3

MF1='SHORT': 'trapmf', [-66.67 33.33 33.33 50]

MF2='MEDIUM': 'trimf', [33.33 50 66.67]

MF3='LONG': 'trapmf', [50 66.67 66.67 66.67]

[Input2]

Name='QUANTITY-REQUIRED'

Range=[0 100]

NumMFs=3

MF1='SMALL': 'trapmf', [-66.67 33.33 33.33 50]

MF2='MEDIUM': 'trimf', [33.33 50 66.67]

MF3='BIG': 'trapmf', [50 66.67 66.67 66.67]

[Input3]

Name='PRODUCTION PROCESS'

Range=[0 100]

NumMFs=3

MF1='LOW': 'trapmf', [-66.67 33.33 33.33 50]

MF2='MEDIUM': 'trapmf', [33.33 43.33 56.67 66.67]

MF3='HIGH': 'trapmf', [50 66.67 66.67 66.67]

[Output1]

Name='THE AMOUNT OF SHIFT-NEEDED'

Range=[0 100]

NumMFs=3

MF1='1^ SHIF': 'trapmf', [-66.67 33.33 33.33 50]

MF2='2^ SHIFTS': 'trapmf', [33.33 43.33 56.67 66.67]

MF3='3^ SHIFTS': 'trapmf', [50 66.67 66.67 66.67]

[Rules]

1 1 1, 1 (1) : 1

1 1 2, 1 (1) : 1

1 1 3, 2 (1) : 1

2 1 1, 1 (1) : 1

2 1 2, 1 (1) : 1

- 2 1 3, 2 (1) : 1
- 3 1 1, 1 (1) : 1
- 3 1 2, 1 (1) : 1
- 3 1 3, 1 (1) : 1
- 1 2 1, 1 (1) : 1
- 1 2 2, 2 (1) : 1
- 1 2 3, 3 (1) : 1
- 2 2 1, 1 (1) : 1
- 2 2 2, 2 (1) : 1
- 2 2 3, 3 (1) : 1
- 3 2 1, 1 (1) : 1
- 3 2 2, 1 (1) : 1
- 3 2 3, 2 (1) : 1
- 1 3 1, 2 (1) : 1
- 1 3 2, 3 (1) : 1
- 1 3 3, 3 (1) : 1
- 2 3 1, 2 (1) : 1
- 2 3 2, 3 (1) : 1
- 2 3 3, 3 (1) : 1
- 3 3 1, 1 (1) : 1
- 3 3 2, 1 (1) : 1
- 3 3 3, 2 (1) : 1

In Figure 10 three-dimensional surface viewer, it is possible to see graphically changing the angles the results found.

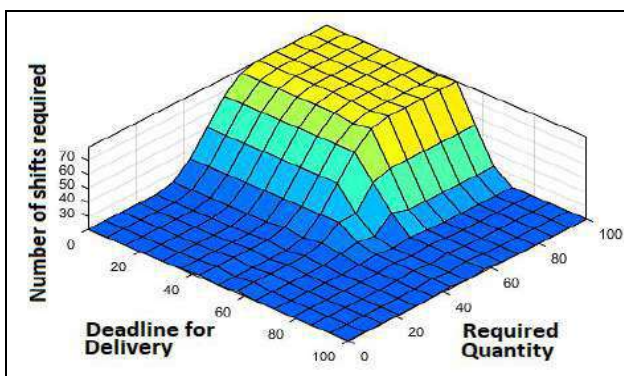


Fig. 10: Three-dimensional surface viewer

The data displayed in the rule viewer facilitates the interpretation of the fuzzy inference process, where it is also possible to demonstrate functions that reflect on the overall result of the system. By varying the input values, it is possible to evaluate the outputs of the proposed system,

obtaining a value that allows a correct analysis of the efficiency of the method adopted to aid in decisions. In Figure 11 viewer of rules of number of shifts, it is shown the results that refer to the production order, where the decision model is visualized using Matlab, which represents the output.

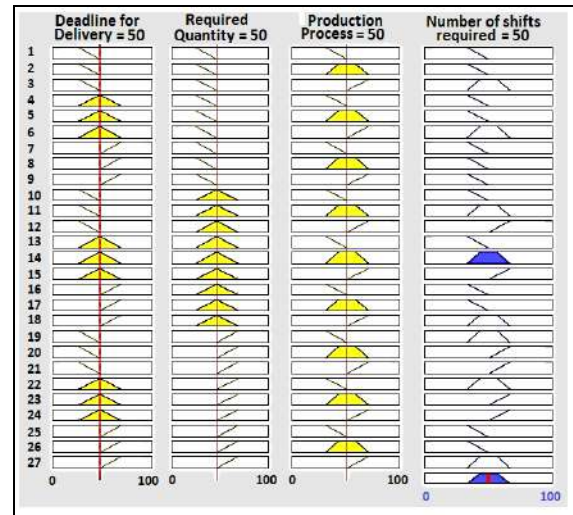


Fig. 11: Shift quantity rules viewer

In Figure 12, when adopting hypothetical values to the input values, considering them in percentages, in which the value adopted for the input variable delivery time represents 50%, for the required quantity 50% and for the production process 50%, resulting in a shift forecast corresponding to 50%, that is, two shifts of work will be necessary using all the lines, considering their maximum production to perform the subsequent task, so that the third shift will continue working ahead of the production of other orders.

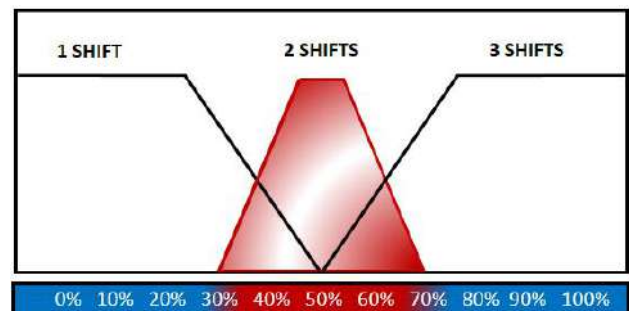


Fig. 12: Selected shift output

IV. CONCLUSION

From the observation of the analyzed aspects it was concluded when describing the production model, a better conduction in the development of the proposed support model because it encompasses the processes as a whole

that helped to segment the operations performed in the production of plastic packaging, in view of the arguments cited it can be observed that improving the shift management actually reduces unnecessary costs, which entails the definition of a new approach in the production cycle that organizes it by the characteristics of orders. We concluded that the use of fuzzy logic as support in decision making is undoubtedly a differential within the production of plastic packaging, since it is plausible to indicate a specific procedure within the company, as occurred in the sequencing of activities. The return that was obtained by the system proceeded in an acceptable manner, demonstrating in a short way that the decision making based on inaccuracies and indeterminacy is able to be supported by the proposed fuzzy inference system. However, it is necessary to highlight the consideration of the expert's understanding for the modeling of the system, adding estimates and disseminating the teaching applied in the manipulation of data, and especially in the preparation of the rule base.

In relation to the implementation of inference, the support in the decision-making measures of the production management system of a given plastic packaging plant, adapting to the customer's request, with the purpose of improving the sequencing of production, consecutively seeking to reconcile effectively the amount of labor to the requested request, regardless of the scenario required by the customer. In situations of rapidly changing scenarios, where companies are submitted, imply that within the enterprises the automated systems can elaborate a new dynamic, building concise routines, not remaining conditioned to people's decisions, because in decision making there will always be differences.

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Individual and social vulnerabilities to the occurrence of hepatitis A and B in traditional populations of the Paraense Amazon

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Abstract— *Introduction: Hepatitis A and B are infectious diseases that represent an important public health problem in Brazil. Objective: to analyze the epidemiological profile and possible behavioral and environmental factors that may be related to the occurrence of viral hepatitis A and B in riverside communities located in the Amazon region. Methodology: cross-sectional epidemiological, with a quantitative approach, carried out in the riverside communities of the Paraense Amazon. Results and discussion: The results reveal that the prevalence of hepatitis A and B in this population group is higher than that existing for the entire Brazilian population, it was found that 88.89% of the reported cases were of Hepatitis A and 11.11% of hepatitis B. The majority (53.73%) of the interviewees, never performed the examination for early detection of hepatitis, and part of the 8.96% did not have the vaccines and 35% shared personal objects, such as nail pliers and razors, in addition we have that only about 50% of individuals use contraceptive methods and most use condoms. Final considerations: The riverside populations have satisfactory conditions of basic sanitation, food, a fact that interferes not so much in the quality of life of these individuals, but also leads to a greater susceptibility to the development of health problems.*

Keywords— *Hepatitis A and B, epidemiology, public health.*

I. INTRODUCTION

Hepatitis A and B are infectious diseases that represent an important public health problem in Brazil. Hepatitis A and B are diseases caused by different etiologic agents, with primary tropism for hepatic tissue, which present similar epidemiological, clinical and laboratory characteristics, however, with important particularities [1].

Hepatitis A is transmitted via fecal-oral route, water, food and spread from person to person, being the most common cause of acute viral hepatitis in the world. According to an assessment by the Pan American Health Organization, approximately 130 new cases per 100,000

inhabitants occur in Brazil each year, and the country is considered a risk area for the disease [2]. In the North region, studies show that there is a high prevalence of the disease with an endemic pattern reaching 95% [3].

Hepatitis B, on the other hand, is the most serious type among viral hepatitis [4], with the main transmission routes being sexual, parenteral and vertical [5]. According to estimates by the World Health Organization, two billion people have already had contact with the hepatitis B virus (HBV) and 350 million have become chronic carriers [6].

In Brazil, the Ministry of Health reveals that at least 15% of the population has been in contact with HBV and

that 1% of the population has a chronic disease related to this virus [2], while only in the North region does the prevalence of HBV reach 24.1% in relation to the general population, characterized as an area of high endemicity [6]. Epidemiological studies carried out among indigenous, riverside dwellers, and immigrant populations in the Brazilian Amazon reveal that, in these places, the prevalence of HBV can vary from 0% to 20.6% [7].

Thus, hepatitis A and B are of great importance due to the number of individuals affected and the possibility of complications, which “depending on the etiologic agent, viral load and host conditions, can progress to chronic hepatitis, cirrhosis, liver cancer and acute fulminating forms”[8].

Research on the subject has become extremely relevant, especially among riverside populations in the Amazon region, given that it is a region more prone to the spread of viral diseases. Such problem can be related to several factors, such as the environmental characteristics of the place, behavioral habits of the riverside residents and the fact that studies addressing the issue with these populations, are infrequent or even, not disclosed.

This study aimed to analyze the epidemiological profile and possible behavioral and environmental factors that may be related to the occurrence of viral hepatitis A and B in riverside communities located in the Amazon region, in the municipality of Santarém, Pará, Brazil.

II. METHODS

This research is an epidemiological study of a transversal character, which is a modality of study in which we can investigate “cause” and “effect” simultaneously and investigate the existing association between exposure and disease. Its main advantage is to generate information necessary for understanding the endemic-epidemic process and thus subsidizing intervention strategies [9]. We use the quantitative approach, which is characterized by the quantification and use of statistical techniques in the treatment of information. We use descriptive statistics to analyze the collected data, which is conceptualized as an intelligible description of the collected data [10].

Data collection was carried out through a form with 21 questions that were asked and noted by an interviewer, the sample is composed of 67 individuals living in the riverside communities São Ciríaco and Campos do Urucurituba, both located on the banks of the Amazon River. These communities make up the municipality of Santarém, located in the west of the state of Pará, in the

northern region of Brazil. We used as inclusion criteria those who expressed their acceptance by signing the Informed Consent Form (ICF) as long as they were over 18 years old, the researchers guaranteed ethical commitment to the interviewees.

III. RESULTS

Among the population studied, the majority (67.16%) live with 3 to 5 people and when asked about personal and family history, of the reported cases of Hepatitis, 88.89% were of Hepatitis A and 11.11% of hepatitis B. Regarding their knowledge about these pathologies, 68.66% of the interviewees reported knowing what this disease is, however when asked what form of transmission, which signs and symptoms, they did not know how to answer, only when asked about some clinical manifestations, there was an association to have manifested in the period of the disease, among the individuals who mentioned that they already had.

Of the individuals interviewed, 22.73% of those interviewed had already lost their appetite, 46.97% had had diarrheal episodes, 16.67% had liver problems and 13.64% reported having eliminated dark colored urine, the majority (53 , 73%) reports that he never underwent the early detection test for the detection of Hepatitis A and B, as well as the rest of his family.

Regarding the use of preventive methods for Hepatitis B, it was found that only about 50% of individuals use contraceptive methods and that most of them use condoms. As for risk factors, we highlight that part of the study population (8.96%) did not take the necessary doses to prevent this disease and approximately 35% share personal objects, such as nail pliers and razors.

Regarding the knowledge about the forms of hygiene to prevent Hepatitis A, the majority of respondents (92.54%) claim to know what hygiene is and what to do to prevent waterborne diseases (washing hands, washing food), and inform that the basis of their diet is the consumption of cooked fish, for disease prevention, in 46.77% of the cases.

IV. DISCUSSION

The results of the present study reveal that the prevalence of hepatitis A and B in this population group is higher than that existing for the entire Brazilian population. According to data from the National Survey of Viral Hepatitis, in the Brazilian capitals and in the Federal District, the percentage of the population that has or has had hepatitis (prevalence) was 39.5% for type A and

0.37% for the virus B, while in this research, it was detected that 88.89% of the reported cases were of Hepatitis A and 11.11% of hepatitis B [11].

It is believed that some factors, such as low schooling, lack of knowledge about the disease, mainly in relation to the transmission mechanism, in addition to early sexual activity combined with poor adherence to condom use, are the primary determinants for the acquisition of viral hepatitis. In this study, it was observed that most of the interviewees have only incomplete elementary education, which hypothetically may imply that individuals had little access to health-related information that usually incorporates the basic curriculum of high school. When asked about their knowledge in relation to hepatitis, 68.66% of the interviewees reported knowing what this disease is, however, most of them revealed to be unaware of its form of transmission. Therefore, it is understood that they have heard of the disease, however, they do not know it faithfully.

In view of this situation, it is clear that there is a high probability of these people having hepatitis A and B, but they did not associate with these diseases, thus expanding the transmission chain. As the data shows, 22.73% of the interviewees have already had loss of appetite, 46.97% have already had diarrheal episodes, 16.67% had liver problems and 13.64% reported having eliminated dark colored urine. Despite having presented such symptoms characteristic of hepatitis, the majority (53.73%) of the interviewees never underwent an early detection test, as did the rest of their family.

The lack of information may also have influenced early sexual initiation. The results show that most of the interviewees became sexually active from the age of 16. Several authors associate the younger age of sexual initiation with a low level of education [12]. In his studies, the aforementioned author shows similar results, where most of the population had their sexual life beginning between 14 and 19 years old.

Another important factor related to sexual life is unprotected sex. In this research, it was found that only about 50% of individuals use contraceptive methods and that most of them use condoms. The other half of the population, however, may be a vehicle for the transmission of hepatitis B to their partners, taking into account that most of the interviewees said they were married or in a stable relationship. Faced with this situation, the presence of a vulnerability group is detected in the study population. Thus, there is a need to develop prevention strategies that aim to promote behavioral changes in these individuals who do not have safe sex.

These preventive measures can also focus on vaccination against hepatitis B and not sharing sharps, since part of the study population (8.96%) did not take the necessary doses to prevent this disease and approximately 35% shares personal objects, such as nail pliers and razors. HBV can remain infectious on inert objects / surfaces for up to one week, contributing to the expansion of a new transmission route: that of invasive aesthetic procedures, such as the cuticle extraction habit, the use of piercings and tattoos [3]. Regarding vaccines, we have that vaccination against hepatitis B and A achieves a reduction in its incidence among children in industrialized countries [13].

Three aspects may have influenced this situation, namely: geographical barriers (the fluvial distance from riverside communities to the nearest cities, making access to health services difficult), lack of adequate infrastructure for the conservation of immunobiologicals (highlighting the lack of water supply) electricity in most of these locations) and a low rate of health professionals to meet all existing demand. Such aspects were found in the locality under study, revealing the fragility in public policies aimed at riverside communities and traditional peoples.

Taking into account that hepatitis A is a disease of fecal-oral infection, hygiene practices, food preparation, as well as basic sanitation conditions, are of fundamental importance for the occurrence or not of this pathology in a population. The study reveals that the majority of respondents (92.54%) claim to know what hygiene is, moreover, it shows that 46.77% consume fish in cooked form. Such a situation becomes a positive point, since with prior knowledge about hygiene, the individual tends to adopt preventive measures that will bring benefits to his health, such as, for example, boiling foods that, even after going through a wash, still contains a minimum rate of microorganisms.

Despite the adoption of these practices, it was noticed that the prevalence of hepatitis A was still very high for those communities. Faced with this problem, we sought to identify what other risk factors could be contributing to the proliferation of this disease. From this, it was found that the hygienic-sanitary conditions that the interviewees had were precarious: the water they used daily for consumption came directly from the river that bathes the community; there is no selective garbage collection, which leads residents to give inappropriate destinations for their household waste; in addition, they did not have an infrastructure with a sewage network, allowing the discharge of their organic waste in the river present there and also in "black tanks".

The absence of such minimum basic sanitation conditions, coupled with the fact that the majority (67.16%) of the interviewees live with 3 to 5 people, becomes a worrying factor, since all these vulnerabilities contribute largely to the transmission of Hepatitis A. Brazil has a National Policy for the Sustainable Development of Traditional Peoples and Communities, which has among its objectives: to implement adequate infrastructure to the socio-cultural realities and demands of traditional peoples and communities and to ensure access to quality food, based on health-promoting food practices. , that respect cultural diversity and that are environmentally, culturally, economically and socially sustainable. Given the existence of this policy, it is clear that little or nothing has been done to improve the quality of life of the study population.

V. CONCLUSION

The study made it possible to identify the possible behavioral and environmental risk factors that are related to the occurrence of viral hepatitis A and B in the two riverside communities located in the Amazon region. We consider poor socioeconomic conditions, low level of education and difficulty in accessing health services as the most relevant points for the high rate of hepatitis A and B in these locations.

The investigation also allowed us to perceive the weaknesses in public health policies aimed at traditional populations that do not have satisfactory conditions for basic sanitation, food, a fact that interferes not only in the individual health of riverside dwellers, in addition, these populations are lacking in knowledge. on the transmission of these viral hepatitis, in addition to other diseases and their forms of prevention, making the problem not only preventive, but also due to the number of health professionals working in these areas, demonstrating a deficiency in treatment-related interventions, preventing infection from other people within the community.

Academics, health professionals and public managers should play a role in facing this situation with the communities, which have few resources to combat HAV and HBV, guidelines and compliance with effective measures, supported by public policies that should act to reduce or eradicating the risks of infection and hepatitis viruses within traditional communities.

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Performance Evaluation of Sewage Treatment Plant at Juet Campus, Guna (MP), India– A Case Study

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Abstract— Sewage Treatment Plants (STPs) are recognized as the solution to domestic and industrial wastewater treatment in developing countries. These are cheap, easy to construct and do not require high skilled labor. This paper describes the performance evaluation of the STP located at Jaypee University of Engineering & Technology (JUET) campus, Guna (MP), India. It includes testing of biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS) and pH. Samples are collected and analyzed over eight months at five different sampling points i.e., inlet, and effluents of aeration, equalization, pressure filter and outlet. The BOD, COD, TDS, and TSS average removal efficiency were observed to be 57%, 68%, 12% and 40.43% respectively. The treated effluent values were below the tolerance limit specified by Bureau of Indian Standards for sewage effluent discharged into surface water sources and public sewers. The results demonstrated that STP is working very efficiently and contributing to clean and healthy environment of the university campus.

Keywords— Biochemical oxygen demand, Chemical Oxygen Demand, Total dissolved solids, Total suspended solids.

I. INTRODUCTION

Sewage is used water from residential, institutional, and commercial and industrial establishments. In homes, sewage includes liquid from toilets, baths, showers, kitchens, sinks, washing machines and dishwashers. In many areas, sewage also includes liquid waste from industry and commercial establishments. The domestic sewage contains 99.9% water, 0.02-0.03% suspended solids and other organic (70%) and inorganic (30%) substances. Inorganic components include ammonia, chloride salts and metals. Metal industries and mines also contribute to the inorganic. Organic components include either nitrogenous compounds like proteins and amino acids or non-nitrogenous compounds like carbohydrates and lipids. Animal sewage is high in protein and lipids and plant sewage is rich in cellulose and lignin. Lipids in the form of fatty acids which escape digestion in the digestive system account for the lipids in the faeces. Sewage water normally comprises of fungi, protozoa, algae, bacteria and viruses. In addition storm runoff burdened with harmful substances via run off from roads, parking lots

and rooftops can harm our fresh water systems. Sewage contains substances such as human waste, food scraps, oils, soaps and chemicals. Human waste naturally contains bacteria that can cause disease. Once water becomes infected with these bacteria, it becomes a health hazard. The disposal of untreated or poorly treated sewage into surface water bodies in urban areas is common in most developing countries, including Zimbabwe [1]. If raw sewage directly discharges into streams causes increased algae, reduced oxygen and murkiness destroy the ability of a stream or lake to support wildlife, and all of the fish, frogs and other life forms quickly die. That's why it is essential to build sewage treatment plants (STPs) and enforce laws against the release of raw sewage into the environment.

STP plays a vital role in the process of removing the contaminants from sewage to produce liquid and solid (sludge) suitable for discharge to the environment or for reuse. Many countries in the world contain limited fresh water resources. Hence, after proper treatment of sewage, can be reused for agricultural purposes. The complete treatment

of sewage accomplish by a sequential combination of various physical unit operations, and chemical and biological unit processes. The general yardstick of evaluating the performance of STP is the degree of reduction of BOD, and suspended solids, which constitute organic pollution [2]. The performance efficiency of STP depends not only on proper design and construction but also on good operation and maintenance[3]. The performance evaluation of STP is extremely useful as it provides information on how the system is working and possible to identify drawbacks for betterment.

About STP

Fig. 1 provides flow diagram of STP located at Jaypee University of Engineering & Technology (JUET) campus, Guna (MP), India. The STP has a capacity to treat 700 m³/d of wastewater from the campus. It's a modern small-scale treatment plant where treatment of sewage takes place and produced wastewater suitable for reuse in irrigation or garden supply. The wastewater generated from the

academic block, hostels and faculty accommodation were collected by means of sewer pipe line. This wastewater screened through a bar screen chamber to remove large debris such as sticks, leaves, trash and other large particles which may interfere with subsequent purification steps then it passes to the equalization tank where it is retained. This tank equalizes the flow rate into subsequent parts of the treatment system. While entering the effluent into aeration tank, urea and DAP (Di-Ammonium phosphate) were added as nutrient for the growth of microorganisms. In the aeration tank air was continuously introduced, which bring about satisfactory aeration of sewage. Sewage also gets thoroughly mixed up with the activated sludge during its downward journey. Then it passes to the settler tank, where sludge settled and water goes to raw water tank. The settled sludge was treated in sludge drying beds. Then it treated in the pressure filters which basically aerated filters. The dual purpose of this media is to support highly active biomass that is attached to it and to filter suspended solids.

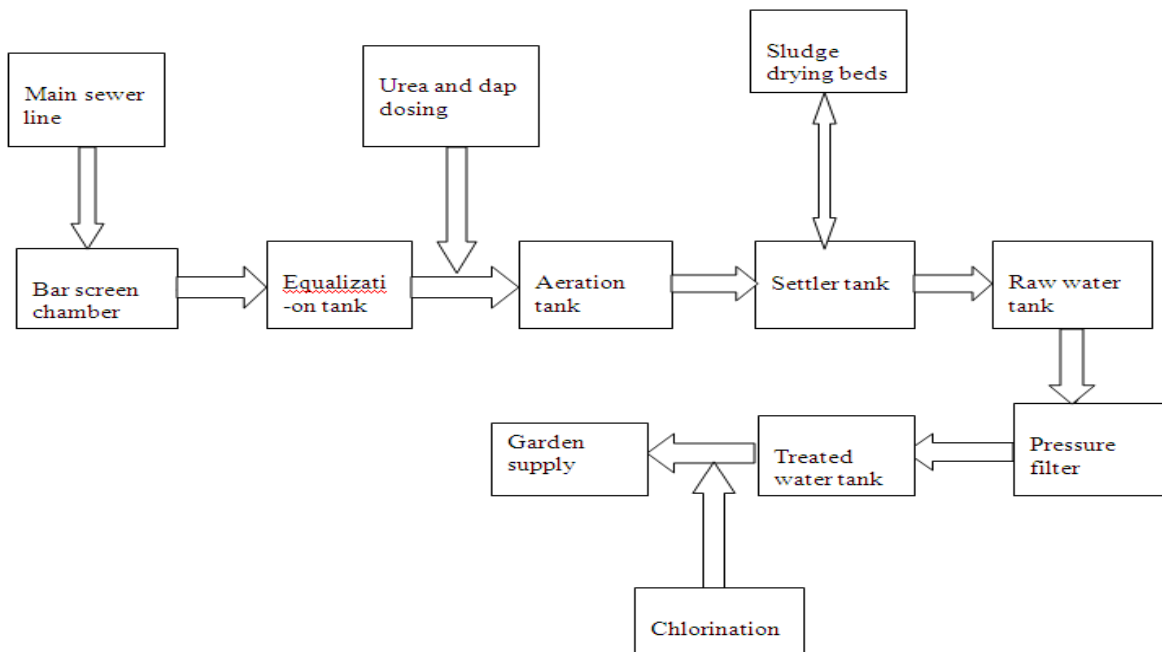


Fig. 1. Flow Chart of JUET's Sewage Treatment Plant

Carbon reduction and ammonia conversion occurs in aerobic mode and sometimes achieved in a single reactor while nitrate occurs in anoxic mode. After that treated water gets collected in the treated water tank. The chlorination of

treated water was done so that treated water should be free of pathogenic (disease causing) microorganisms that cause illnesses as typhoid fever, dysentery and cholera. Then the

treated wastewater is used for gardening, irrigation and recreational purposes.

Dimensions and specifications of the treatment units:

Screen chamber: It is provided with 20 mm equal spacing made from 6 mm thick MS flats.

Equalisation tank: One rectangular tank of 8 m length, 6 m width and 2.5 m liquid depth.

Aeration tanks: Three numbers of aeration tank of 8 m length, 5 m width and 2.5 m depth each are provided. There are three numbers (2 on duty and 1 stand by) of blowers with capacity of 175m³/h and 0.4 kg/cm².

Settler tank: It was one number constructed with RCC and size of rectangular tank was 8 m x 5 m x 2.5 m

Sludge drying beds: There are five identical RCC rectangular tans, having 2.5 m x 2 m x 1 m.

Raw water tank: It was constructed with RCC and size of rectangular tank was 8 m x 4 m x 2 m

Pressure filter and carbon filter: These filters have capacity of 35 cumecs each.

Treated water tank: It consists of one rectangular tank of 8 m length, 5.5 m width and 4.5 m depth.

In view of the above scenario, the present study has been undertaken to find actual treatment ability of STP by

collecting and testing samples in various treatment units. In addition to give suggestions for further to improve the efficiency of STP.

II. MATERIALS AND METHODS

Performance appraisal has been carried out for a period of eight months (September 2009 to April 2010) by comparing the concentrations of pollutants at the inlet and outlet of the treatment unit. The grab samples were collected once in a month of September, November, January, March and April and composite samples in the month of April. The samples were collected at five different units of the treatment plant, namely, a) Influent to the treatment plant, b) Effluent of i) aeration tank ii) settler tank iii) pressure filter unit and iv) outlet unit, and analyzed as outlined in the standard methods for the examination of water and wastewater [4]. The samples were analyzed for various parameters like pH, 5-day BOD, COD, TSS and TDS.

III. RESULTS AND DISCUSSION

3.1 Biological oxygen demand

Fig. 2 shows the variation of BOD pattern from influent to effluent of STP. The BOD values decreased in the effluent

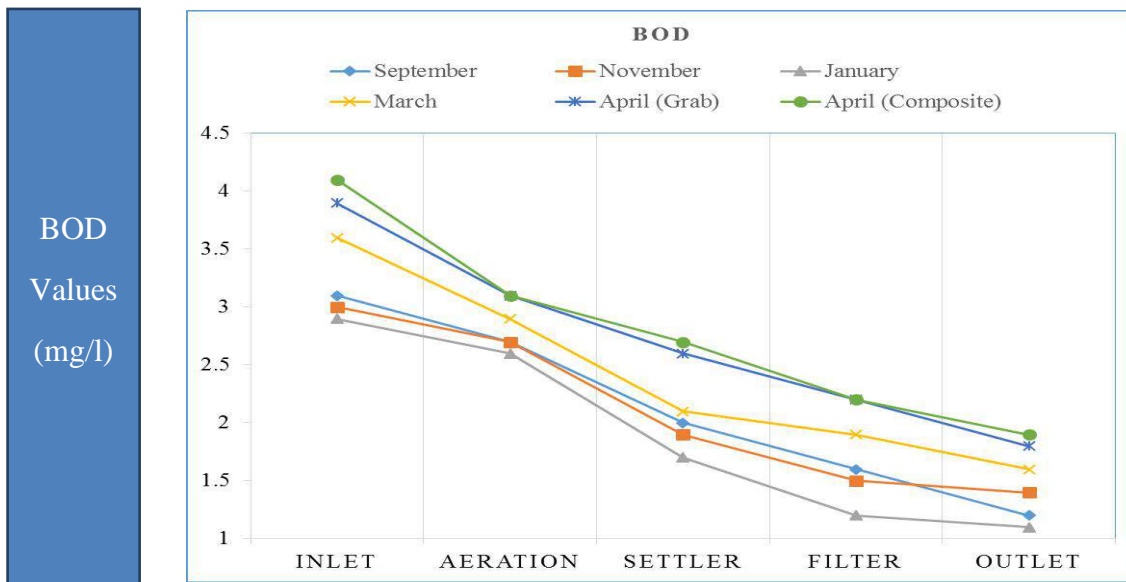


Fig. 2 Variation of BOD during the period of data collection

coming from various treatment units. It has been observed that BOD values in the month of April are higher than the remaining months. The treatment efficiency for the composite sample collected in the month of April reduces ~ 25% by aeration unit and overall reduction takes place by 54%. The aeration tank is considered as a most important step in activated sludge process as it provides DO to the sewage, facilitates rapid decomposition of organic matter.

Table 1. Average efficiency of STP during observation period.

Parameter	Treatment efficiency (%)			
	Aeration	Settler	Filter	Outlet
BOD	15.15	37.57	49.09	56.96
COD	8.22	28.51	54.84	67.77
TDS	2.93	5.8	9.69	11.54
TSS	14.7	33.33	38.57	40.43

Table 1 shows that 57% of average BOD reduction takes place in the STP during the observation period against the expected value of 70-85%. This slight decrease is attributed to the recycling of old sludge that contains fewer microorganisms, besides insufficiency of Mixed Liquor Suspended Solids for the aerobic digestion of the organic matter [5]. The microorganisms such as bacteria are responsible for decomposing of organic waste in the sewage. The tolerance limit for sewage effluent discharged into surface water sources and public sewers as 20 mg/l [6]. However, sewage from JUET campus has been observed

maximum value of BOD as 4.1 mg/l indicates does not require any treatment.

3.2 Chemical oxygen Demand

Fig.3 represents variation of COD pattern during the period of testing the performance. This figure illustrates the decreasing of COD values of influent at end of different treatment units. The influent COD values varies between 40.1 to 47.6 mg/l. Table 1 shows organic matter in the form of COD decreased by 8.22%, 28.51%, 54.84%, and 68% at the end of aeration unit, settler unit, pressure filter unit and outlet unit respectively. Table 1 shows that 68% of average

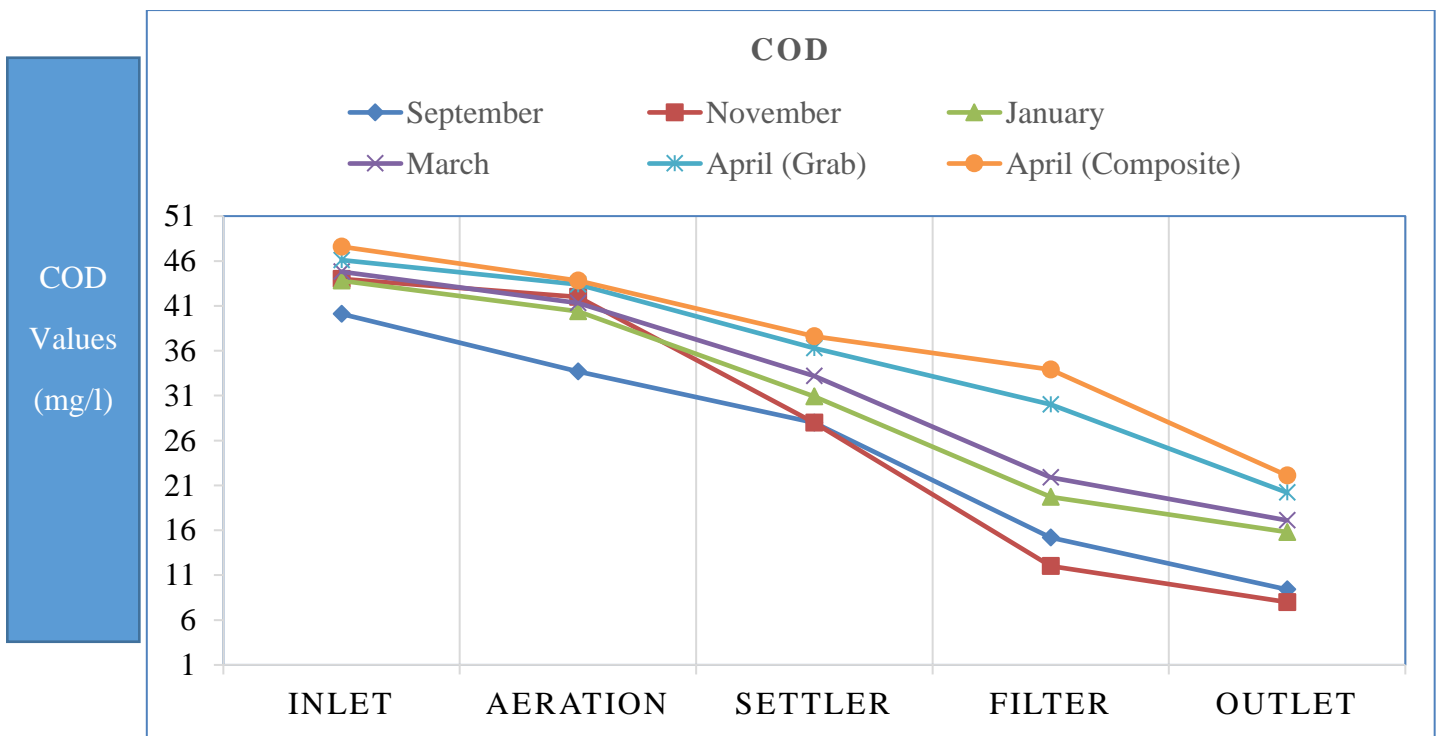


Fig. 3 Variation of COD during the period of data collection

COD reduction takes place in the STP during the observation period against the expected value of 70-80%. This may be attributed to insufficient number of microorganisms present in the aerobic unit. The tolerance limit for sewage effluent discharged into surface water sources and Public Sewers as 250mg/l [6]. However, sewage from JUET campus has been observed maximum value of COD as 47.6 mg/l indicates does not require any treatment.

3.3 TSS & TDS

The average values of TSS and TDS in the influent sewage are 12.2 mg/l and 293 mg/l respectively. Table 1 shows TSS are removed by 14.7%, 33.33%, 38.57%, and 40.43% at the end of aeration unit, settler unit, pressure filter unit and outlet unit respectively. The maximum reduction in TSS is 40.43% against the expected value of 85-90%. The TDS are removed by 2.93%, 5.8%, 9.69%, and 11.54% at the end of aeration unit, settler unit, pressure filter unit and outlet unit respectively. The percentage reduction in TDS is only 11.54% is much below the expected removal of 70-80% indicating poor efficiency in terms of TDS removal. The sewage contains more quantity of dissolved solids and

meager amount of suspended solids. Bouwer [7] reported that removal of TDS is of greater concern as it affects the reuse of wastewater for agricultural purposes, by decreasing the hydraulic conductivity of irrigated land if TDS content in the water exceeds 480 mg/l. The tolerance limit for sewage effluent discharged into surface water sources and Public Sewers for TSS as 30 mg/l [6]. However, influent sewage from JUET campus has been observed maximum value of TSS as 12.2 mg/l indicates does not require any treatment.

3.4 pH

Fig.4 represents variation of pH pattern during the observation period. This figure illustrates the increasing of pH values of influent at end of different treatment units. The minimum value 5.36 observed in the month of April (Grab) and maximum value of 7.7 observed in the month of November. At initial stages, the organic matter in the sewage starts decomposition and release various acids. That is the reason to observe pH values at inlet is between 5.36 and 5.7, indicates in acidic range. Later on the sewage starts stabilization at various treatment units and finally pH values observed on alkaline range.

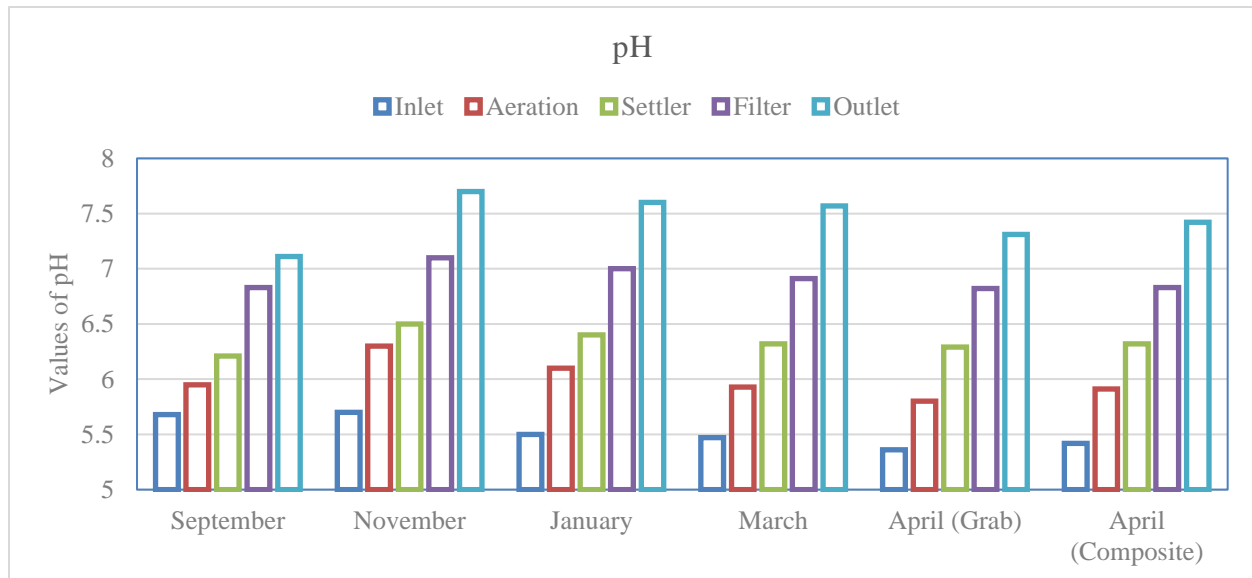


Fig. 4 Variation of pH during the observation period

IV. CONCLUSIONS

The performance studies on the STP located at JUET campus accompanied for a period of eight months indicated overall performance was satisfactory. The BOD, COD, TDS, and TSS average removal efficiency were observed to be 57%, 68%, 12% and 40.43% respectively. In order to achieve

better performance, fresh sludge with higher microorganism populations should be recycled and the aerators must be operated continuously. The treated effluent can be safely reused for gardening, and irrigation purposes.

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The Immigrant's Grief Process

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Abstract— Immigration has become increasingly common around the world. When an expatriate leaves their country, they also leave their family, culture, language, home, etc., that makes them go through a grief process that can be categorized as simple, complicated, or extreme. If the person is going through an extreme grief process, they may develop Ulysses Syndrome. Some factors shape how somebody experiences the process such as social and emotional vulnerability and stressors, besides issues that affect the grief such as cultural protectors, worsening's, and subjective. This project intended to verify and map the mourning process of expats who live in Curitiba and the metropolitan area of the city experience. Method: To collect data, a social demographic survey, a half-open interview, and an adapted version of the Ulysses scale were used. Those tools were applied to 24 immigrants, from different countries. Results and debate: The most common vulnerability and stressor levels during the research were simple. As an outcome 22 of the respondents were suffering from simple mourning, while 2 of the respondents had their grief classified as complicated and none of them were classified as extreme. Final considerations: Having those results in mind it was possible to conclude that most of the immigrants who are living in Curitiba and the metropolitan area of the city are being able to cope with their grieves and the ones that are struggling more are going through worsening factors. Although some of the surveyed expatriates are experiencing extreme stressors.

Keywords— Thanatology, Grief, Ulysses Syndrome.

I. INTRODUCTION

Thousands of people leave their cities and countries every day to escape violence, war, stalking, or to improve their financial and psychosocial status. To immigrate is a natural and inevitable process [21].

After Brazil became detached from Portugal, there was a strong encouragement for immigrants to come to the country to fulfill the country's needs of free labor force, inflicted by the abolition of slavery and prohibition of slave traffic. Also, to create settlements in different places and boost the economy. This strategy turned Brazil into an immigration country [21].

Between the years of 2010 and 2017, 449.174 immigrants were registered in Brazil, mainly from Haiti, Bolivia, Colombia, Argentina, Cuba, and China. As a matter of settlement, the immigrants are living mostly in the states of São Paulo, Santa Catarina, Paraná, and Rio Grande do Sul [9].

Contemplating the migratory flow around the world and also in Brazil, it is possible to consider that currently we are experiencing an immigratory crisis, however, beyond that, we are also undergoing through a humanitarian crisis, bearing in mind the exhaustive walks,

shipwrecks, deaths, people who are homeless, racial and cultural prejudice, violence, etc. [21].

The immigration process has been studied and debated around the world regarding economic, psychological, political, work, and social aspects. Due to the lack of research about this kind of process in Brazil and the rising number of expatriates who arrive daily in the country, the study about the grief of the immigrants, it's worsening factors, and protector aspects becomes a necessity

According to Freud [13]: "Mourning is regularly the reaction to the loss of a loved person, or to the loss of some abstraction which has taken the place of one, such as one's country, liberty, an ideal, and so on" (p.243). It is essential to remember that death means a loss to those who survive and that the grief established from this loss might embrace: a moment, person, landscape, place, habits, and situations. [19] There was a relation between migration and psychic suffering. The migratory loss may be felt by the: land separation (landscapes, weather, oneness symbols), social references, duties, and interactions [10].

When synthesizing the concept of grief as an emotional answer when facing loss, Camacho [8] states:

El duelo se define como la reacción adaptativa normal en el ser humano ante la pérdida de un ser

querido (GARCÍA-GARCÍA, LANDA PETRALANDA, TRIGUEROS MANZANO e GAMINDE INDA, 2001). El término duelo proviene del latín “dolus” y significa “dolor”. Para Freud (1967), el duelo hace referencia a la pérdida del objeto amado. Bowlby (1980) utiliza el término duelo para referirse a los procesos psicológicos, conscientes o inconscientes, que una pérdida pone en marcha. Para Payás (2010), el duelo es la respuesta natural a la pérdida de una persona, cosa o valor con la que se ha construido un vínculo afectivo.” (p.30)

Harder and Zwinger, in the 17th century, had already observed the process of grief in two populations: soldiers that after a long time on the battlefield would come to their country and in peasants that moved to the cities, being named as “Dysthymic disorder”, “Somatic manifestation depression” or “Disorder by somatization”. Nowadays to refer to migratory grief there are different denominations: “Duelo Migratorio”, “Mal del Inmigrante”, “Immigrant Syndrome” [14].

Based on studies about people who were relocated (transferred from their houses for some reason), the researchers noticed that these people were attempting to minimize and postpone the consciousness of the loss, trying to avoid the thoughts about it. It was also observed that the intensity of the grief was related to the number of neighbors the respondent knew. Two patterns of reaction were revealed by the surveys that the respondents answered to: those who weren't involved with the neighborhood overreacted, going through a deep grief state afterward and needed a lot of support from the public service; the ones that became strongly evolved with the neighborhood showed minimal grief but manifested physical and psychosomatic symptoms [18].

The mourner may deny the loss caused by the immigration, ignoring the forfeit and injury this process caused. One of the reasons may be the pain that follows the whole process, and even though its initial function being some kind of protection, this could result in problems for the immigrant. If the loss caused by the migration is denied the expatriate might only adapt artificially [15].

Some authors state that there are three phases of which people go through when experiencing the migratory loss: 1) protest, 2) despair and chaos, and 3) reorganization or relocation [10]. However, some authors affirm that the migration process usually happens within four main steps: 1) preparation, 2) departure and arrival in the new country, 3) awareness about their feelings, and lastly, 4) acceptance [23].

It is possible to create a list of characteristics to distinguish migratory grief from other types of grief: 1) It is a partial mourning; 2) It is recurrent; 3) It is linked to deep-seated childhood issues; 4) It is multifaceted; 5) Results in an identity change; 6) Gives space to psychological regression; 7) Happens in phases; 8) Embraces the establishment of defense mechanisms; 9) It is followed by an ambivalence feeling; 10) It is experienced also by those who stay in the origin country and 11) It is a cross-generation phenomenon [3, 5, 14, 17].

The immigrants end up losing values, traditions, local songs, and even family recipes. They also may lose their social status, meaningful relationships, and some of them may lose even their financial security [15]. Therefore, the seven types of grief that happen during immigration are [1,2,4]:

1. Family and loved ones: the loneliness and separation from their loved ones that they couldn't bring to the new country or visit. The critical moments are mainly at night when memories, emotions, and fears appear. Stress also can be noticed when adapting to build new relationships.

2. Language: to leave your native language to learn and adapt to the new language. It can be more stressful if there is some kind of deficit such as dyslexia, dysgraphia, and illiteracy.

3. Culture: as well as the language aspect, it would be to adapt to new values, habits, life meanings, but without excluding elements of their original culture. Trying to find a balance between both.

4. Land: The luminance, colors, smells, landscapes, and weather are aspects that affect the person.

5. Social status: It is related to the social roles, work, life experiences, access to opportunities, apart from the expectations overcome: the refugees often had better jobs or financial conditions than the ones that they are going to have in their chosen country, or they move hoping that they will have better-living conditions in their chosen country.

6. Contact with the identity group: concerning the feeling of belonging to a human group, with that being a common characteristic of the culture, history, language, etc. That way the immigrant should look for a group to identify with in their chosen country.

7. Physical integrity risks: that would be the risks that the migrant goes through to get into the country, as well as the risks they go through inside the country such as mistreatment, the fear of being deported, diseases, hygiene conditions, etc.

The grief process can appear in several shapes and terms, and so there would be three different kinds of grief constructions existing in the migratory process [6,16]:

1. The simple mourning: can be redressed and happens in good conditions. The migration is free-willed, the host society receives the person without any problems and the lone psychological tools fit. In this case, the benefits of the migration surpass the loss.

2. The complicated mourning: in this type of grief, there are several stressors within the migratory experience. The migration decision wasn't necessarily free-willed, the host society is hostile to migration and the emotional or psychological aspects of the person aren't appropriate for migration. There is a lot of loss and only a few benefits.

3. The extreme mourning: this can't be redressed; it surpasses one's ability to adapt and is the kind of grief where the Immigrant Syndrome is established. There are so many losses and suffering that it becomes hard to maintain the migration project.

Vulnerability and stressors are factors that can shape the redressing of the grief, the vulnerability could be defined as the "baggage" of limitation that one brings from their homeland, and it can be assorted as: simple, and that would be small inhibitions that can be redressed; complicated, with relevant limitations that can be redressed but only with some effort and extreme, when major inhibitions block the redressing. It is possible to address the vulnerability degrees by 3 standards: physical (e.g. diabetes, heart attacks), psychological (e.g. depression, dementia), and personal history (e.g. physical, sexual, psychological abuse). The stressors are the external struggles that the immigrant had been through during the past 6 months, being: simple, when there are small troubles that suppress the grief redressing; complicated, when the struggle is relevant but it is possible to overcome it and extreme when there is a major struggle that blocks the redressing [4].

Some singular factors can also impact the grief process: protector factors (social support, religion, political association), cultural factors (due to the different cultures existing in the world there are diverse ways to live and face struggle), worsening factors (stressors that are experienced since one's birth) and subjective factors (personality, personal history, emotions, fantasies, ideas) [4]. Struggle happens during the migration progress in different degrees; therefore, some people are likely to suffer from the Ulysses Syndrome. [2, 14]

1.1. Ulysses Syndrome

The name is related to the Greek god, Ulysses, who by being far from his loved ones and his motherland presented discomfort, hopelessness, discouragement, depression, suffering, and nostalgia [2, 14]. The factors are so hard that there aren't possibilities to redress the suffering left. The Ulysses Syndrome can be considered as a gateway between mental health and mental disorders. It's a reactive stress disturb; thus, it isn't included in the psychopathology field. It's one's answer to a stressful situation, that exceeds their adaptation capacity. [2, 5]

Going through such intense and long periods of stress is something that ends up changing one psychically and physiologically, affecting the hypothalamic axis - the pituitary-adrenal medulla, the hormonal system, muscular, etc. Which can lead to depressive symptoms (particularly sadness and crying), anxiety symptoms (tension, insomnia, recurring and intrusive thoughts, irritability), and somatization symptoms (such as fatigue, osteoarticular discomfort, headaches, migraines) [5]

At a diagnosis level, the Immigrant Syndrome isn't categorized as a common depressive condition, since the symptoms are related to extreme grieves, but not desolation. It is also needed to distinguish the syndrome from Post-traumatic stress disorder (PTSD), frequently diagnosed in the migrating population. PTSD is a disorder that is linked to torture and repression circumstances, whereas Ulysses Syndrome to the grief experienced [4, 7, 11]. The awareness about the Ulysses Syndrome helps to avoid the immigrants from being wrongly identified as depressive or Post-traumatic stress disorder patients. The psycho-social prevention of the syndrome should be given more importance than the treatment and it must be contemplated by psychologists, doctors, social assistants, nurses, social educators, and other health workers [4]. Based on the revision of the reading the general objective of the study was to verify the process of grief that the immigrants interviewed had been through in Curitiba and the metropolitan region. And as specific goals established were the analysis of the influence the culture of the mother country has in the process of grief redressing and to identify the Ulysses Syndrome.

II. METHODOLOGY

2.1 Participants

24 immigrants, from different countries, 18 men and 6 women, being between 19 and 66 years old. Concerning their nationalities 8 were from Venezuela, 7 from Haiti, 3 from Argentina, 2 from Uruguai, 1 from Colombia, 1 from Nigeria, 1 México, and 1 from Peru.

2.2 Material

During the research 3 tools were used. A social-demographic survey for the interviewer’s profiling with questions about age, gender, marital status, origin country, and if they had children. A half-open interview to verify the vulnerability and stressors degrees by the 7 migration grieves. Considering the protector factors, the worsening factors, and the subjective factors beyond other factors and remarks that may appear throughout the interview. Lastly, an adapted version of the Ulysses Scale aims to identify the immigrants’ grieving experience, and therefore the presence of the Ulysses Syndrome.

2.3 Procedure

After the approval of the ethics commission, the sample was selected by convenience, using Pontifical Catholic University of Paraná (PUC-PR), as the data collecting site, whereas the university offers Portuguese classes for immigrants, in coffee shops and cafeterias near the interviewer’s workplace or college, and in Tiradentes square accompanying the “Médicos de Rua”, a program that provides medical, psychological and dental services to homeless people. The program ends up providing services also for immigrants, bearing in mind that some of them are living on the streets, not having the required documents or spare time to be attended by SUS (Brazil's free health system), and/or don’t have money to go after particular services.

III. RESULTS

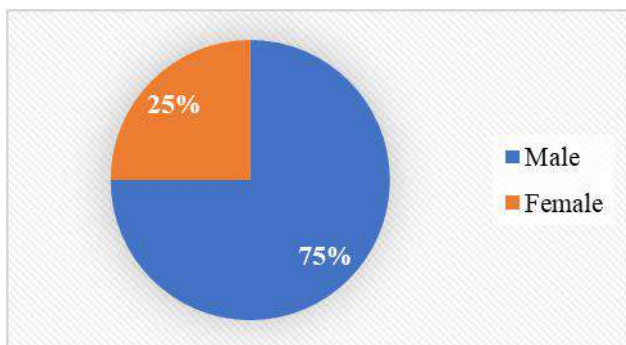


Fig. 1: Participants’ gender (The author, 2019).

Based on figure 1 it is possible to observe that 18 of the surveyed were men (75%) and 6 were women (25%).

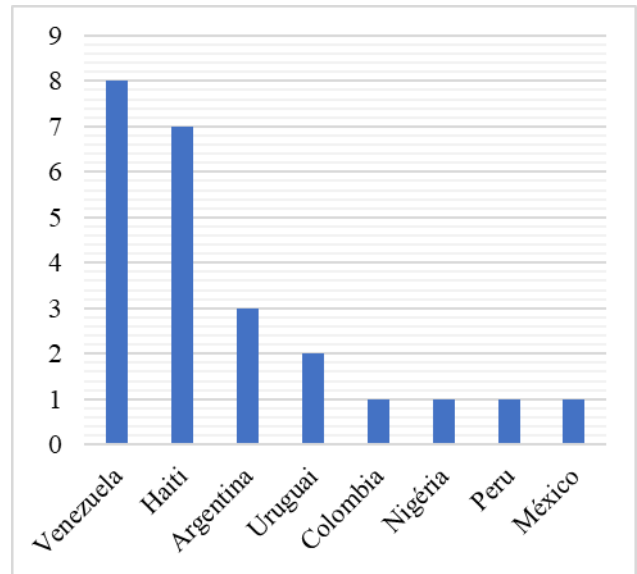


Fig. 2: Participants’ origin country (The author, 2019).

Figure number 2 refers to the nationality of the surveyed, in which 8 are from Venezuela (33%), 7 from Haiti (29%), 3 from Argentina (13%), 2 from Uruguay (8%), 1 from Colombia (4%), 1 from Nigeria (4%), 1 from Mexico (4%), and 1 from Peru (4%).

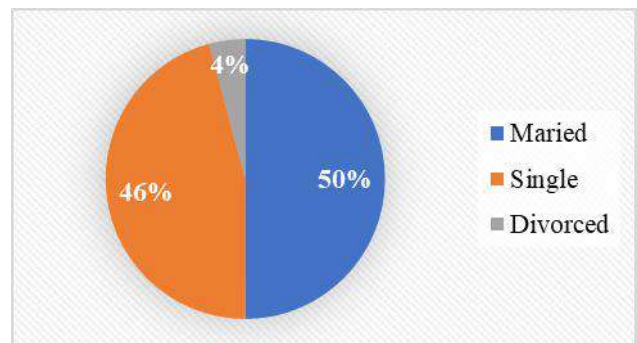


Fig. 3: Participants’ marital status (The author, 2019).

Figure number 3 reveals that 12 of the participants were married (50%), 11 were single (46%), and 1 is divorced (4%).

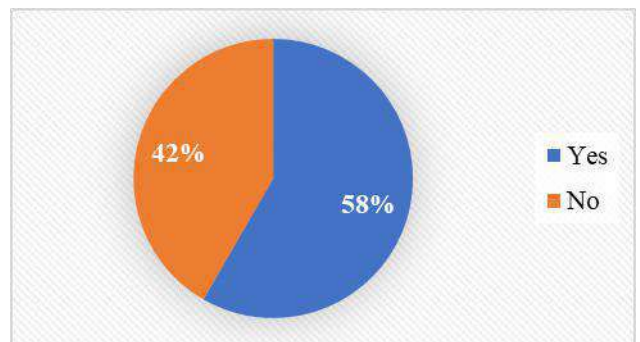


Fig. 4: How many of them have children (The author, 2019).

On figure number 4 it is possible to see that 10 people of the surveyed group didn't have children (42%) while 14 had at least 1 child (58%).

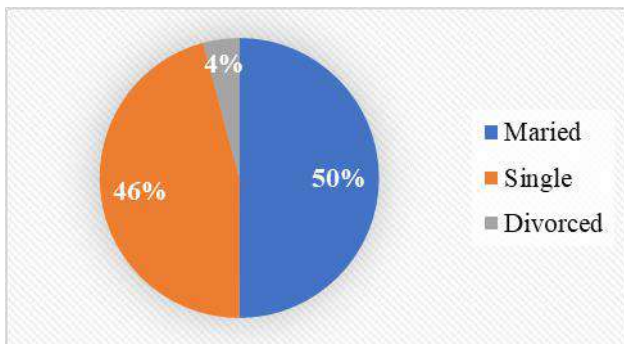


Fig. 5: Absence or Presence of the children in Brazil. (The author, 2019).

On figure 5 it is possible to notice that 7 of the parents interviewed had their children living in Brazil (50%), 6 of them didn't (43%) and 1 had their child being born in Brazil (7%).

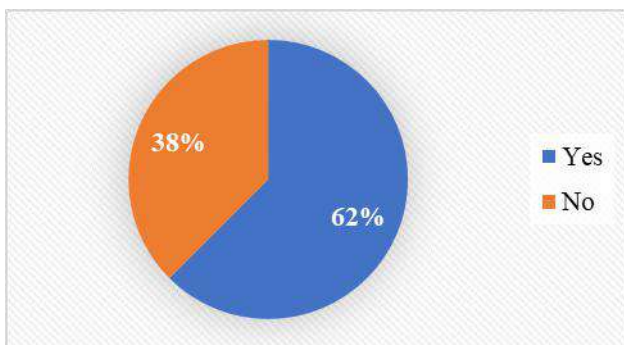


Fig. 6: Employment (The author, 2019).

Based on Figure 6 it is possible to see that 15 individuals of the interviewed group had jobs (63%) while 9 were unemployed (37%).

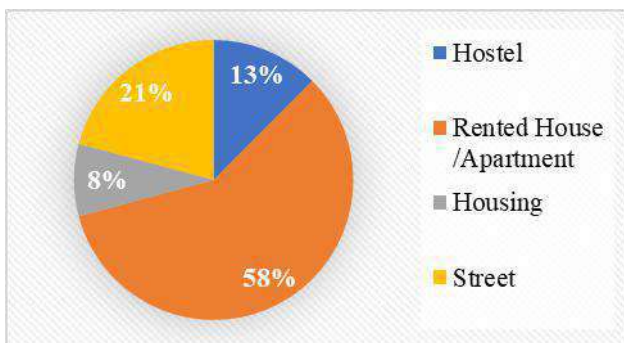


Fig. 7: Housing (The author, 2019).

Figure number 7 refers to the participants' housing, 14 people lived in houses or rented apartments (58%), 5 were homeless (21%), 3 were living in hostels (13%), and 2 were living in households (8%).

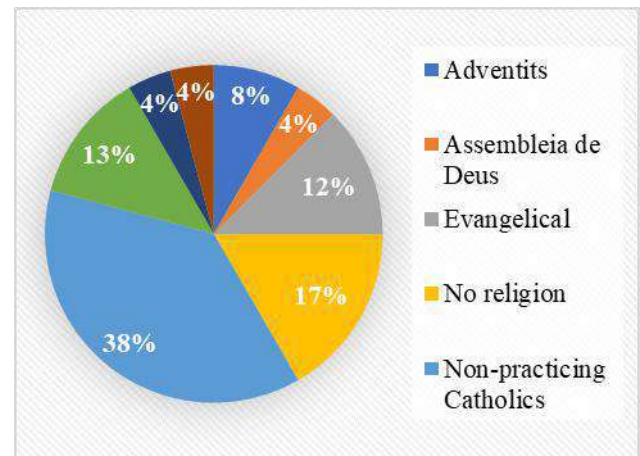


Fig. 8: Participants' religion (The author, 2019).

On Figure number 8 it is possible to comprehend that 9 individuals of the interviewed group were practicing Catholics (38%), 4 didn't follow any religion (17%), 3 were non-practicing Catholics (13%), 3 were evangelical (13%), 2 were Adventists (8%), 1 frequented the Assembléia de Deus (4%), 1 was a Presbyterian (4%), and 1 was an agnostic.

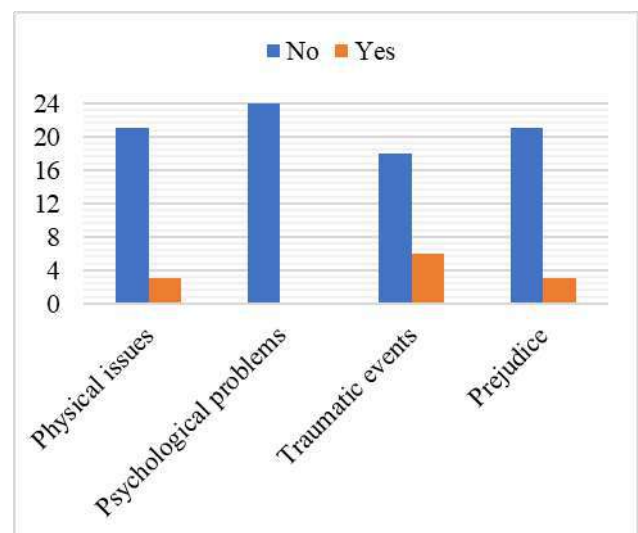


Fig. 9: Presence of physical or psychological issues, traumatic events, and/or prejudice. (The author, 2019).

Based on figure 9 it is possible to realize that 3 people of the interviewed group showed physical issues (12%), while 21 didn't (88%). However, none of the participants reported psychological problems. Also, it is possible to see that 18 of them didn't report traumatic events (75%) and 6

did (25%). Lastly, it is shown that 21 of the interviewed immigrants haven't been submitted to prejudice (88%), while 3 of them have (12%).

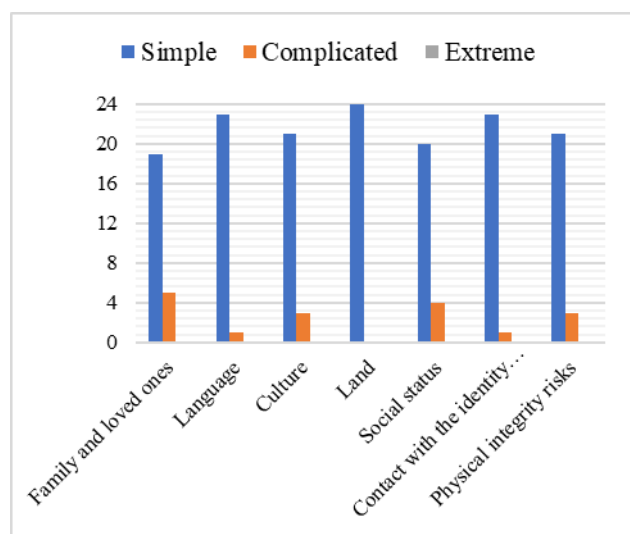


Fig. 10: Vulnerability degrees (The author, 2019).

Figure number 10 portrays the vulnerability degrees. Regarding grief due to family, 19 people of the interviewed group showed simple vulnerability, and 5 of them presented complicated vulnerability. About the grief due to language 23 people of the interviewed demonstrated simple vulnerability and 1 of them complicated vulnerability. Concerning grief due to culture, 21 people of the group presented simple vulnerability, while 3 presented complicated vulnerability. Now when it comes to grief due to land all group presented simple vulnerability. About the grief due to social status, 20 people presented simple vulnerability and 4 complicated vulnerabilities. Regarding the grief due to the belonging group, 23 people of the interviewed demonstrated simple vulnerability while 1 presented complicated vulnerability. Lastly, about the grief due to physical risks, 21 people of the group presented simple vulnerability while 3 presented complicated vulnerability.

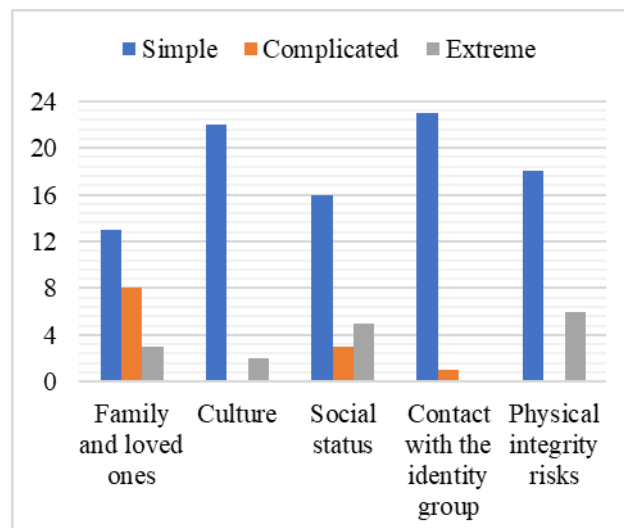


Fig. 11: Stressors levels index (The author, 2019).

Figure number 13 presents stressor levels. Regarding the grief due to family, 13 people of the group presented simple stressors, 8 complicated stressors, and 3 extreme stressors. About the grief due to culture, 22 of them presented simple stressors and 2 extreme stressors. About grief due to social status, 16 of them presented simple stressors, 3 showed complicated stressors, and 5 extreme stressors. Now when it comes to grief due to the belonging group, 23 people showed simple stressors, and 1 person presented complicated stressors. Lastly, about the grief due to physical risks, 18 people of the interviewed group showed simple stressors while 6 presented extreme stressors.

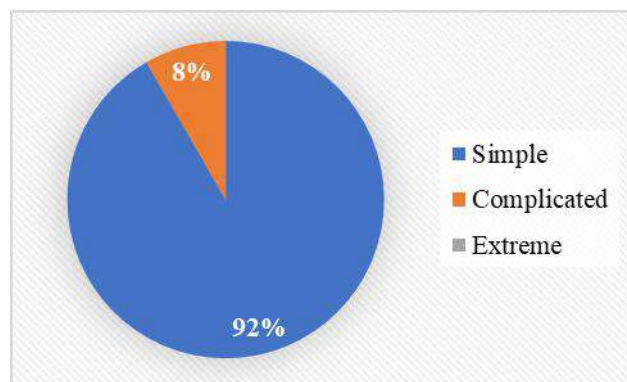


Fig. 12: Incidence of the grief types (The author, 2019).

Figure number 12 says that 22 of the people interviewed presented simple mourning (92%), while 2 presented complicated mourning and none of them showed extreme mourning.

IV. DISCUSSIONS

It was possible to identify that the most common nationality in the surveys was the Venezuelan, and that relates to the Policia Federal's data that 199.365 Venezuelans came to Brazil between 2017 and 2018, of which 100.928 left and 98.437 stayed in the country [20]. It is believed that the great evasion from Venezuela is happening due to Human Rights violations, lack of medicaments, and medical teams that are inserted in a political, economical, and social crisis that is happening in the country. [21].

The second most common nationality interviewed were the Haitians, that according to the Policia Federal is the most regularized nationality in Brazil, with 95.497 legalized immigrants between 2010 and 2017 regularizes in Brazil, com 95.497 entre 2010 e 2017 [20]. And that migration might be a consequence of the earthquake that happened in 2010 in Haiti [22].

Regarding gender, 75% of the immigrants interviewed were men, and this data also endorses the literature on which most of the immigrants are men, with a portion of 170 men to every 100 women group [9]. Focusing on the prejudice episodes, 12% of the interviewed group reported going through an episode. It is possible to notice that a portion of the immigrants in Brazil suffers from some kind of discrimination, whether because they "take the jobs", "overload the country" etc. [12]. It's worth highlighting that living explicit discrimination situations is considered a complicated stressor by the belonging group [4].

The vulnerability degree is characterized by three criteria previous to the migration: physical, psychological, and personal history [4]. During the research the most frequent degree of vulnerability was simple, and that can be explained by the fact that 88% of the interviewed didn't show physical problems, none of them presented psychological disorders, and 75% of the group hasn't gone through traumatic events. The other vulnerability levels are since 12% of the surveyed group presented physical problems, 12% had suffered from some sort of prejudice and one of them was more than 65 years old.

The stressors are the external struggles that the immigrant went through during the last 6 months [4], most of the people from the interviewed group had simple stressors because they went through bland difficulties. The ones who presented complicated stressors had relevant difficulties such as significant illness in the family, major economical difficulties, and not being able to go to the funeral of a close family member. Those who presented extreme stressors went through situations such as: being

apart from their underage children, starvation and being homeless.

It is conceivable to assume that the reason for the simple mourning predominance - 22 people from the group presented this degree of grief - is because most of the participants from the survey presented simple vulnerability and simple stressors. The other 2 people who were interviewed, P22, and P15, who presented complicated mourning, had been through significant struggles redressing the grief. Those difficulties are due to the fact that P22 is 66 years old, which is a complicated vulnerability factor, and also that P15 informed to have epilepsy, a major physical issue [4].

An interesting matter to be approached is the vulnerability degree of the participants who were homeless and presented simple mourning: P12, P13, P16, and P19. To be homeless is classified as an extreme stressor [4], which made them score extreme stressor on grief due to social status and grief due to physical risks. However, all of them scored simple vulnerability on the 7 migration grieves. That is to say that even though the struggles that they were going through by living on the streets, they didn't show relevant or major blockage about the grief redressing. Another important point is the fact that P10 and P13 reported that they haven't made friendship bonds yet, which is a complicated stressor regarding the grief due to culture, whereas the immigrant doesn't have relationships with the local people [4].

Based on this reality it is possible to identify that none of the participants were experiencing extreme mourning, and this scenery may be due to the vulnerability and stressors punctuation. It is worth highlighting that some elements might as well have influenced the results, such as protective, cultural, aggravating, and subjective factors. With that in mind, there is a possibility that the protective factors [4], especially the religion, may have influenced, bearing in mind that 79% of the participants followed some religion.

V. CONCLUSION

The migration process is becoming increasingly frequent, and in some cases, it is needed. Due to its history and features, Brazil has become one of the chosen places for migration. Therefore, there is a major diversity when it comes to people from different nationalities living in the country, especially Venezuelans and Haitians. It was possible to realize that the different migration nationalities and its numbers change every year, however, these changes can be justified by the other countries' social and political contexts.

Based on the data found, it was possible to determine that 22 people from the interviewed group showed simple mourning, while 2 presented complicated mourning and none extreme mourning, which can be justified by their vulnerability and stressors levels. Thus, it can be said that most of the immigrants who are living in Curitiba and the metropolitan region are being able to redress their grieves well, and those who are presenting difficulties are going through worsening factors.

The survey showed that some of the participants presented extreme stressors, due to the fact that they were homeless or didn't bond with anyone in Brazil. However, most of them presented simple vulnerability, a factor that shapes the degree of grief directly.

None of the people from the surveyed group had symptoms of the Ulysses Syndrome, bearing in mind the absence of extreme mourning on the results of the research, therefore, related to the nonappearance of the syndrome. It was also not possible to observe if there is an influence of the culture of their origin country over the redressing of their grieves since most of the immigrants were experiencing simple mourning.

Daily, immigrants register themselves in Brazil and some aspects should be accounted for when registering those people such as public services and creation of projects, whether they are governmental or not, vulnerability, the stressors, cultural factors, and worsening's because those factors could help in a better understanding of the immigrants' needs and therefore stronger prevention to the Ulysses Syndrome.

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Air Pollution: Bibliometric Analysis and Space-Temporal Distribution of Specialized Scientific Production

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Abstract— Environmental pollution, especially air pollution, is a serious problem that plagues the world population, due to the presence of solid and / or gaseous elements, which alter the characteristics of atmospheric air, causing diseases in humans. In this context, the objective of this work was to analyze the spatio-temporal distribution (1970 to 2020) of global scientific production regarding air pollution through a bibliometric analysis of data hosted on the Scopus and CAPES periodic platforms. To this end, a selection of the main publications about air pollution was carried out, in CAPES journals and Scopus, obtaining a profile of world production in the last 50 years (1970 to 2020), using bibliometric analysis. According to the data obtained, it was noticed that, of the 44 published articles, 31 were developed in Brazil, while 13 articles were developed in the rest of the world. It is also noted that, over the years, the number of published works increases, following the same trend of greater knowledge production in Brazil. Most of the published works were developed by authors affiliated with institutions in the Southeast, Northeast and South regions. In northeastern Brazil, only authors affiliated with Rio Grande do Norte, Pernambuco, Bahia and Ceara appear. These works were mainly indexed in the areas of medicine, environmental sciences and social sciences. Therefore, when analyzing scientific production, it was concluded that air pollution has a major negative impact on the health of the population, especially in large centers where there is a higher emission of pollutants, thus triggering respiratory diseases.

Keywords— Pollutants, Atmospheric Air, Environment, Respiratory Diseases.

I. INTRODUCTION

Air pollution, today, is a serious environmental problem, due to air contamination by certain solid and / or gaseous elements called pollutants, that is, an air pollutant is any gas or particulate material that, in high concentration can be harmful to life, the environment and / or property.

Pollutants originate from natural sources, anthropogenic or both. Natural sources of air pollution include smoke from forest fires, volcanic ash that is emitted in the troposphere and stratosphere, and winds bringing dust from cultivated agricultural fields. A study by [1] revealed that 96% of the total ammonia emitted in Europe is due to the management of organic waste and fertilizers from agricultural soils. Anthropogenic air pollution enters the atmosphere from fixed and mobile sources, while fixed sources include factories, power plants, ore smelters and farms, while

mobile sources include all forms of transport that burn fossil fuel.

Air pollutants are classified into two categories, primary and secondary, the primary ones being carbon monoxide (CO), hydrocarbon (HCs), particulate materials (solid particles or liquid droplets), sulfur dioxide (SO₂), nitrogen oxides (NO_x) and lead. Secondary pollutants are formed during chemical reactions between primary pollutants and other atmospheric constituents, such as water vapor (EPA-Environmental Protection Agency USA). Ozone (O₃) is considered a secondary pollutant because it is formed from the chemical reaction induced by the photochemical oxidation of volatile organic compounds (VOCs) and NO₂ in the presence of ultraviolet rays from sunlight [2]. In addition to these pollutants, EPA identified 188 chemicals that are considered to be dangerous or toxic air pollutants for urban air. Many of them are volatile organic chemicals,

such as benzene found in gasoline and used as a solvent, and trichlorethylene, which is used as a solvent. Mercury is an example of a dangerous inorganic compound.

Air pollution has affected several segments of society, for example, it represents an ecological risk with negative consequences for biodiversity; it is capable of causing damage to building structures and corroding the external surfaces of buildings, especially those constructed with limestone materials that react with precipitated acid solutions [3]; vegetation can be damaged by the absorption of pollutants through the leaf surface and / or by leaf damage in susceptible plants due to sufficiently high concentrations of sulfur dioxide or ozone. For example, annual losses of 4% have been recorded in the cultivation of corn, 10% in the cultivation of wheat and 11% in the cultivation of soybeans, due only to ozone [4]. Even with chronic exposure to relatively low levels of pollution, plants can be harmed by reducing their resistance to diseases and insect predators, reducing crop yields.

However, more commonly, air pollution poses a health risk that can damage life, harming the human respiratory and pulmonary systems. According to data from the Institute for Health Metrics and Evaluation [5], air pollution has already caused more than 80 million deaths worldwide since the beginning of the 21st century. The harmful effects of air pollution on the health of the population have increasingly drawn the attention of the scientific community, especially that associated with emissions in large urban centers [6].

Children, adolescents and the elderly are the age groups most susceptible to the effects of air pollutants and the cases related to respiratory problems (asthma, pneumonia and bronchitis) in children have increased significantly [7].

In addition, the negative effects of air contamination affect the population in an unequal way, with the middle and lower class regions being the most affected and, in addition to causing serious damage to health, it has also generated high costs to the State, since they bear with the consequences of air contamination such as an increase in the number of visits, deaths and hospital admissions, in addition to the high expenses with medications that could be avoided by improving air quality [8]. Studies, considering 29 Brazilian capitals, estimated monetary losses in the order of US \$ 1.7 billion annually related to air pollution [9].

One of the main obstacles is that most Brazilian states do not have monitoring of air quality, so it is necessary to implement public policies that seek to adopt measures to minimize, prevent and / or remedy the effects of air pollution. in the health of the population, especially the

elderly and children. However, the lack of monitoring and data on air quality in states and cities, except in large industrial centers that already have air quality monitoring, as is the case in the city of São Paulo, makes it even more difficult to implement these measures. It should be noted that the lack of data limits scientific production, and further research is needed to highlight the current air quality scenario and the impacts that are being caused.

In this context, the objective of this work was to analyze the spatio-temporal distribution (1970 to 2020) of global scientific production regarding air pollution through a bibliometric analysis of data hosted on the Scopus and CAPES periodic platforms.

II. MATERIALS and METHODS

1.1. Search classification

The research comprised an exploratory-descriptive study, mainly because it describes the study context and allows greater familiarization of the academic community with the peculiarities related to the theme [10].

Bibliometrics is a methodology from information sciences that uses mathematical and statistical methods to map documents from bibliographic records stored in databases. This technique also allows relevant findings such as: number of production by region; temporality of publications; organization of research by area of knowledge; count of literature related to the study citation; identification of the impact factor of a scientific publication among others that contribute to the systematization of the research result and the minimization of the occurrence of bias when analyzing a given theme [11].

2.2. Data collection and analysis

As a literature search method, systematic search was used in the online databases of Scopus and CAPES journals, followed by a bibliometric analysis of the results. Bibliometric analysis was performed according to the methodology described by [11], with adaptations.

The research planning was carried out in May and June 2020. In this stage, the search terms were defined as the combination "Air pollution AND Northeast", "Pollution AND air AND Northeast", "air pollution AND Northeast" and "pollution AND air AND Northeast", avoiding that divergent themes from this were rescued by the search. The combination of terms was inserted in the search on July 10, 2020, without time, language or any other restriction that could limit the result. After obtaining a certain number of published work records, filtering by country was applied, limiting the results to Brazil, where

only works developed in the Northeast region of Brazil were subsequently selected.

The number of documents published worldwide was expressed by countries, then data from the Northeast region of Brazil were expressed by year of publication, area of concentration, periodicals, states in the Northeast region, educational and / or research institutions and authors. The data obtained were submitted to descriptive analysis [12] using an electronic spreadsheet.

III. RESULTS AND DISCUSSION

With the obtained data, there was a greater production of free access articles (35) and 9 (25.7%) restricted access articles (Figure 1). Similar behavior was observed with the production data in Brazil, where the number of documents with free access (27) was 6.75 times greater than that found in restricted access scientific literature (4). Worldwide, publications with this theme are reduced, with a total of 13 publications divided into 8 open access and 5 private access.

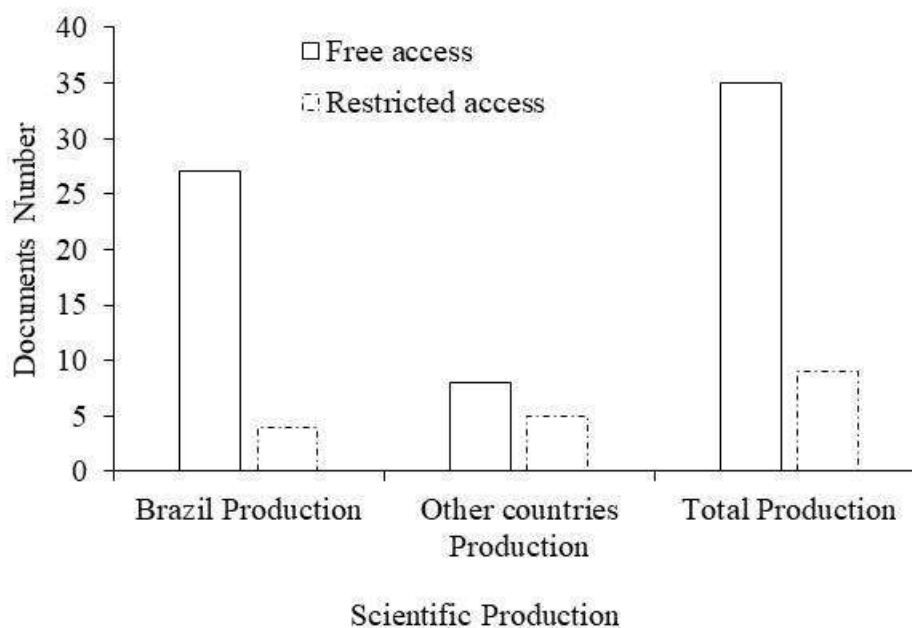


Fig. 1: Documents number depending on the type of access.

Brazil stood out with a greater number of published documents, with 31 publications (Figure 2). This may be a reflection of an accelerated urbanization process in the country that has caused a decrease in air quality, promoting the interest of researchers in studying the consequences of this pollution in the country. The main

pollutants monitored in Brazil and in the world are nitrogen oxides (NO_2 or NO_x), volatile organic compounds (VOCs), carbon monoxide (CO) and sulfur dioxide (SO_2) [2]. Another factor that possibly contributed to a higher publication rate in Brazil is the fires that the country has suffered in recent years [13] [14].

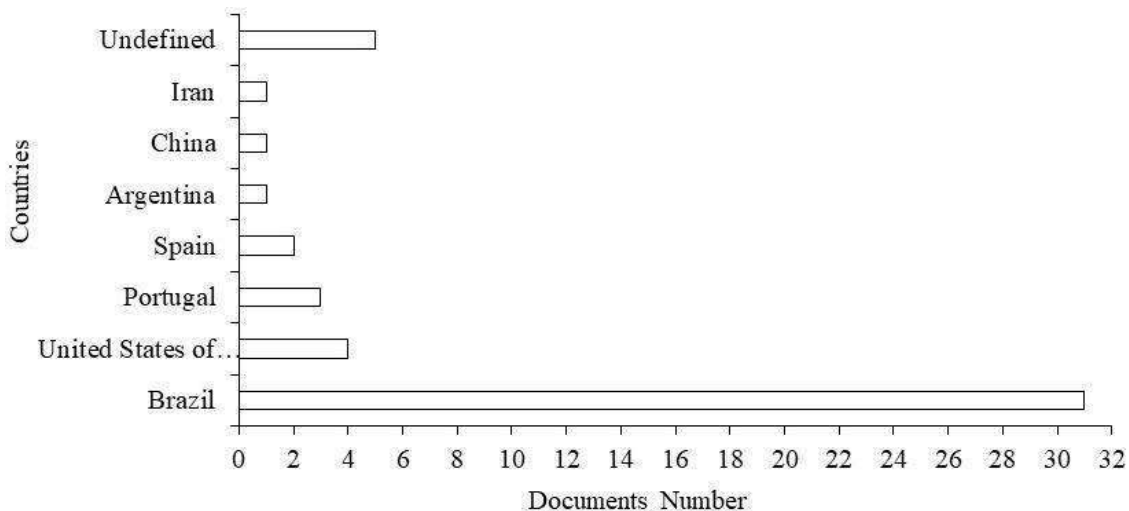


Fig. 2: Documents number published according to each country studied.

The distribution of the number of publications in the last 50 years, referring to the period between the 1970s and 2020 is shown in Figure 3. The data collected showed an increase in the number of publications only from the year 2008. The years of greatest publication were 2010, with 9.1%; 2016, with 9.1%, and 2018, with 11.4% of total production. This information demonstrated that the subject is contemporary, being a problem studied worldwide,

showing a greater concern with human health. The increase in the number of documents from 2010 in Brazil, may be related to the communication by the monitoring agencies about the increase in the number of fires in the North and Midwest region of the country, which promoted a greater emission of particulate materials in the air, promoting damage to human health [15].

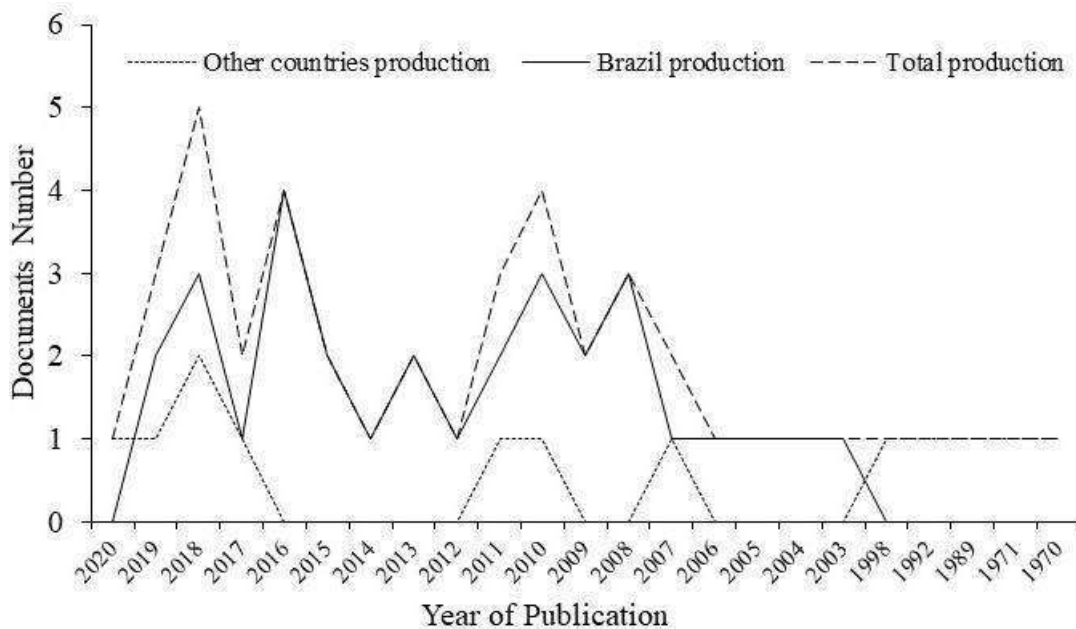


Fig. 3: Documents number published for the period from 1970 to 2020.

Brazil had a higher average of scientific production, when compared to the world average (other countries) (Figure 4). Total production in Brazil was greater than the average world (other countries) production in the years 2008, 2009, 2010, 2011, 2013, 2015, 2016 and 2018, while in the years

1970 to 2007, 2012, 2014 and 2017 the Brazilian production was lower than the world average (other countries). This can be justified by the fact that Brazil is a developing country with the increase of facilities of multinational industries and an increase in the population,

which has caused more and more pollution of the atmospheric air. Another factor that may have contributed to the increase in the number of publications may be

related to international treaties, which, in turn, seek to solve environmental problems, especially regarding air pollution.

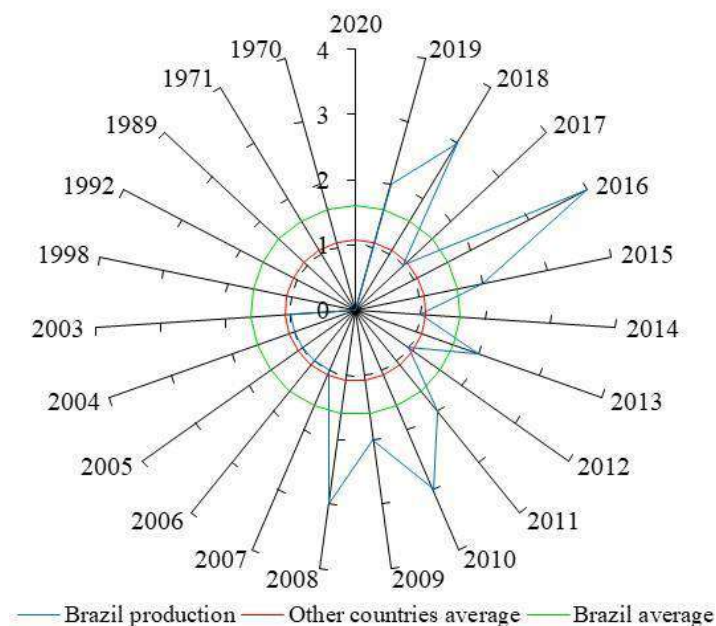


Fig. 4: Scientific production in Brazil, world average and in Brazil over the last 50 years.

The largest scientific production since 1970 until today, was in the area of medicine, both world production (other countries) and Brazilian production (Figure 5). Scientific production in the field of medicine in Brazil was much

higher than scientific production worldwide, and in Brazil nineteen articles were produced, while in the rest of the world only six articles were produced (Figure 5).

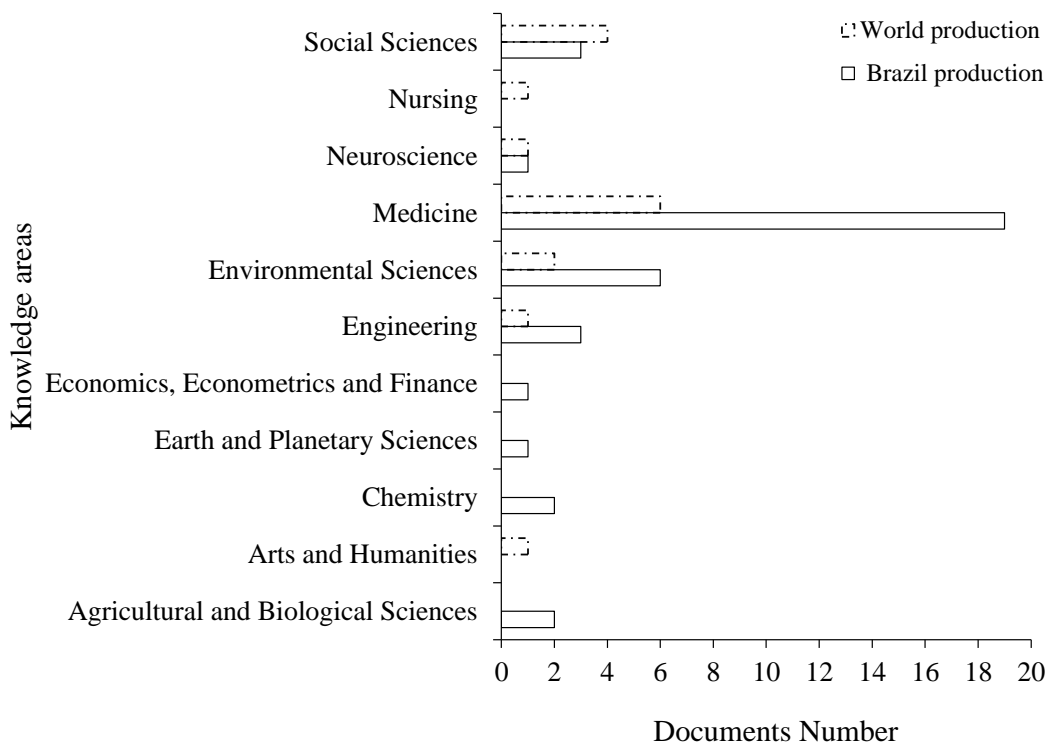


Fig. 5: Documents number published (1970-2020) by area of knowledge.

The second largest production was in the area of environmental sciences, where Brazilian production was greater than world scientific production, producing six and two articles, respectively. It was also found that the third largest scientific production was in the area of social sciences (Figure 5). In this area, unlike the others mentioned above, the largest production recorded was world production (4 articles) and the lowest was Brazilian production (3 articles).

According to the data presented above, as expected, articles published in the fields of medicine, environmental

sciences and social sciences were also published in scientific journals directly related to the area of study (Figure 6). Of the 44 articles published, 31 of them were published in Brazilian journals, while 13 were published in journals from other countries. In descending order of production, the journals that most published articles were: Cadernos de Saúde Pública (6), Ciência e Saúde Coletiva (5), Holos (3), Revista de Saúde Pública (3), Arquivos de Neuropsiquiatria (2), Cadernos de Saúde Pública do Ministério da Saúde Fundação Oswaldo Cruz (2) and SAE Technical Papers (2), as shown in Figure 6.

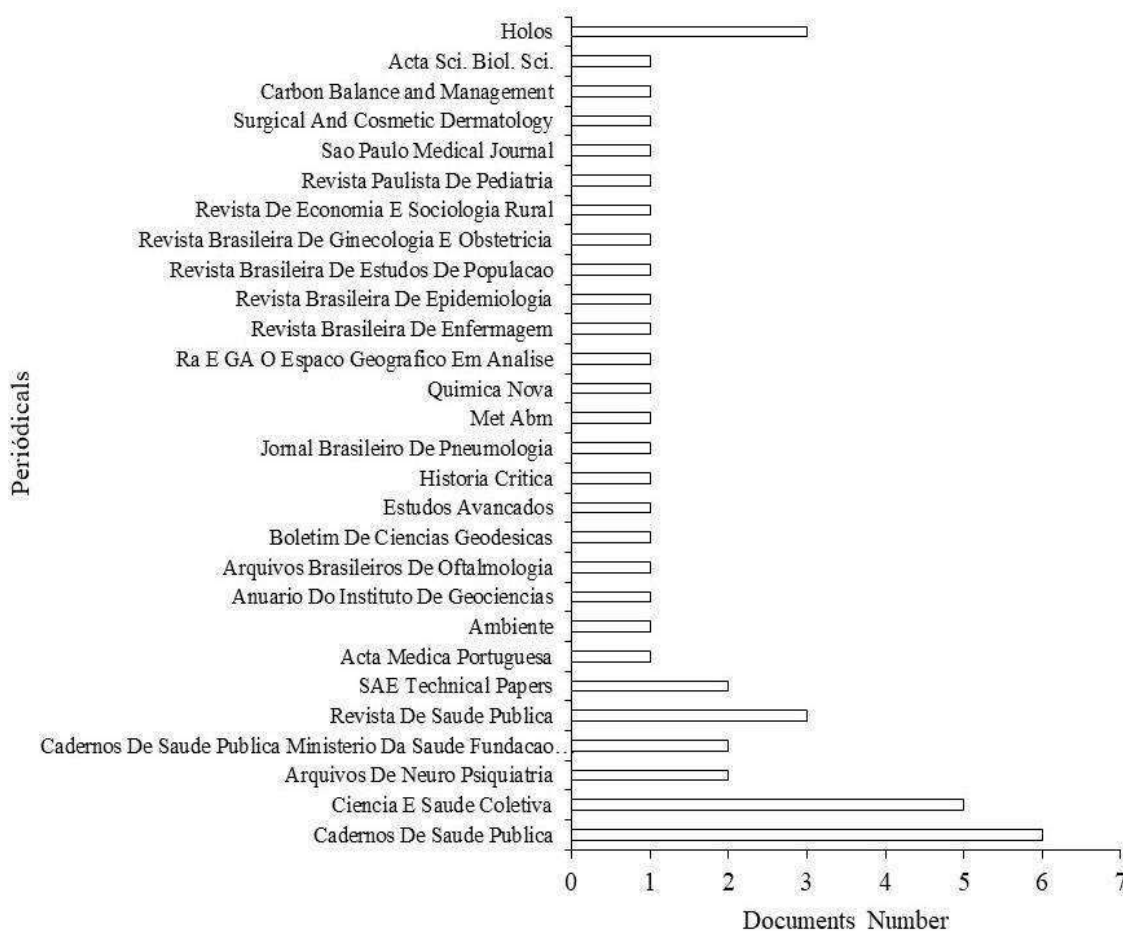


Fig. 6: Documents number published in national and international journals during the period from 1970 to 2020.

The data presented in Figures 5 and 6 demonstrated the concern of researchers regarding the deleterious effects that air pollution can cause on the environment, on the human body and on society in general. Scientific productions in the areas of medicine, environmental and social sciences in specialized journals in public health, show great concern of scientists with the health and well being of the population, reinforcing the interest in this

theme, in view of the increase in the number of studies in the last years (Figure 3).

In this conjecture, the growth of publications in Brazil stems from an intense search for the reduction of the environmental impacts caused by air pollution, since the earth cries out for it and, thus, with the advance of science, the number of publications and consequently, international treaties were carried out to minimize the impacts of pollution, the main ones being: Tbilisi Conference

(Georgia, 1977); ECO-92 (1992, Rio de Janeiro, Brazil); Kyoto Protocol (1997, Kyoto, Japan); Agenda 21 (Rio de Janeiro, Brazil, 1992; Johannesburg, South Africa, 2002); Rio + 10 (Johannesburg, South Africa, 2002) and Rio + 20 (Rio de Janeiro, Brazil, 2012).

At the Tbilisi Conference, several recommendations and criteria were established that should be observed for a better use of nature, in order to satisfy human needs without compromising nature [16]. At ECO-92, the need to preserve forest resources on the planet and conservation of biological diversity was discussed, aiming at reducing the exacerbated consumption of raw materials for industries [17]. Discussions at the event called the Kyoto Protocol, it was agreed that more industrialized countries should join efforts to reduce the emission of polluting gases, such as carbon dioxide [18]. Agenda 21 brought up the importance of sustainable development, concerned with the preservation of the atmosphere and oceans, Indians, riverside dwellers, the insertion of women and young people in the social context [19]. Rio + 10, again discussed what had been proposed in ECO-92 and Agenda 21, that is, about the objectives achieved and new strategies for mitigating environmental impacts [20]. Rio + 20, on the other hand, was about the importance of renewing the political commitment to sustainable development from the

Tbilisi Conference to the Rio + 10 treaties. In addition to the themes of the previous treaties, new themes are added to this conference, such as, the green economy in the context of sustainable development and the eradication of poverty and the institutional structure for sustainable development [21].

In view of the above, it is noted that the global concern about the environment arose from ecological ideas that were widely disseminated since the 1970s, with the Tbilisi Conference as its starting point. From then on, several study groups around the world were not restricted only to environmental and human health issues, but also to social and cultural aspects (Figures 5 and 6).

With regard to scientific production in Brazil, authors from various regions of Brazil figure with important contributions to the advancement of the state of the art on air pollution (Figure 7). In descending order, the authors who presented the largest number of publications were: Junger, W.L and Leon, A.P, appearing in 5 articles; Braga, A.L.F, Gouveia, N., Martins, L.C. and Pereira, L.A.A. appear in 3 articles. It should be added that these authors stand out from the others for presenting a scientific production above the average worldwide and Brazilian production.

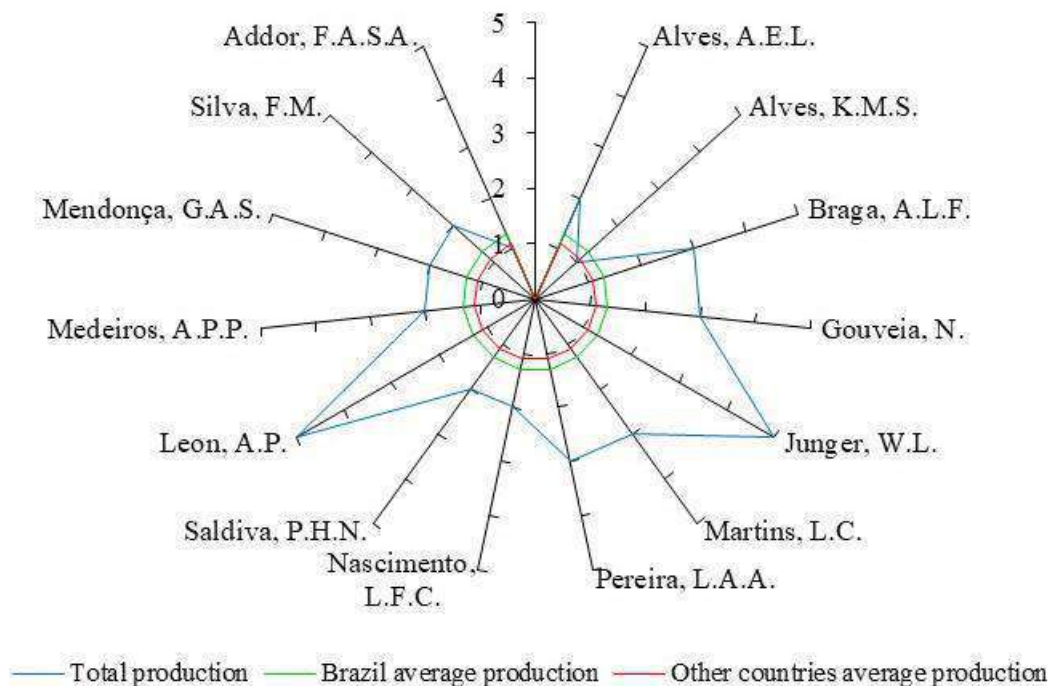


Fig. 7: Total scientific production by authors and average world and Brazilian production between 1970 and 2020.

The studies by [22], focus on assessing air quality and acute respiratory disorders in children [23], air pollution and health impacts in the Metropolitan Region of Belo Horizonte, Minas Gerais, Brazil [24], air pollution and hospitalizations for diseases in the subequatorial Amazon: a time series approach [25] and air pollution and respiratory and cardiovascular diseases: a time series study in Cubatão, State of São Paulo, Brazil [26] and [22].

The studies by Braga, A.L.F., correlated air pollution and low birth weight in an industrialized city in southeastern Brazil, in the years 2003 to 2006 [27], air pollution and the health of children: a sickle cell disease [12] and air pollution and respiratory system [2].

The studies by Gouveia, N., were focused on air pollution and health impacts in the Metropolitan Region of Belo Horizonte, Minas Gerais, Brazil [24], perinatal mortality and air pollution generated by vehicles [28] and the relationship between low birth weight and air pollution in the city of São Paulo [29].

The authors Martins, L.C. and Pereira, L.A.A. are part of the research group composed by the authors [2], [12] and [27], which appear in the same publications previously mentioned.

Given the above, it was noticed that studies demonstrate that there are serious environmental problems that contribute to air pollution in the studied places, such as the presence of particulate matter (PM₁₀; PM_{2.5}), sulfur dioxide (SO₂) and ozone (O₃), carbon monoxides (CO) and nitrogen dioxide (NO₂). It should be noted that the studies have a bias towards the medical and health sciences (Figures 5 and 6). In this sense, it is necessary that government policies are adopted to mitigate air pollution and, with this, reduce the harmful effects of pollution on the environment, on society and, above all, on human health.

Considering the number of authors who had their articles published, it was noticed that the authors have affiliations in different institutions and regions of Brazil (Figure 8).

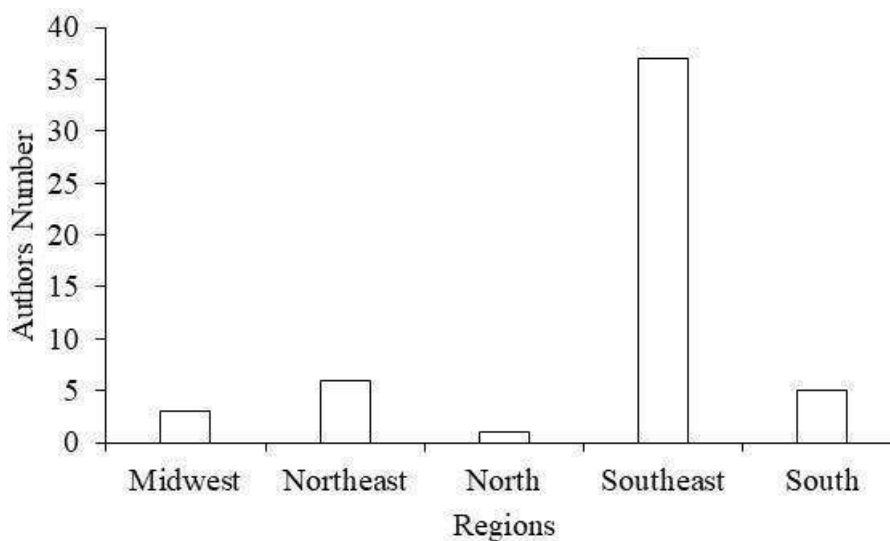


Fig. 8: Authors number belonging to institutions in different Brazilian regions.

Also analyzing Figure 8, it was found that most of them are affiliated with institutions in the Southeast region with 35 authors, followed by the Northeast with 6 authors, South with 5 authors, Midwest with 3 authors and the North region with only 1 author.

This fact may be related to the development of the regions, in which in the Southeast Region of Brazil there is a high level of development and the largest urban centers of the country are present, as a consequence a greater number of factories and industries, a large fleet of vehicles, and a greater concentration of people; on the other hand, the

North Region has few industries in comparison to the other regions of Brazil and small demographic density, and these facts may be directly related to the number of authors, research and publications by region.

In Brazil, the largest urban centers such as São Paulo and Rio de Janeiro, have high rates of industrial and vehicular air pollution. For this reason, the first records in Brazil of the manifestation of diseases related to air pollution occurred in these cities. From these episodes, verified in the main urban centers of Brazil, that the theme of air pollution aroused the interest in the academic community

of several Brazilian cities, through studies to investigate the evidence of air pollution and its effects on human health [30].

Analyzing the number of articles published with affiliations in the states of the Northeast region (Figure 9) as an object of study, the states of Rio Grande do Norte and Pernambuco have 02 authors each, Ceará and Bahia with only one author; in the other states of the Northeast

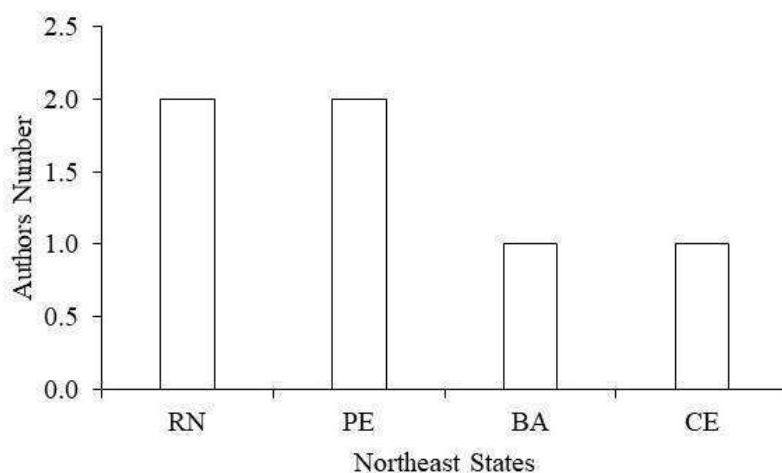


Fig. 9: Authors number affiliated with institutions belonging to Rio Grande do Norte (RN), Pernambuco (PE), Bahia (BA) and Ceará (CE) States, northeast region of Brazil.

From the general analysis of the publications, it was found that the topic of air pollution was more addressed with the concern of people's health than of the Environment itself. It is true that air pollution affects people's health, especially in children and the elderly, with respiratory and lung diseases being more frequent, but they can also, in a more critical state, develop cardiovascular diseases and the appearance of some types of cancer. The most frequently studied events related to air quality and health are morbidity and mortality from respiratory and cardiovascular diseases, lung cancer, decreased respiratory function and school absenteeism [22].

The increasing number of vehicle circulation in the world and industrial activities are factors that contribute strongly to the pollution of the atmosphere [31]. This can also be caused by natural sources such as accidental burning of biomass (material derived from plants or animals) and volcanic eruptions [32]. The records of the publications became more evident in regions of large urban centers, relating air quality to the impact of human activities, with the presence of large industries and great movement of vehicles.

The publications found that highlighted the negative environment were few found, and it is observed that the

Region, authors and publications related to air pollution were not found. This fact can also be related to the size of cities and their development; the states of the Northeast that had publications are states with a greater number of industries, a large number of vehicles and a large part of the population resides in these urban centers, decreasing the quality of the air as in the Metropolitan Region of Recife.

existing ones are related to the increase in the greenhouse effect and the increase in the frequency of acid rains.

IV. CONCLUSIONS

Air quality in the atmosphere is an extremely important issue for human life and the environment. With the increase in industrial activity, demographic growth and the construction of large urban centers have had negative impacts on human health.

The research showed quantitative results related to air pollution studies, finding that poor air quality results in negative impacts for children and the elderly, with the most frequent respiratory diseases.

The general analysis of the publications made it possible to establish a standard in terms of space, in which the largest number of publications was related to large urban centers, thus allowing the association of the functioning of industries, a large route of vehicles and population growth to the decrease in air quality and consequently increase in respiratory diseases.

As for time, it was clear that, with the advancement of international discussions and treaties on the preservation of the environment, the interest of researchers increased and, with this, a greater number of publications were made.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this paper.

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Assessment of the abundance and diversity of airborne fungi in two different air conditioning systems in Paraíba, Brazil

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Abstract— *Indoor air quality is directly related to the health of individuals, and when air conditioning systems have poor sanitation and lack of adequate monitoring, they become sources of potentially pathogenic organisms. Thus, the aim of this study was to evaluate internal contamination in two different environments located in the city of João Pessoa, state of Paraíba, Brazil, which use different forms of air conditioning, analyzing fungal quantity and abundance. The analysis of the conventional air conditioning system and the air conditioning system that uses air renewal was performed using a bio-aerosol impactor to quantify the pathogens. Later, the fungi identification of the air samples was carried out by the slide microculture technique. The conventional air conditioning system, used in the health clinic, showed a greater amount of anemophilic fungi in some sectors compared to the sectors of the judicial public sector, which use the system with air renewal. The health clinic's air samples indicated that nine of the eleven sectors analyzed had a fungal density above the acceptable limit according to the current national regulatory standard, and in judicial public sector, two of the five were above this limit. In both establishments *Aspergillus niger* was detected, i.e. 7% in the kitchen pantry of the judicial public sector, 2% in the operating room, and 1% in the kitchen pantry of the health clinic. The results presented in this study indicate the need for better hygiene measures for air conditioning units, as well as periodic monitoring of air quality in these environments.*

Keywords— *Anemophiles, air quality, Aspergillus niger, Bioaerosols, Monitoring.*

I. INTRODUCTION

Indoor air quality is essential for maintaining the individual's health, especially those who stay there for a long time. Currently, most of the indoor environments are air-conditioned, in order to provide comfort to occupants. However, some aspects of these systems must be taken into account, such as the periodic need to clean the equipment used in the indoor temperate control (Dehghan et al., 2018).

The correct hygiene of air conditioning equipment aims to avoid the presence of bioaerosols, which include airborne pathogens, viruses, bacteria, and fungi (Fernstrom and Goldblatt, 2013). It is important to note that environmental factors substantially influence the proliferation of these microorganisms. These air-

conditioned systems provide an ideal environment for the growth of these microorganisms, due to the high humidity rates and the accumulation of impurity in the devices (Hatayama et al. 2018). Exposure to these types of pathogens deserves attention, especially in individuals with chronic respiratory diseases or immunosuppressed patients (Moretti et al., 2018; Arrais et al., 2019).

The growth of biological species even after sanitation likely resulted from poor procedures. In addition, some factors may contribute to the persistence of these microorganisms, such as insufficient ventilation, resuspension of settled dust by sweeping the floor, water-damaged materials causing excess moisture, and the movement of people (Prussin and Marr, 2015). The prevention of airborne pathogens transmission is not

simple process, it consists of a combination of measures, such as a control of airflow with the use of specially designed ventilation systems, added to use the practice of antiseptic techniques and wearing personalized protective equipment (Memarzadeh and Xu, 2012; Baseer et al., 2016).

Dehghan et al. (2018), when analyzing the concentration of bioaerosols before and after cleaning in operating rooms demonstrated the growth of bacteria above the recommended concentrations, and the growth of different species of fungi, even after sterilization and disinfection of the environment and HEPA filters. In this and others studies, the main fungal species found are *Aspergillus* sp. and *Penicillium* sp. (Perdelli et al., 2006; Dehghan et al., 2018; Zenaide-Neto and Nascimento, 2020). These filamentous fungi are associated with different negative health conditions, such as respiratory infections, skin lesions, allergies, among others (Egbuta et al., 2017). In addition, the toxigenic and cytotoxic potential of secondary metabolites produced by these and other fungi groups should be highlighted (Skóra et al., 2017).

The first hypothesis of the study is related to the fact that the conventional air conditioning system present in the health clinic favors the proliferation of bacteria and anemophilic fungi, in comparison with the air renewal system used in the judicial public sector. The second hypothesis of the study is that in both establishments, in some sectors, the presence of anemophilic fungi will occur above that permitted by technical norms.

In view of the growing concern with air quality in urban environments, indoor and outdoor, it is necessary to monitor air conditioning systems, both those that use the indoor air reuse system and those that use the system with air renovation. Thus, the objective of the study was to evaluate internal contamination in two different environments located in the city of João Pessoa, state of Paraíba, Brazil, which use different forms of air conditioning, analyzing the quantity and abundance of anemophiles fungal.

II. MATERIAL AND METHODS

Sampling sites

The study was carried out in two different types of location, a health clinic and a judicial public sector, located in the city of João Pessoa, state of Paraíba, Brazil. Both establishments are air-conditioned, in the clinic, a conventional system for reusing indoor air is used, and in

the second establishment, the system used is for renovation with external air.

Collection and processing samples

The samples were collected inside of the establishments and data were provided for this study with permission and consent signed by their respective responsible.

The health clinic were divided into several environments, kitchen pantry, nursery, nursery for COVID-19, rest room, post-surgery room, operating room 01, operating room 03, operating room 04, medical Intensive Care Unit (ICU), neonatal ICU, and pharmacy ICU. The judicial public sector were divided in service location, cash machine, attendance boxes, nobreak room, and kitchen pantry.

Sampling was performed using the active method by air impaction. The equipment used in the sampling was a model of a 1-stage bioaerosol impactor, model CF-6 (Andersen type) that the human respiratory tract, more specifically the terminal bronchi (1.1 to 2.1 μm in diameter) characterized by sampling pump, flow rate: 28.3L / min, supply: 110V, dimensions 241 x 139 x 114mm and 3,880g in weight.

In operation, the impactor causes the flow to be collected through a surface filled with holes of predetermined diameter that prevents greater amounts of bacteria and fungi from 0.6 to 22 micrometers from reaching and contaminating the medium, affecting the flow speed of air and causing molecules to deviate. Thus, inert microorganisms collide with the culture medium of disposable Petri dishes that were fixed to the impaction system with culture medium ready for use (Fernandes 2014). The plates were identified according the location and the culture medium used was Agar Sabouraud Dextrose. The sampler was placed at a height of 1.5 meters and 70% alcohol was applied in the period between collections.

Microbiological analysis

The samples and microorganisms manipulation was carried out in the microbiology laboratory of the Department of Physiology and Pathology (DFP) located at the Health Sciences Center (CCS) of the Federal University of Paraíba.

The identification of the fungi used in the air samples was carried out by the slide microculture technique, which consisted of cultivation on microscopic slides in the humid chamber. For this, 0.5 cm^2 of Potato Dextrose Agar was transferred to the filtration center. With a flamed needle, each colony was picked by these fragments of the medium.

A slide was added over the medium and incubated in a humid chamber, followed by the Petri dish lined with water-soaked paper. The incubation was performed in 3 to 5 days in an oven at 25 ° C. An answered microscopy of fruiting structures such as hyphae, conidia, and sporangiospores was performed with the aid of the addition of lactophenol blue dye (Carvalho 2018). For a macroscopic analysis of the colonies that isolate the primary isolation, characteristics such as color, texture, surface, and pigment dispersed in the culture medium were evaluated. To identify or fungus, a subculture was essential in Petri dishes containing Sabouraud Dextrose Agar, observed as formed reproductive structures. At the end of these analyzes, how dimensions were sterilized and discarded.

Data analysis/processing

With the quantitative and identification results, as microbial containers were verified according to the provisions of the norms 9 of 2003, RDC no. 15, of March 15, 2012, and DRC no. 222, of March 28, 2018, from ANVISA. Graph production were used using the GraphPad Prism 4.0.

III. RESULTS

Concentrations of airborne microorganisms

The **Table 1** demonstrated the values for the colony-forming unit (CFU/m³) of fungal microorganisms. According to analyzes, nine of the eleven sectors in the health clinic were in poor condition regarding the total amount of fungal organisms. Analyzing the judicial public sector it was found that in two samples concentrations were recorded above the Resolution n° 9 of ANVISA (ANVISA, 2003).

Microorganisms groups

After counting of colony-forming units, the anemophilic fungal genera obtained from the samples were identified through microcultures for morphological analysis. In the **Figure 1** we can observed the genera found in the different sections of the health clinic, with a higher prevalence of detection of *Aspergillus* sp. and *Penicillium* sp., with the detection of *Aspergillus niger* (1%) in the kitchen pantry and in the operating room 01 (2%).

Figure 2 demonstrated the detection of fungal genera in the judicial public sector. *Aspergillus* sp. and *Penicillium* sp. were detected in all sectors, and as in the first location, *Aspergillus niger* (7%) was detected in the kitchen pantry. In this area it was possible to identify fungal genera different from the first, *Curvularia* sp. with

4% in the cash machine, and *Paecilomyces* with 9% in the attendance boxes.

Table.1: Concentration (Colony Forming Unit – CFU/m³) of airborne fungi in different environments analyzed.

Designation	Colony number	CFU/m ³	I/E ratio	Class
Health clinic				
kitchen pantry	356	1,263	14.8	×
nursery	186	660	7.8	×
rest room	57	202	2.4	×
nursery for COVID-19	60	213	2.5	×
post-surgery room	42	149	1.8	×
operating room 01	59	209	2.5	×
operating room 03	45	160	1.9	×
operating room 04	52	184	2.2	×
neonatal ICU	64	227	2.7	×
medical ICU	26	92	1.1	↓
pharmacy ICU	6	21	0.3	↓
Judicial public sector				
service location	54	192	1.6	×
cash machine	72	255	2.1	×
attendance boxes	46	163	1.4	↓
nobreak room	41	145	1.2	↓
kitchen pantry	45	160	1.3	↓

Legend: × - samples that exceeded the level of contamination established by ANVISA. ; ↓ - samples with contamination below the norm established by ANVISA.

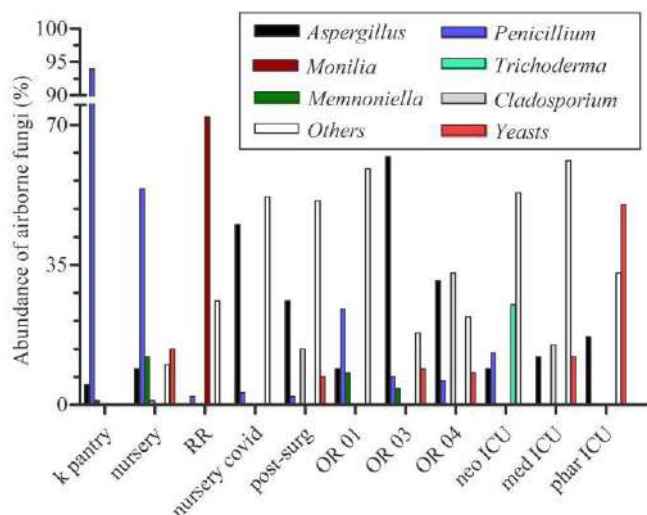


Fig. 1: Average percentage of fungal diversity in the interior rooms of a health clinic in Paraíba, Brazil.

Legend: RR – rest room; OR – operating room; neo ICU – neonatal ICU; med ICU – medical ICU; phar ICU – pharmacy UCI.

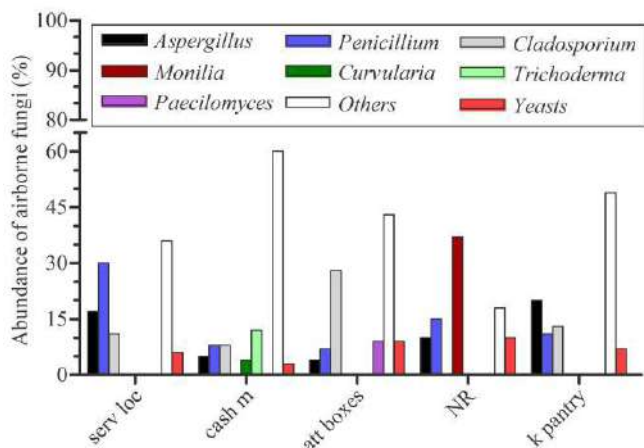


Fig. 2: Average percentage of fungal diversity in the interior rooms of a judicial public sector in Paraíba, Brazil.

Legend: serv loc - service location

;cash m – cash machine; att boxex - attendance boxes; NR – nobreak room.

IV. DISCUSSION

In this study, areas with different air conditioning system were evaluated. The clinic health use a conventional system, where the air already used is filtered and returned to the indoor environment. This is a less efficient air conditioning system than that using air renewal, with regard to minimization the amount of airborne pathogens. The clinic presented a greater contamination rate of airborne potential pathogenic and

higher values of the *Penicillium* genus in comparison to the judicial public sector.

The quality of indoor air in a health environment is a critical factor for the health status of individuals, where an environment below the established quality standards can cause the aggravation of disorders and diseases already present in patients (Choi and Min, 2020). The highest fungal density was associated with the kitchen pantry (1,263 CFU/m³) and the nursery (660 CFU/m³), both with the majority detection of *Penicillium* sp. (94% and 54%, respectively), an organisms that can be an indicator of hospital indoor fungal levels (Araújo et al., 2008). In study of Zenaide-Nato and Nascimento (2020), *Penicillium* sp. was the genus detected in the highest percentage (40.72%) within a hospital located in the same city as the present study. *Penicillium* spp. is often found in indoor environments, and is present in high concentrations in homes with asthmatic children when compared to homes without an asthmatic child, being associated with the increase in exacerbated asthmatic conditions (Baxi et al., 2016).

Probably the higher rate of contamination of health clinic and the judicial public sector by fungal organisms may be related to failure in the cleaning of the physical space and to a greater circulation of people, where in most cases shoes are not sanitized after circulation outdoors. Fungi have excellent aerosol dispersion mechanisms in the atmosphere, however some measures such as cleaning the air conditioning system and water lines every two weeks can be effective in reducing the formation and dispersion of these bioaerosols (Oliveira et al., 2018).

The cooling system of the second location analyzed in this study, the judicial public sector, is made through the air renewal, where the external air is filtered before entering the internal environment. Some considerations must be made when using this system; first, it must be taken into account that the outside air directly influences the quality of the indoor air, since it has been demonstrated that the microbiota observed in indoor air were closely related with those in outdoor air (Prussin and Marr, 2015). Second, when there is a poor sanitization of the filter present in the air conditioning equipment, it is expected that in addition to microorganisms from outside, also microorganisms accumulated in the internal environment will contaminate the air (Fernstrom and Goldblatt, 2013).

Cash machine and service location were the sectors with the greatest abundance of fungal organisms, 255 CFU/m³ and 192 CFU/m³, respectively. This fact can probably be associated with a greater flow of people in these places, and consequently a greater abundance and

microbial diversity. The species of anemophilous fungi found in the judicial public sector, can be potentially pathogenic and affect mainly those individuals who remain in this environment for a longer period of time, which is the case of employees. *Penicillium* sp., *Trichoderma* sp., *Cladosporium* sp., *Monilia* sp. and *Aspergillus* sp. were species were identified in higher percentages in certain sectors. The abundance of each of these genera varies practically according to the conditions of the environment, such as relative humidity and temperature (Segers et al., 2016). Continuous indoor exposure to fungal groups such as those mentioned above can become a risk factor for the development of asthma and increased asthma morbidity (Baxi et al., 2016).

The facts described demonstrated the main peculiarity of the clinic health environment in relation to the judicial public sector. The hospital is an environment of high selective microbial pressure, which favors the permanence of strains resistant to sanitizing products (Khan et al., 2018). In view of this aspect, preventive measures against the proliferation of microorganisms in these environments remains an effective air filtration system, with periodic filter changes, and restricted access for people in environments that deal with human health (Araújo et al., 2008). In addition to this, it is necessary to carry out qualified reports periodically about the sanitization of filters for air conditioning systems and the environment.

V. CONCLUSION

In this study, the anemophiles fungi levels were investigated in two different air-conditioned systems. Of the eleven sectors of the health clinic analyzed, nine had more contamination than the norm, including the operating rooms. In the judicial public sector, two sectors out of five exceeded the fungal contamination levels predicted by the norm.

The health clinic had a greater abundance of fungi than the judicial public sector, a fact probably related to the use of the conventional air conditioning system used in the first. The air conditioning system used in the second mentioned space tends to be more efficient than the conventional one, due to the renewal of the air that will be used indoor. The most common genera found in both environments were *Penicillium* sp. and *Aspergillus* sp.

The results presented in this study demonstrated the importance of regular and correct sanitization of filters and environment. Added to this, It is extremely important to periodically assess the quality of indoor air, in order to prevent the proliferation of potentially pathogenic

organisms, both in hospitals or clinics and in environments with a greater daily flow of people.

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Accuracy of digital Radiography in the detection of Root Fractures in Multirooted Teeth

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Abstract— This study aimed to evaluate the contribution of filters of Cliniview™ software on detection of vertical root fractures of multirooted teeth with intracanal metal retainers on periapical digital radiographs. For this, 22 human teeth were randomly divided into fractured group and control group, each one containing 11 teeth. The teeth were endodontically treated and after desobturation of 2/3 from the root, intracanal metallic posts were installed. The fractures were made only in the fractured group, and all teeth were x-rayed using an Express™ intraoral digital system and the images optimized in Cliniview™ software. The analysis of radiographs was made for 2 specialists with, at least, five years of experience in the area. The original images were evaluated, with application of filters Sharpen 1, grayscale inversion, emboss, vertical and vertical + horizontal, separately. After analysis, the accuracy, sensitivity, specificity, positive and negative predictive value of original periapical radiography were calculated and with the use of filters, for each evaluator. The filter “sharpen 1” had the highest accuracy (0.652) and sensibility (0,543). On the other, the filter “grayscale inversion” had the highest specificity (0.955). The interobserver kappa index was 0,351, considering $p < 0,001$ and interobserver kappa 0,333 and 0,512 for the evaluators 1 and 2 respectively. It is concluded that the contribution of the filters is professional-dependent and, in this study, the filter “sharpen 1” contributed to all of images evaluated, differently from the filter “grayscale inversion”, that disturbed the radiographic diagnosis of root fracture in multirooted teeth.

Keywords— dental radiography, fractures of teeth, digital radiography.

I. INTRODUCTION

The vertical root fractures (VRF) are characterized by a line of longitudinal fracture, that can propagate from the cervical part to the apex and is limited to the root of the tooth and may extend from the pulp to the periodontium¹.

The etiology of VRFs is multifactorial, and may be caused by physical and occlusal trauma, pathological resorption, repetitive parafunctional habits, instrumentation technique, susceptible dental anatomy, as well as iatrogenic complications during and after endodontic treatment, which involves instrumentation of the canal, excessive force during the condensation of the obturator material and placement of intracanal metal retainers^{2,3,4,5}.

The signs and symptoms of VRFs are diverse and may vary according to the dental group, position of the

fracture, time after the fracture, periodontal condition and bone architecture of the area adjacent to the fracture⁶. Clinically, pain, edema, dental mobility, periodontal pocket, fistula, abscess or sensitivity to palpation and percussion can be observed⁷. In several cases, teeth with VRF have a long history of discomfort and/or pain ranging from mild to moderate, being rarely severe^{6,8}.

In this way, most of diagnosis can only be reached after a combination of clinical signs and radiographic findings. However, the signs and symptoms of VRFs can be confused with those present in periodontal disease, failures in endodontic treatment or with the presence of accessory canals. Due to the non-specificity of their clinical signs and radiographic findings, their diagnosis becomes a difficult task⁹.

Periapical radiographs have been used to assist in diagnosis of VRFs due to their common presence in practical routine, as well as low cost and low radiation

dose. However, these two-dimensional images are intrinsically affected by overlapping structures, making diagnosis difficult^{9,10,11}.

Taking this into consideration and with the advent of the digital system, the possibility of image enhancement through computational resources in two-dimensional images examination arose. Some studies bring alternatives to increase the accuracy of the VRFs diagnosis, such as the use of filters in digital periapical radiographs on single-rooted teeth^{12,13,14,15}.

An alternative to the diagnosis of VRF would be Cone-Beam Computed Tomography (CBCT) for the possibility of examine the image in three dimensions, as well as the observation in several planes: axial, sagittal, and coronal, without overlapping structures^{16,17}. However, the presence of intracanal metallic retainers are limiting factors for diagnosis when producing artifacts in the CBCT image, as well as the high radiation doses of this exam and its high cost compared to the radiography^{18,19}.

Thus, the present study aimed to evaluate the contribution of “*sharpen 1*”, “*grayscale inversion*”, “*emboss*”, “*vertical*” and “*vertical + horizontal*” filters of the *CliniView™ software* in the detection of vertical root fractures of multirouted teeth in periapical digital radiographs.

II. MATERIAL AND METHODS

2.1 Sample selection and tooth storage

This project was approved by the local Review Board under number 447.315, in 2013. For its accomplishment, 22 multirouted teeth were selected (11 for the fractured group and 11 for the control group), extracted from patients of the School of Dentistry of the Federal University of Goiás.

2.2 Endodontic treatment and metal retainer placement

The crowns of the teeth were sectioned at the cement-enamel junction with a diamond disc. Then, the canal was explored until the apical foramen with file to verify the total clearance of the conduit and foraminal opening. The root canals were instrumented by the hybrid technique. The cervical and middle thirds were prepared with *Gates-Gliddendrill*, followed by *Pro Taper®* rotatories (Dentsplay Maillefer, Tulsa, UK). The root canal obturation was obtained by the active lateral condensation technique and the main cone was chosen according to the diameter of the apical third enlargement.

The resin cement RelyX U200 (3M ESPE, Sumaré, SP, Brazil) was used for the cementation of cast metal posts, according to the manufacturer’s orientation. The metal post was placed in position with digital pressure and the excess cement removed with an explorer, after previous light curing.

2.3 Confection of vertical root fractures

The fractures were only accomplished on the fractured group with aid of a hammer, in accordance with the protocol proposed by Abdinian, Razavian and Jenabi (2016)²⁰.

2.4 Radiographic Examinations

A dissected human mandible of the Department of Radiology of the School of Dentistry of Federal University of Goiás, with the alveolar processes present, was used as a phantom (Img. 1). In order to simulate the attenuation of the X-ray beam by soft tissue, wax was placed in the mandible in the vestibular aspect. The digital periapical radiograph was taken. For this purpose a phosphor plate number 2 was used and the Focus periapical radiography equipment (Kavo, Brazil), with focal tube of 0,8 mm X 0,8 mm, by the parallelism technique, using orthocentric incidence.



Fig. 1: Tooth in the alveolus of the mandible for radiographic image acquisition.

The original images were saved to be adjusted in *CliniView™ software*. The optimized images had activated the tool “calculate brightness according to the contrast”. This tool had the function of adjusting the brightness value according to the contrast acquired by the image. Afterwards, five possibilities of adjustments to improve the image quality were made for comparison: application of *sharpen 1*, *grayscale inversion*, *emboss*, *vertical* and *vertical plus horizontal* filters (Img. 2). The images were saved and identified by letters: protocol A (*sharpen 1*), B (*grayscale inversion*), C (*emboss*), D (*vertical*), E (*vertical + horizontal*) and F (original).

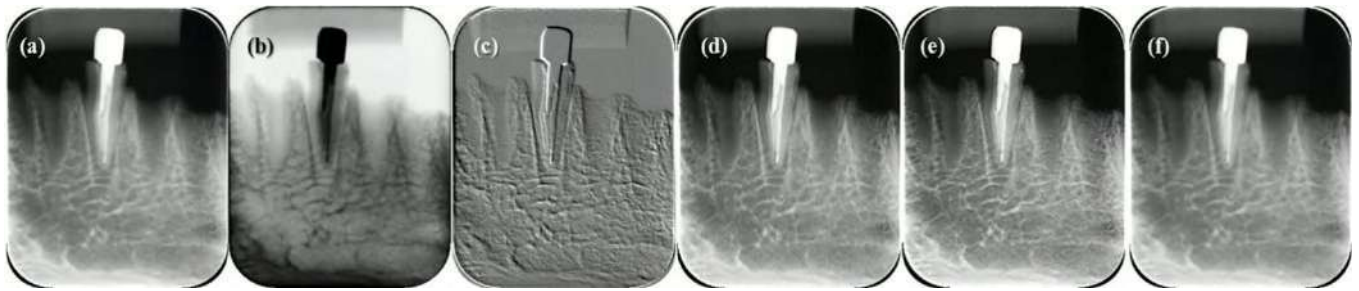


Fig.2: (a)sharpen 1, (b) grayscale inversion, (c) emboss, (d) vertical and (e) vertical + horizontal filters.

Table 1: Inter and intraobserver kappa value

	Evaluator 1	Evaluator 2
Evaluator 1	0,333	0,351
Evaluator 2	-	0,512

Table 2: Accuracy, specificity, sensitivity, PPV and NPV

Image	Accuracy	Specificity	Sensitivity	PPV	NPV
Original	0.490	0,818	0,408	0,702	0,579
Sharpen 1	0.652	0,769	0,543	0,685	0,641
Grayscale inversion	0.248	0,955	0,180	0,875	0,547
Emboss	0.545	0,906	0,453	0,889	0,635
Vertical	0.643	0,861	0,544	0,794	0,657
Vertical + Horizontal	0,588	0,767	0,499	0,690	0,607

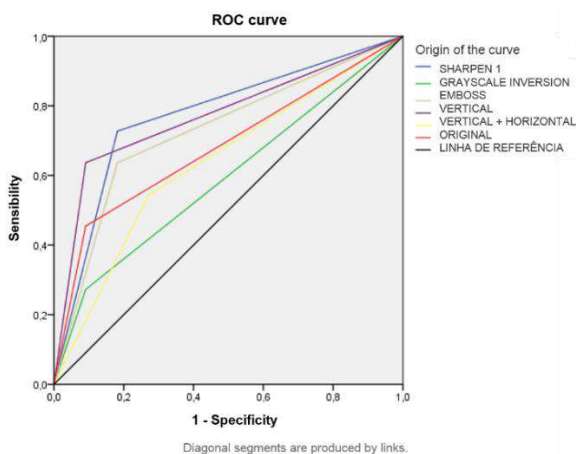


Fig. 3: ROC curve for evaluator 1

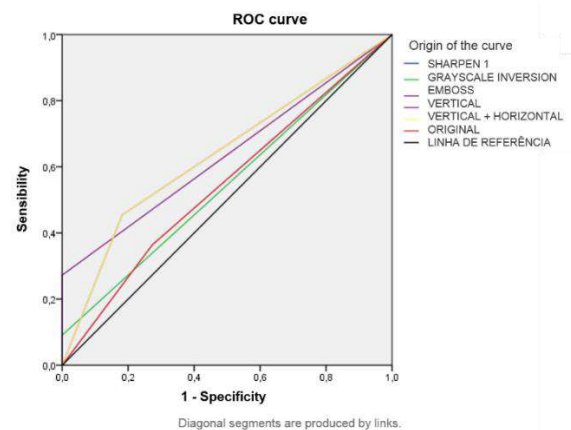


Fig. 4: ROC curve for evaluator 2

III. DISCUSSION

The purpose of this study was to evaluate whether digital improvement filters influence the diagnosis of VRFs in multirouted teeth. Our results showed that the filters had higher accuracy values than the original image, except the “grayscale inversion”. The filter that presented

the highest value for sensitivity was the “vertical” and the filter that presented the highest value for specificity was the “grayscale inversion”.

The highest value of accuracy was observed on the images that were applied to the “sharpen 1” filter. This result is similar to that of Nascimento et al. (2015), who despite using a direct digital radiography system (*Digora™ Optime*), and single-rooted teeth, found that the “sharpen 1” filter assists in the radiographic diagnosis of vertical fractures.

Regarding sensitivity, that is, the ability of the examination to detect the fracture when the tooth is actually fractured, this work showed that the “vertical” filter had the highest values. Differently from the work of Tofangchiha et al. (2012), who showed in his study, with single-rooted teeth and coupled loading device, that the original image obtained higher sensitivity when compared to filters. The “vertical” filter uses algorithms that aim to highlight the vertical lines of the radiographs and probably, therefore, the fracture lines were more easily detected by evaluators of this study.

Queiroz et al. (2016), when using images with “emboss” filter, with the DBSWIN™ software on single-root teeth and photostimulated phosphorus plates, concluded that due its acceptable diagnostic accuracy, it is an imaging modality that should be used for the diagnosis of VRFs. In the present work, the “emboss” filter also presented a high value of specificity (0,906), that is, approximately 91% of the cases without fractures were correctly diagnosed.

No studies evaluating the VRF and the “vertical + horizontal” filter were found in the literature. This tool aims to highlight the vertical and horizontal lines and, in this way, it was believed that the visualization of the vertical and transversal fracture lines was facilitated. The accuracy value for this filter, in this study, was higher than the original radiography, however, this difference was not significant.

The low value of interobserver kappa in this study reflects the difficulty in diagnosing VRF in periapical radiographs, and is in accordance with other studies that reported low levels of interobserver agreement^{14,21}. The improvement of digital systems tools and effectiveness depends on the experience of the observer, which may contribute to such values¹³.

This study compared the use of original images and with the application of software filters *Cliniview™* in the detection of VRFs in multirooted teeth through two observers. In the literature researched, no studies were found comparing the diagnostic accuracy of digital

enhancement filters in the diagnosis of VRFs in multirooted teeth.

The limitations of the present study are inherent to an *ex vivo* in which the actual clinical cannot be completely simulated²².

The values obtained with the filters were higher than the original, except the “grayscale inversion” and there was still a relevant variation among the evaluators, but more studies are needed, in multirooted teeth in order to compare the efficacy of image enhancement tools.

IV. CONCLUSION

It is concluded that the contribution of the filters is professional-dependent and that, in this work, the “sharpen 1” filter contributed to all images evaluated, differently from the “grayscale inversion” filter, which impaired the radiographic diagnosis of root fractures in multirooted teeth.

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Looking at Education in Agroecology in different Levels of Teaching: A Systematic Mapping

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Abstract—The growth of Agroecology courses at different levels is a reality in Brazil. This work presents a systematic mapping of the literature on the occurrence of Education in Agroecology at different levels of education in the country. For that it investigates the methodologies, the challenges, the contributions and where it has occurred. 228 papers were identified and after applying inclusion and exclusion criteria defined in the study, 12 papers were analyzed. Among the results, it can be seen that the methodologies applied range from the implementation of technical, higher and postgraduate courses to extension projects involving the agroecological theme. Such courses are present in all five Brazilian regions and one of the challenges is to change the concept in the field, from agribusiness to agroecological.

Keywords—Education in Agroecology, implementation methods, challenges, contributions.

I. INTRODUCTION

This work aims to present a systematic mapping of the state of art in Agroecology Education within the levels of education provided by in Law 9.394/96 – Law of Guidelines and Bases for National Education (Brazil, 1996). According to this law, Brazilian education is presented in two levels: Basic Education that comprises the stages of Early Childhood Education, Elementary and High School; and Higher Education that is presented in sequential courses: graduation, postgraduate and extension. Thus, although the focus of this work was not teaching modalities, professional, indigenous, special and field education, also offered in current legislation, are inherent to discussions, perceived in the works identified in the mapping process.

Initially, in a study that has agroecological education at different levels as its central theme, it is important to understand Brazilian historical scenario that marks the relationship between man and nature, based on the assumption that "nature is in man and man is in nature, because man is the product of natural history and nature is a concrete condition, then, of human existentiality" (MOREIRA, 1995, apud OLIVEIRA, 2002, p.1). In this context, the relationship between man and nature is

necessary to identify the prevailing economic system adopted in Brazil, because according to it, the vision and conception of this relationship between man/nature changes. In Brazil, the economic system is the capitalism, which has a view of this relationship of man/nature as of domination of man before nature, nature is seen as one of "the means of production from which capital benefits" (OLIVEIRA, 2002, p.5).

Therefore, in Brazil, the development of capitalist relations in the field has its origins in the Green Revolution and in the exploitation of natural resources in a predatory way (SOUZA, 2017). The said Green Revolution sought to achieve high productivity based on intensive use of chemical inputs (fertilizers and pesticides), without concern with socio-environmental impacts arising from this proposal called conservative modernization. Currently, this development perspective has been identified with the sector and its perspective called "Agribusiness" that has been constituted as a capitalist proposal for the development of the field and it is configured as a junction of agricultural and livestock production chains.

According to Souza (2017) for implementation and dissemination of agribusiness ideas in Brazil, agricultural education and rural extension were used, selling the image

of modernization from technology, whether in production, in the use of chemicals and pesticides for expansion of crops, among other instruments that caused the change in peasant relationship with agroecosystems, artificializing nature. It stands out that these changes in dynamics and technological aspects did not take into account the impacts on the lives of rural populations, much less the consequences for human and animal health and environmental degradation (ALMEIDA et al, 2001).

In their studies, Caporal and Costabeber (2004), highlight that rural extension actions proposed at the time of the implementation of The Green Revolution, and it lasted for many years, were based on development for the field limited to an economic perspective, besides being incompatible with the way of life and relations between environment and society established by traditional communities and those inherent to the diversity of Brazilian family farming. So, aspects related to the perspective of sustainable rural development and the demands of these populations regarding education, health, agrobiodiversity, food security, exchange relations, culture and identity of the populations and aspects of life of the families in the countryside were not considered in the context of the proposal of conservative modernization of rural Brazilian.

In opposition to this process, the redemocratization of the 1980s and the expansion of movements and technical advisory organizations to rural communities intensified in the 1990s led to the construction of proposals and expansion of initiatives in the field of Agroecology for the promotion of Sustainable Rural Development (CAPORAL and COSTABEBER, 2001). This process intensified with the arrival of Lula Government in 2004 so that various actions in the field of Sustainable Rural Development in dialogue with the needs of families began to come on the agenda in the context of public policies and development actions in the field. One of the main actions proposed already in 2004 was the expansion of technical assistance and rural extension (ATER) actions based on the agroecology perspective and articulated this with numerous other actions to promote Sustainable Rural Development. In this rural extension action, then called "Nova ATER" (BRASIL, 2004), the various demands of the populations of the field and participatory processes were considered, presenting as its purpose: "participate in promotion and animation of processes capable of contributing to the construction and execution of sustainable rural development strategies, centered on the expansion and strengthening of family agriculture and its organizations, through educational and participatory methodologies, integrated to local dynamics, seeking to

enable as conditions for the exercise of citizenship and the improvement of society quality of life" (BRAZIL, 2004).

Thus, the extensionist action based on agroecology in the context of ATER is brought to the status of promoter of non-formal educational actions essential for sustainable rural development from the proposition of the Nova ATER (MARINHO et al, 2015). For this, it was also necessary a process of training technical extension agents through free courses and also began to require the creation of agroecology courses at different levels of education to account for the actions in the field of sociotechnical intervention of extension professionals, as well as training for the populations of the field for the agroecological transition (BALLA et al, 2014; SOUZA, 2017).

In field, education assumes an important role promoting Agroecology or nature of this field as a base for knowledge construction necessary for transition and social intervention processes of agroecological basis, by the educational processes under development with different teaching initiatives in agroecology. Then, as a foundation education as a science, it articulates with a set of other fields of scientific knowledge such as agrarian sciences, biology, ecology, economics, sociology, history, geography, anthropology, communication, physics, among others, in an integrative way, to make up what Caporal calls the "disciplinary matrix" of Agroecology as a new paradigm. (CAPORAL et al, 2006)

Education interconnects with Agroecology throughout its trajectory, initially basing actions in the field of informal education such as Extension and Rural Development actions. Over time, especially after the 2000s, these initiatives are articulated and even identified with other education proposals such as Alternation Pedagogy and popular school networks (PEREIRA et al., 2019), Education of/in the Field (FERRARI et al, 2019) and the intensification in the process of institutionalization and creation of regular and formal courses of agroecology (PAIXÃO, 2017) according to established levels of education established in Law of Guidelines and Bases of National Education.

It is in this context that several agroecology courses are offered in the field of professional performance, which are medium technical and higher level, such as bachelors and technological, as well as in the level of specializations, master's and doctorate. After more than two decades of creation and expansion of experiences in formal education in Agroecology in Brazil, analyses are needed on the process of constitution and operation of these courses, regarding the aspects that underlie Agroecology Education, the functioning of the pedagogical proposals,

insertion of these professionals in society, as well as the main achievements and challenges.

II. AGROECOLOGY EDUCATION

It is correct to affirm that to break the whole view of agribusiness implemented over the years in educational institutions, agroecology education has been presented as an appropriate alternative for this rupture, manifesting itself in the agreement with the formation of the "Omnilateral" citizen and not unilateral formation. The educator Gaudêncio Frigotto (2012, p.267), clarifies that "Omnilateral" is a term that comes from Latin and whose literal translation means "all sides or dimensions". "Omnilateral" education thus means the conception of education and human formation that seeks to take into account all the dimensions that constitute the specificity of the human being and objective and subjective conditions in its full historical development" while unilateral education "forms for work and productive market" (Frigotto, 2012, p. 269).

In this context, it seeks that the individual emanates in all senses and dimensions, since thinking about Education in Agroecology permeates the knowledge of the populations of the field and the educational process of this type of teaching, enabling a new field and society project from agroecological principles, reconstructing the world based on a new relation of man with nature. So, at the 1st National Seminar on Agroecology Education in 2013, discussions were presented on the themes involved in insertion of agroecology in formal and informal teaching environments, culminating in the creation of the principles and guidelines of Agroecology Education: "a set of comprehensive, fundamental, guiding and defining guidelines and values of the way forward to put a certain end into practice. Here we understand that principles and guidelines are orientations for decision-making on which way to follow in order to carry out an Education with an agroecological focus committed to the construction of a more sustainable future". (AGUIAR, 2016, p.5)

We believe that these were created and designed to affirm and reaffirm the paths to be trodden for Agroecology Education in Brazil. As well as basing together those who have not yet entered this journey that it is plausible, has significant foundations and results throughout the process. Thus, four integrative axis were described to guide the work with Agroecology Education: Principle of Life, Principle of Diversity, Principle of Complexity and Principle of Transformation.

The principle of life assumes that nature must be respected, it is from nature that it is possible to keep alive

all forms of life. It is important to "learn from nature observing the interrelationships of the diversity of living beings in various ecosystems and to overcome the anthropocentric view towards a planetary consciousness." (AGUIAR, 2016, p. 7) . That is, from nature it is important to respect, care, know, observe, value, be supportive and enable sustainability in economic, cultural, ecological, ethical and political aspects searching for a life on a planet viable to all beings.

The principle of diversity infers about the multiplicity and possibilities of building knowledge in various spaces. In this way, it is recognized that "the different ecosystems, agroecosystems and landscapes, the wealth of natural goods, the different social practices, knowledge (local and academic), values, culture and forms of social and productive organization, which determine the relationship of human beings with nature". (AGUIAR, 2016, p.8)

In this principle, it relates to the territory as a diverse good, whether in the countryside or in the city, where the fundamental is to know, recognize and value the diversity of peoples.

The principle of complexity is based on "multidisciplinary, interdisciplinary and transdisciplinary actions and attitudes, but fundamentally in the dialogue of the various knowledge and areas of knowledge, considering their socio-historical contexts" (AGUIAR, 2016, p.10). This principle aims to break this reductionist and fragmented view of knowledge, visible in educational institutions, for example, in course projects that discipline knowledge, each one takes care of the contents related to a given discipline, one does not engage with the other. It is important to know "the whole", each element that "composes" it and from this perform an analysis based on the various holistic, social, cultural, economic dimensions, among others.

Last but not least, the principle of transformation, which believes that through education the individual is able to "understand and act with autonomy for promotion of life and sustainability of the planet" (AGUIAR, 2016, p. 12). However, it is necessary for this individual to recognize himself as belonging to society, breaking the ties imposed by hegemonic society, that is, it can be transformed, not only for the individual good, but for the collective starting to have a differentiated formation, based on the recognition of its role as knowledgeable of how the relation between man and nature should happen.

With the dissemination of these principles and guidelines that were collectively constructed, educators, researchers, technicians and other scholars in the area

began to have a direction in the activities of teaching, research and extension that may involve the theme Education in Agroecology beyond the guiding documents of the government. An example of applicability of these principles and guidelines is the reformulation of technical, technological and undergraduate course projects that were created prior to this document and that often do not express the importance of a professional who will have a differentiated view of nature, territory, diversity, culturality, interdisciplinarity, among other principles.

Anyway, as Arroyo describes: We need to educate for an agriculture model that includes the excluded, that expands jobs, increases opportunities for the development of people and communities, and that moves towards directing production and productivity towards ensuring a more dignified life for all, respecting the limits of nature. (ARROYO, 2004, p.13)

That is, we need to think, rethink, reflect, reconstruct, resignify, restructure, know the knowledge beyond the minimalist vision of the field disseminated by hegemonic society over the years and to do so, Education in Agroecology can and should be a path.

III. SYSTEMATIC MAPPING OF LITERATURE (MSL)

To define the state of art with a reliable and solid basis for work, we opted for systematic mapping of the literature. Systematic Mapping is designed to provide a broad view of a research area to establish whether there is research evidence in a topic and provide an indication of the amount of evidence (KITCHENHAM et al,2007). It allows mapping the evidence of a domain at a high level of granularity and identifying groups and voids of evidence, in order to direct the focus to future systematic reviews and to identify areas for conducting new primary studies (KITCHENHAM et al,2007).

The systematic mapping process is done in stages. In the first, the planning is carried out, in which the research questions are defined. In the second, the search for primary studies, using research tools. In the third stage, the identification of studies relevant to the research is performed from the application of inclusion and exclusion criteria.

Definition of Research Questions

Some research questions (QP) were proposed, the most relevant was: how has Agroecology Education occurred at different levels of education? To answer this question, some Secondary Questions were defined: Q1– What methodologies, techniques, resources and strategies have

been adopted in the implementation of agroecology education?; Q2 - What are the challenges of implementing agroecology education?; Q3 - What are the contributions of agroecology education?; and Q4 - Where have the actions of education in agroecology occurred? Therefore, proposing this determined the possibility of seeing the behavior of Agroecology Education at different levels of education, and with the analyses build bases for future work in this area.

Searching process

To outline the scope of the research, criteria were established to ensure, in a balanced way, the feasibility of execution (cost, effort and time), accessibility to the data and scope of the study. According to Kitchenham (2007), research of primary studies can be carried out in digital libraries indexed through their respective search engines. To ensure the inclusion of important studies for this study, manual searches were carried out in the field of important events and journals related to the theme. For this survey, results from: (1) Google Scholar were accessed; (2) Anais of the Latin American Congress of Agroecology; and (3) Anais of the National Seminar of Education in Agroecology - SNEA, these last two through the Brazilian Journal of Agroecology.

The next step was to define the search arguments that would return related works on agroecology education at different levels of education. This was a time-consuming process, which consisted of several tests in the academic search engines. In addition, there was a need to adapt the search arguments in Portuguese differently by the returns that in many situations were null or returned articles of great scope and amplitude and little relevance. Thus, by suiting the keywords and connectors to refine the search returns, the results presented in Chart 1 were reached.

Table.1: Search arguments

Search arguments
MAIN QUESTION: "education in agroecology" AND "levels of education" AND "methodology" OR "intervention" OR "practices" OR "models" OR "teaching degree" OR "types of teaching" AND "challenges" OR "difficulties" OR "obstacles" AND "contributions" OR "benefits" OR "advantages".
QUESTION 1: "education in agroecology" AND "levels of education" OR "types of teaching" OR "teaching degrees".
QUESTION 2: "education in agroecology" AND "levels of education" OR "types of education" OR "teaching degrees" AND "challenges" OR "difficulties" OR "obstacles"
QUESTION 3: "education in agroecology" AND "levels of education" OR "types of education" OR "teaching degrees" AND "advantages" OR "contributions OR "benefits" OR "impacts"

In this process, 228 papers returned among articles, dissertations and theses in search engines were obtained, which are shown in Chart 3 in the primary survey column. Next, the primary studies were submitted to the inclusion¹ and exclusion criteria, in order to identify the most relevant aspects that propose to respond to this mapping.

Inclusion and exclusion criteria

Inclusion and exclusion criteria, shown in Table 2, are used to direct the chosen subject and exclude non-relevant papers to answer questions from the research were based on the indications of Kitchenham (2007).

Table.2: Inclusion and exclusion criteria

Inclusion	Exclusion
CI1. Studies dealing with the teaching of agroecology at different levels.	Ce1. Studies clearly irrelevant to the research, according to the research issues raised.
CI2. Studies that present strategies for the implementation of agroecology education.	CE2. Studies that do not answer any of the research questions.
CI3. Studies that present advantages, contributions and benefits of agroecology education.	Ce3. Studies that are outside the reality proposed by the research.
CI4. Studies that present challenges, difficulties, obstacles, barriers in performing education in agroecology in the country.	Ce4. Studies that are in English will not be accepted.
CI5. Studies published from 2014 to the present date, and which are in Portuguese.	Ce5. Studies that do not treat agroecology education at least one level of education in the country.

IV. RESULTS AND DISCUSSIONS

This section presents the results obtained from the systematic mapping through execution of the protocol. The results are structured in five sections described below, according to the data obtained and research questions¹.

Results of the execution of the search protocol

The search arguments were executed in the search sites returning a total of 228 papers between articles, dissertations and theses (see table 3). A complete frame with all works returned in execution can be checked on the protocol metadata collection form².

Table 3: Statement of the articles raised in the repositories

Machines	Primary survey	Selected by website
Google Scholar	68	5
Journal Cadernos de Agroecologia	160	7
Total	228	12

After the primary survey, inclusion and exclusion criteria defined in the protocol were applied. The criteria were applied in three rounds. First, the title, keywords and

¹Disponível em: <<https://bit.ly/33FEtlf>>. Acesso em 29 de nov. de 2019.

²Disponível em: <<https://bit.ly/2OA8ZZn>>. Acesso em 29 de nov. de 2019

abstract were read. Second, in addition to the metadata of the previous round, the reading of the introduction and conclusion was included. In the last selection round, the previous procedures plus the methodology were used, to then reach the 12 papers selected for extracting evidence as described in Figure 1.

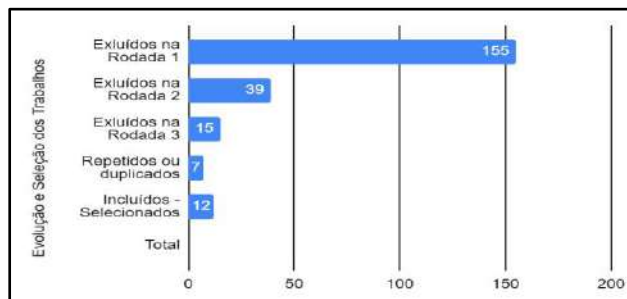


Fig.1: Selection process evolution for selected papers.

The period in which the selected papers were published is shown in Figure 2. We note a high frequency of publications in the years 2014 and 2017, we believe that this result is due to the realization of the first and second National Seminar of Education in Agroecology (SNEA), which took place respectively in 2013 and 2017. Thus, it is possible to highlight the importance of the event for the publication and scientific dissemination of practices, initiatives and research in Agroecology Education. In addition, eight of the twelve works were returned from this device under this mapping.

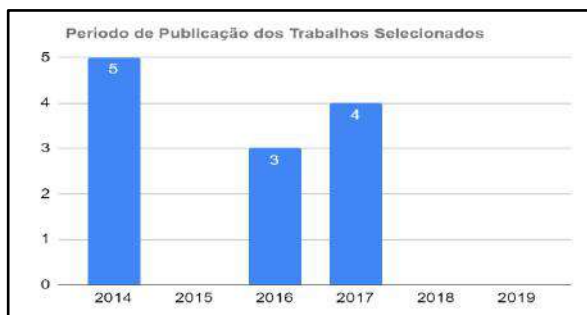


Fig.2: Publication period of selected papers

From the Primary Studies, it was possible to extract the necessary evidence to answer the secondary questions of this research. Table 4 presents the twelve articles that served as the basis for answering the four questions proposed in this study after the proposed systematic survey.

Table 4: Primary Studies Selected to answer questions

Primary Study	Articles	
	Title	Authors
EP01	Overview of agroecology courses in Brazil.	João Vitor Quintas Balla et al.
EP02	Agroecology from the perspective of Professional Education of the Field: the experience of the technical course in Agroecology of IFPR in Ortigueira-PR	Ezekiel Antonio de Moura et al.
EP03	Technology in Agroecology: advances and challenges	Edmilson Cezar Paglia et al.
EP04	The teaching of agroecology in formal courses: brief considerations for the Midwest region.	Lucia Tereza Ribeiro do Rosário
EP05	Agroecological environmental education: in the rescue of the natural being	Fernanda Oliveira de Lima et al.
EP06	The Masters and Masters Griôs in Agroecological Education	Tadzia by Oliva Maya et al.
EP07	Reading tree project at Flor da Serra Resettlement, in Porto Nacional - TO	Jaqueline Ferreira et al.
EP08	Reflections on Agroecology in Country Schools in the City of Goiás	Rejane Medeiros et al.
EP09	Reflections on Higher Education in Agroecology	Manoel Baltasar Baptista da Costa
EP10	Postgraduate in Agroecology: the experience of the specialization course in Agroecology at IFPR - EAD modality	Ana Paula Cavalheiro de Andrade et al.
EP11	Experience report of agroecological principles	Jeovani de Jesus Couto & et al.

	developed in the Alternation Pedagogy of the Rural Family House of Breves	
EP12	In High School, Technical or Higher Education, Agroecology: Present!	Irene Maria Cardoso

Q1– What methodologies, techniques, resources and strategies have been adopted in the implementation of agroecology education?

Concerning the creation of new courses, regardless the level of education it is necessary to follow the guidelines from Ministry of Education, as well as the current legislation, even as the organs and councils of the category. However, institutions have autonomy to define which methodology, technique and strategies will be used in the process of creating and executing the courses. The resources used for the creation and maintenance of the courses vary in the form of funding, for example, if the institution is public or private, if it is Federal, State, Municipal, as well, they can receive investments from institutions or funding agencies through partnerships.

Thus, through the survey conducted, it was possible to perceive diversities of methods, techniques and strategies for implementation of courses in the area of Agroecology. It was perceived, for example, in Santa Catarina, the Technical course in Agroecology of Vintee Cinco de Maio School in Fraiburgo began in 2005 with 51 students using the methodology of Alternation Pedagogy. Several actors participated in the structuring of the course, such as the Landless Rural Workers Movement (MST), the Federal University of Santa Catarina (UFSC) and other institutions [...] In Amapá, the Technical course in Agroecology is offered by Escola Família Agroextrativista do Maracá, one of the 5 Agricultural Family Schools of Amapá. An Agricultural Family School (EFA) has as a model of teaching and learning methodology the Rural Family Houses of France, which emerged in 1930. One of the most important pillars of this model is the Alternation Pedagogy. (BALLA et al,2014, p.5).

Like these institutions, others in the country also make use of the Alternation Pedagogy. It is assumed to divide pedagogical work with the student in two moments: school time and community time. At the moment they are at school the students work the technical-scientific knowledge related to the courses according to the national curriculum guidelines for the courses that are inserted and at the moment they are in the community, from activities

involving teaching, research and extension, proposed by teachers in classes, students experience the practice (BALLA, et al,2014). It is noteworthy that this methodology allows students to be doing the process of reflection of theory with practice, either when they are in the school space, or at the moment they are inserted in the community, their experiences are always used in pedagogical teaching processes.

In addition to the presence of Alternation Pedagogy in the work with Agroecology, it is possible to find the use of participatory methodology, not only in formal education proposals, but in extension projects. They seek to apply the principles of agroecology and education throughout the practices that normally develop through workshops, such as the "Reading Tree" Project, at the Carmencita Matos Maia Municipal School, in Flor da Serra Resettlement, in Porto Nacional - TO. In this project, the workshops worked on themes such as socio-environmental identity, resettlement, culture, ecology, indigenous peoples, memories and school space, not only involving the students of the school, but the whole community. The highlight of this project is the constant search of the school for a "school identity of the field, starting with the curriculum with significant contents, as well as a pedagogical practice consistent with the students' life project" (DE SOUSA et al, 2017, p.8).

Another experience identified happens with elementary school students who attend a Public School in the countryside in Rio de Janeiro. This school, due to the initiative of local youth, embraced the idea of working with the theme of agroecology through Griô Pedagogy. This provides an invitation to a recognized person in the community for their knowledge and doing, who is named Mestre Griô and through orality shares with the students stories, experiences and knowledge, highlighting the role of agroecology as a driver of respect for agricultural communities (MAYA et al,2017). At the same time, the presence of this professional allowed the debate at school about the importance of farmers bringing the experiences of their knowledge to school, questions about public policies for agroecology in the region and social transformations from this dialogue with the other.

Finally, we also identify the use of school vegetable gardens whether in rural or urban spaces as an instrument to work on agroecological principles in communities, through extension projects developed by educational institutions and institutions in the third sector.

Q2 - What are the challenges of implementing agroecology education?

The challenges of implementing a policy aimed at the education of the populations of the field are one of the main challenges of education in Agroecology and primarily of the struggle for autonomy as a new science involving knowledge and experiences of farmers, indigenous peoples, forest peoples, fishermen, quilombola communities as well as subjects involved in rural development processes. Any plan to consider this diversity in educational proposals.

Two aspects are fundamental for understanding this construction: the guiding principles of family agriculture and capitalist agriculture (agribusiness) that dimetrically define in their forms of experiences. However, this incompatibility has a consensual element which is the *Mançano Agrarian Question itself* (2004) which is based on food sovereignty; on the democratization of the land and territories of traditional peoples and communities; on the recognition of local knowledge; on economic logic grounded in cooperation that supports Agroecology itself.

The courses, at any level or modality of teaching, aiming academic training in Agroecology must break with copies of curricula of related areas such as Agronomy or Agriculture seeking for, preferably meet the requirements of field education policies, methodological principles of the Alternation Pedagogy, considering popular knowledge and the diversity inherent to peasant populations. Caporal (2005) understands Agroecology as an integrative disciplinary matrix formed by contributions from various areas of knowledge. For Sevilla & González (1993) agroecology is essentially peasant, and human history has its roots in peasants, so we can say that it is the means by which we cover all human and environmental elements.

Another indispensable element to be considered is the understanding of the meaning of peasant territory as a place where agroecological knowledge is produced (LIMA, 2016), and political-pedagogical contributions should be considered in educational actions. Among the principles that are based on we can highlight: [...] the diversity of the field in its social, cultural, environmental, political, economic, gender, generational and race and ethnic aspects; encouraging the formulation of specific political-pedagogical projects for field schools; valuing the identity of field school through pedagogical projects with curricular contents and methodologies appropriate to the real needs of students [...] of the field, as well as flexibility in school organization, [...] adequacy of the school calendar to the phases of the agricultural cycle and

climatic conditions; [...] social control of the quality of school education, through the participation of the community and social movements of the field (BRASIL, 2010, p.1).

Before the agroecological theme was considered as a curricular component in peasant schools, culture, knowledge, experience, field peoples daily lives were rarely referred to the organization of pedagogical work, education systems, teacher training or production of teaching materials (LIMA, 2016; DE SOUSA et al, 2017; ROSARIO,). Therefore, building curricular matrices for courses aiming teaching agroecology, whether in rural or urban schools, is a key and challenging element in knowledge construction for the change of formative sense, having as its central element the subject and its territory. The curricular components and their menus should be based on an approach that prioritizes the exercise of reflection on the contradictions of the current technological model in addition to reformulating the technical model that has been consolidated in recent times (PAGLIA et al, 2016).

It was also verified that in the process of implementation of agroecology courses throughout the country, some were created to meet the demand of the social movements of the field, identified through partnerships between higher education institutions and communities. In some of these cases, the courses faced infrastructure difficulties, lack of professionals prepared to work with agroecology and to understand the interdisciplinary view of knowledge application, the construction of the political pedagogical project, among others as the reported experience of implementing agroecology courses at Federal Institute of Paraná (MOURA, 2016).

Q3 - What are the contributions of agroecology education?

From the articles studied in this systematic review process, it was possible to realize that implementation of agroecology in Brazil allows a look at traditional communities, on countryside population, valuing life story, culture and enabling the recognition of who they are, from their roots, their fight against the hegemony and imposition of agribusiness. However, as these are new courses, they face many challenges, such as the teachers who teach the classes in these courses were formed within a conception of agribusiness, monoculture. Balla, Massukado and Pimentel highlight: the courses are contributing to the expansion of the agroecological debate in Brazil. Because they are in the field against hegemonic Brazilian agriculture, the courses are facing many

challenges, obstacles and still make mistakes. With the time and learning provided by the exchange of experiences, agroecology courses are strengthening and seeking for consolidation and recognition towards academia, organs and society in general. (BALLA, MASSUKADO, PIMENTEL, 2014, p.6).

The debates caused by the study and dissemination of agroecology throughout Brazil also contributed to broaden the conversations and concerns about the meaning of territory, failing to see only the physical space, to reflect on the set of representations that permeate the site, as highlighted in the 1st National Seminar on Education in Agroecology:[...] considering all its complexity and ecosystem and social diversity and as a space in dispute and conflict among different socioeconomic sectors; values and knowledge of traditional peoples and communities as a source of ecological and cultural teachings essential for the conservation of biodiversity and the construction of sustainability; Recognition and appreciation of traditional peoples and communities in the countryside and the city, especially the farmer, a family and peasant (maroons, artisanal fishermen, riverside, extractivists, background dwellers of pastures, cleaners, seafood, babassu coconut breakers, indigenous and others) and the different movements and social organizations, considering the issues of gender, sexual diversity, ethnic and generational and reaffirming the territory as a space of identities and cultures; (I SNEA, 2013, p. 09, apud MEDEIROS et al, 2017, p.2).

It is thought that working with agroecology messes with the roots of communities, peoples, culture, identity, the "I" and the way I relate to the other and to nature, so it will mess with the conception of space and where "I" recognize myself as a person. Thus, the understanding of education in agroecology goes beyond simply teaching new alternatives for the maintenance, preservation, conservation of nature, provokes questions about the existing society and its applicability in collective well-being.

Another contribution of agroecology education to society is the "resignification, through participatory methodologies, of sociocultural and historical context in which the students of School are inserted, so that the subjects feel protagonists of their stories" (DE SOUSA et al, 2017, p.2). That is, by using the context of students' lives, applying interdisciplinarity in everyday situations, promoting dialogue, reflection, appreciation, recognition of who they are, they learn to preserve not only where they come from, but the history of the place, the conquest of space, of the territory.

Q4 - Where have the actions of education in agroecology occurred?

The actions of Agroecology Education have taken place throughout Brazil, in all regions, at the various levels of Education. The rise of these courses began from the year 2000 and as highlighted by Balla, Massukado and Pimentel (2014) there were 136 agroecology courses spread throughout all five Brazilian regions, offering technical, graduation and postgraduate courses. "The 136 identified courses are offered by 84 institutions. Of these institutions, 7 are private and 77 are public. Among public institutions, 48 are state and 29 are federal." (BALLA, MASSUKADO, PIMENTEL, 2014, p.8). As well as, from this offer it was identified by the authors that the highest concentration of technical courses is in the Northeast Region, with the presence of 47 courses, equivalent to 30% of the total quantity. However, the authors have not investigated the reasons that intensified the presence of technical courses in agroecology in this region.

Regarding to Basic Education, it was not identified the performance of activities in early childhood education for this axis in the texts investigated in this mapping, even as, in Elementary School, the same happens through extension projects. Finally, "Brazil is probably the country with the highest number of agroecology courses or with an agroecological focus in operation today, both at middle and higher education" Caporal (2009, P.4). This reinforces the interest of the population in studying this theme and modifying the proposition of agribusiness.

V. CONCLUSION

It is observed through the carried readings in this thematic mapping that in many institutions (public, private or third sector) Education in Agroecology only happens through the creation of extension projects carried out by researchers and students involved in the community and/or by the actors of social movements, technicians of third sector organizations..

The Basic Education Schools do not have in their curriculum the discipline of Agroecology, not even a discipline of Education in Agroecology, being visible such disciplines in some teaching modalities such as Field Education and Professional Education. This situation happens as a result of this science to propose an appreciation of the roots of populations subjugated by society such as peasants, quilombolas, indigenous, among other traditional communities that normally advocate the implementation of agroecology. It is worth mentioning that the implementation of agroecology education breaks with the view of agribusiness and the perspective that nature is

aproduct for man to generate results, so even agroecology is not a discipline, or a content provided for in the curriculum matrix of basic education, it must be worked in schools, urban, rural and in the field.

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Real Estate Industry in the Philippines: Problems, Policy Implications and Societal Contributions

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Abstract— Addressing the problems of the real estate industry enhances and creates positive policy implications and societal contributions. This paper described the profile of the real estate human resources. It also described the problems encountered by the respondents. Further, policy implications and societal contributions of real estate industry were identified. Descriptive method was used in this paper. A total of 239 human real estate resources (163 males and 76 females) were surveyed using a questionnaire. In relation to the gathered and analyzed data, this research has concluded that, first, the top three most common problems encountered by the real estate industry were unlicensed real estate persons, commissions received, and unethical practices. In spite of the presence of RA 9646, individuals are not yet aware of its implementing rules and regulations. It projects the traditional selling and buying of properties which sometimes caused problems to stakeholders. Second, these problems encountered have policy implications on the real estate industry such as land conversion, areas prone to calamity and hazards, and hidden charges upon turnover. Policy implications from different situations were generated such as from different government agencies. And last, despite of these problems and policy implications, real estate industry has societal contributions such as it can be a source of employment for the people, provides shelter to the people for social protection and security, and it is one of the sources of the government's income. Jobs generated, taxes collected and social housing shared by the real industry are the major contributions of the real estate industry. The researcher recommends that Information dissemination for the awareness of RA 9646 for the professionalism of the industry must be participated for the benefit of the stakeholders. Implementation and proper monitoring of this law through authorized group improve the professionalism in the industry. Vigilant buyers and seeking necessary information before investing hard earned money in real properties must be done by prospective buyers in order to prevent future problems. Income generated from assessors can be improved over the years through proper payments on real property tax. Following the proper land use must be practiced in order to get the highest and best use of the property.

Keywords— Real Estate, Problems, Difficulties, Policy Implications, Societal Contributions.

I. INTRODUCTION

Addressing the problems of the real estate industry enhances and creates positive policy implications and societal contributions. In order to achieve their objectives, healthy organizations need to maximize human resources; they need to integrate their programs and empower their employees (Santos & Nocum, 2020).

Proper corporate culture in the real estate industry should be maintained while agents and other human capital in the real estate sector compete with clients (Hipolito, 2020). The rules

and procedures of a transparent company must be followed to enable contract employees such as real estate agents to remain committed to work to avoid dishonest activities (Santos & De Jesus, 2020).

Land and real estate are the core components of the material socio-economic foundation, and thus all problems of land transfer have always been relevant and significant for the advancement of society (Kauškalė & Geipele, 2016). Since the real estate market is directly related to the functioning of the economy, its disproportionate growth is a significant risk

factor for the development of the financial sector and the economy as a whole (Glock et al., 2007).

In lieu of the insights, the researcher sought to identify the problems, policy implications and societal contributions of the real estate industry in the Philippines.

II. CONCEPTUAL FRAMEWORK

Real estate is therefore a physical setting with many various activities, such as commuting, shopping, housing and recreation, and thus has a range of political, social and cultural influences (Toivonen&Viitanen, 2016).

Distortions in the rate of investment and allocation of capital, insufficient delivery of subsidies for housing finance, ineffective processes for choosing the target population for subsidies, lack of suitable and reasonable financial tools to resolve perceived risk in housing finance, lack of standard criteria for determining appropriate interest rates are the main shortcomings in real estate financing (Sarket et al., 2008).

Policymakers are forced to balance the need for stability in the real estate sector against the degree of unfair pricing with the taxable sector that could occur if the tax-advantaged sector is unconstrained (Campbell & Sirmas, 2002).

III. OBJECTIVES OF THE STUDY

This paper described the profile of the real estate human resources. It also described the problems encountered by the respondents. Further, policy implications and societal contributions of real estate industry were identified.

IV. METHODOLOGY

The descriptive method of research was used in this study because it requires the exact presentation, documenting, examination and explanation of the situation. It is necessary to use the descriptive approach to obtain information on the current situation (Creswell, 2014). A total of 239 human real estate resources (163 males and 76 females) were surveyed using a questionnaire of liker-scale responses (Vagias, 2006).

V. RESULTS AND DISCUSSION

Table.1: Profile of the Real Estate Human Resources

VARIABLES	FREQUENCY	PERCENTAGE
Sex		
Male	163	68.00
Female	76	32.00
Total	239	100.00
Age		
20-30	8	3.00
31-40	86	36.00
41-50	84	35.00
Total	239	100.00
<i>Mean:</i>	39.58	
<i>Oldest:</i>	60	
<i>Youngest:</i>	27	
Civil Status		
Single	9	4.00
Married	230	96.00

Total	239	100.00
Educational Attainment		
College Graduate	219	92.00
Master's Degree	20	8.00
Total	239	100.00
Realtor Affiliation		
Appraiser	24	10.00
Broker	163	68.00
Broker/Appraiser	38	16.00
Consultant	5	2.00
Consultant/Broker	9	4.00
Total	239	100.00
Length of Years in Service		
less than a year	5	2.00
1 to 5 years	138	57.00
6 to 10 years	68	28.00
11 to 15 years	23	10.00
20 years and above	7	3.00
Total	239	100.00

Table 1 shows the profile of the respondents as real state human resources. The respondents of the study were dominated by males with a relative frequency of 68% with only 32% female. Majority of the respondents working in the real estate industry were between 31-40 years old (36%). Oldest respondent from the real estate industry is 60 years old and the youngest is 27 years old. In terms of educational attainment, it was noted that most of the real estate human resources were holding a Bachelor's degree (92%) and there

are few having master's degree (8%). Most of the respondents are working as broker (68%), followed by serving as broker and simultaneously as appraiser (38%), appraiser (10%), broker/consultant (4%), and consultant (2%). For the length of service in the real estate industry, it was noted in this study that most of the persons involved are already within one to five years in the business, as reflected by 57% of the respondents.

Table:2: Problems Encountered by the Real Estate Industry

Statements	Frequency	Ranking
1. Unlicensed real estate persons	146	1
2. Unethical practices	126	3

3. Documents	123	4
4. Commission	141	2
5. Unfair sellers	99	5
6. Unreasonable demand for property prices	90	6

Note: Multiple responses

Table 2 shows the problems encountered by the real estate industry. Under the Rule V Penal and Final Provisions of the RA 9646, any violations of the RA 9646 by licensed real estate practitioner shall be penalized with a fine of not less than one hundred thousand pesos (P100,000.00) or imprisonment of not less than two (2) years or both upon the discretion of the court. However, if the perpetrator is an unlicensed real estate practitioner, the fines and imprisonment will be double. In the case that the violation is committed by a partnership, corporation, association or any juridical person, the president, director or manager who has committed or consented to or knowingly tolerated such

violation shall be held liable and responsible as principal or co-principal of other participants, if any. However, despite the existence of such provision, unlicensed estate persons are the most commonly encountered problem particularly in selling real estate properties with 146 respondents. This is caused by the traditional belief that selling properties in unprofessional engagement. It is followed by problems obtained from commission with 141 respondents, some encountered unequal distributions, and delayed payments. Unethical practices ranked third which reveals even in the presence of the Implementing Rules and Regulations of the industry there were practitioners who.

Table 3. Policy Implications of the Problems Encountered by the Real Estate Industry

Statements	Frequency	Rank
1. Hidden charges upon turnover	103	3
2. Substandard construction	98	4
3. Real state scam	77	6
4. Areas prone to calamity and hazards	123	2
5. Fraud documents	87	5
6. Land conversion	165	1

Note: Multiple responses

Based from the brief interview the following policy implications revealed by the practitioners as they experienced in dealing with their clients as presented on Table 3.

Hidden charges upon turnover

Some land developers disclosed information from the property in order to easily catch prospective buyers. Before closing a deal in buying a property there's a need to verify all the documents and computations specially the miscellaneous fees and the like. "Unexpected connection fees, charges for utilities and restrictions Generally, the more common problem with hidden charges is that transfer and/or miscellaneous fees are either not properly declared

beforehand or not emphasized enough during the sales process."

Sub-standard Construction

It revealed that the some developers used low quality products in building a house which caused problems to the buyers and also the practitioners. Construction warranty bond could be necessary during the agreement.

Real Estate Scam

These were so-called double and triple sale of properties of different big real estates. Pag-IBIG Fund assured the homeowners of XeveraMabalacat in Pampanga

that Pag-IBIG will continue to accept housing loan payments from original buyers as appearing in the records of the Fund.

Areas Prone to Calamity Disasters and Hazard

Property sales form flood/landslide prone area which caused casualties like in Marikina and properties being sold in the west valley fault which were unsafe for stakeholders.

Fraud Documents

These were illegal papers obtained from unlawful transactions. Different government agencies such as

municipal or provincial assessor’s office, Land Registration Authority can assist in the verification of the authenticity of the property.

Land Conversion

Agricultural lands were converted into residential land which the Local Government Units (LGU) have approved the Comprehensive Land Use Plans (CLUPs)/Zoning Ordinance, have updated CLUPs/Zoning Ordinance.

Table.4: Societal Contributions of Real Estate Industry

Statements	Mean	Verbal Interpretation
Economic		
1. Real estate industry is one of the contributors in Gross Domestic Product of the country	3.29	Strongly Agree
2. Real estate industry has also its own share in the value-added and multiplier effect within the economy	3.20	Agree
3. Real estate industry is a source of employment for the people	3.79	Strongly Agree
Social		
4. Real estate industry provides shelter to the people for social protection and security.	3.56	Strongly Agree
5. The real estate industry is also playing a greater role in generating jobs.	2.20	Agree
6. Real estate industry offers calamity assistance particularly to informal settlers that are affected.	3.08	Agree
Political		
7. The real estate taxes are also considered as major source of local and national government finances	2.95	Agree
8. The execution of the document evidencing the absolute sale of the real estate will attract a documentary stamp tax.	3.43	Strongly Agree
9. All real estate industry taxes collected by the government became part of the government’s source of income	3.10	Agree
General Weighted Average	3.18	Agree

Table 4 presents the results of the societal contributions of the real estate industry in terms of economic, social, and political. Based on the result, societal contributions of the real estate industry got an average

weighted mean of 3.18 and had a verbal interpretation of Agree. To highlight, first in terms of economic contributions, respondents strongly agreed that real estate industry is a source of employment for the people (Mean = 3.79). The

effect of growing real estate industry in the country and other countries is unidirectional which means that as the industry increases its services and activities there is also an increase in the demand for human resources. In social contributions, real estate practitioners responded that they strongly agree that real estate industry provides shelter to the people for social protection and security (Mean = 3.56). Second, in relation to this, housing may reduce social cost associated with the spread of preventable diseases. Moreover, well-located settlements protect families from disaster; thus, it became a target for disaster mitigation and recovery. And last, in terms of political contributions, respondents also strongly agreed that the execution of the document evidencing the absolute sale of the real estate will attract a documentary stamp tax. With this, the real estate taxes are also considered as major source of local and national government finances.

VI. CONCLUSIONS AND RECOMMENDATIONS

In relation to the gathered and analyzed data, this research has concluded that, first, the top three most common problems encountered by the real estate industry were unlicensed real estate persons, commissions received, and unethical practices. In spite of the presence of RA 9646, individuals are not yet aware of its implementing rules and regulations. It projects the traditional selling and buying of properties which sometimes caused problems to stakeholders. Second, these problems encountered have policy implications on the real estate industry such as land conversion, areas prone to calamity and hazards, and hidden charges upon turnover. Policy implications from different situations were generated such as from different government agencies. And last, despite of these problems and policy implications, real estate industry has societal contributions such as it can be a source of employment for the people, provides shelter to the people for social protection and security, and it is one of the sources of the government's income. Jobs generated, taxes collected and social housing shared by the real industry are the major contributions of the real estate industry

The researcher recommends that Information dissemination for the awareness of RA 9646 for the professionalism of the industry must be participated for the benefit of the stakeholders. Implementation and proper monitoring of this law through authorized group improve the professionalism in the industry. Vigilant buyers and seeking necessary information before investing hard earned money in real properties must be done by prospective buyers in order

to prevent future problems. Income generated from assessors can be improved over the years through proper payments on real property tax. Following the proper land use must be practiced in order to get the highest and best use of the property.

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Evaluation of the efficiency of engineering courses in a Brazilian University: An application of Data Envelopment Analysis

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Abstract— Assessing the efficiency of similar undergraduate courses based on the analysis of reliable and complete information, allows opportunities for improving courses to be identified to support the institution's management, which are assigned the decision-making role. In this way, this research aims to evaluate the efficiency of Engineering courses at a Brazilian university from the Data Envelopment Analysis (DEA). For this, the BCC model was used with orientation to the output. As inputs the variables Number of Entries (x^1) and Faculty Size (x^2) were used, and as outputs the Number of Graduates (y^1) and the Course Concept (y^2). Thus, 13 Engineering courses, such as Civil, Electrical, Chemical, Industrial, Environmental and Sanitary Engineering and Computer Engineering were evaluated. The inefficiency of 2 courses was found and aspects of improvement were indicated to be put into practice to achieve this efficiency.

Keywords— University education. Engineering. Efficiency. Data Envelopment Analysis.

I. INTRODUCTION

Engineering was born out of the need to create armaments and secure fortifications in Europe in the 16th and 17th centuries [1]. Until the 1950s, in Brazil, there were only 16 institutions teaching about 62 engineering undergraduate courses [2]. In 2018, 6.106 undergraduate engineering courses were accounted for, in 60 different areas, distributed throughout the country [3]. Despite the growing increase in the offer of engineering courses, there is a high number of dropouts from students in these courses [4].

An important issue, in addition to increasing the offer of courses, is to analyze their efficiency. Evaluating the efficiency of undergraduate courses allows defining opportunities for improving courses [5] [6]. Relating the academic activities and the efficiency of each of them is essential to support the institution's management, which are assigned the decision-making role, based on the analysis of reliable and complete information [7].

To evaluate this efficiency, Data Envelopment Analysis (DEA), developed by Charnes, Cooper and Rhodes in 1978, can be used. In this context, this research aims to analyze the comparison between Engineering courses at a university Brazilian. With this, we intend to present management

metrics for the respective coordinations of the courses, based on efficiency indexes, goals and benchmarks.

The work is divided into 5 sections. The first comprises the introduction about the theme, together with the objective of the work. The second section covers the theoretical foundation, with a brief explanation of the Data Envelopment Analysis in conjunction with the Two-dimensional Representation. Then, the third section will demonstrate the methodology applied in the work, with the steps for conducting the research. The fourth section presents the results achieved. And the last section, the conclusion, concerns the understanding of the entire study.

II. THEORETICAL FOUNDATION

a. Data Envelopment Analysis

Efficiency is the comparison between what was produced with the available inputs and what could have been produced with those same inputs [8]. To calculate efficiency there are three techniques that can be used: the Stochastic Frontier, the Malmquist Index and the Data Envelopment Analysis [9]. This work has a scope the application of the last technique, motivated by the fact of

being a tool that since its emergence has been applied to the educational scenario.

Data Envelopment Analysis (DEA) is a tool based on mathematical programming models with the objective of measuring the efficiency of Decision Making Units (DMU's), considering multiple input variables and multiple output variables [10]. The application of DEA comprises some steps described below [8]:

- Definition and selection of DMU's: They can be defined as organizations that transform a set of inputs into a set of products or services. These DMU's must be homogeneous, so they perform the same tasks and have similar goals.
- Selection of inputs and outputs variables: Input variables, known as inputs and output variable, known as outputs. These variables must be the same for each DMU analyzed, varying only in terms of intensity. With the selected inputs and outputs, the productivity of the DMU's can be calculated, which is the ratio between the number of outputs and the number of inputs, indicating the performance of the DMU.

The last stage comprises the identification and application of the model. For this there are two classic DEA models: the CCR model that considers constant returns to scale, which considers an increase in the number of inputs, consequently, causes an increase proportional to the number of outputs; the BCC model considers variable returns to scale [10]. Figure 1 depicts the borders corresponding to the two models.

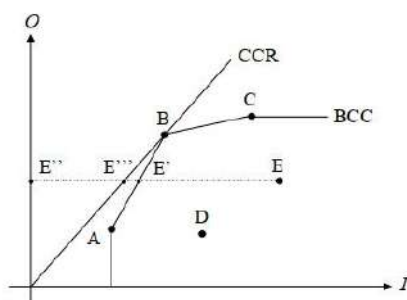


Fig.1: BCC and CCR models efficiency frontier

Efficient DMU's have an efficiency score of 1 and serve as a reference for inefficient DMU's, which have an efficiency score of less than 1, to become efficient [11]. In Figure 1, it is possible to see that DMU's A, B, and C are efficient and DMU's D and E are inefficient. DEA models have two orientations: input and output. Input-oriented models aim to minimize inputs with constant outputs. The output-oriented models seek to maximize the outputs with

constant inputs [12]. Chart 1 shows the model that will be used in this work.

Orientation: Input	
Configuration: Primal	$\begin{aligned} & \text{Max} \sum_{i=1}^m u_i y_{io} + u \\ \text{s. t.} & \sum_{i=1}^m u_i y_{ik} + u - \sum_{j=1}^n v_j x_{jk} \leq 0, k = 1, 2, \dots, z \\ & \sum_{j=1}^n v_j x_{jo} = 1 \\ & u_i, v_j \geq 0; i = 1, \dots, m; j = 1, \dots, n \end{aligned}$
Configuration: Dual	$\begin{aligned} & \text{Min } \theta \\ \text{s. t.} & \sum_{k=1}^z y_{ik} \cdot \lambda_k \geq y_{io} \\ & \sum_{j=1}^n x_{jk} \cdot \lambda_k - \theta \cdot x_{jo} \leq 0 \\ & \lambda_k e \theta \geq 0; i = 1, \dots, m; j = 1, \dots, n; \\ & k = 1, \dots, z \end{aligned}$
Orientation: Output	
Configuration: Primal	$\begin{aligned} & \text{Min} \sum_{j=1}^n v_j x_{jo} + v \\ \text{s. t.} & \sum_{i=1}^m u_i y_{ik} - v - \sum_{j=1}^n v_j x_{jk} \leq 0, k = 1, 2, \dots, z \\ & \sum_{j=1}^n u_i y_{io} = 1 \\ & u_i, v_j \geq 0; i = 1, \dots, m; j = 1, \dots, n \end{aligned}$
Configuration: Dual	$\begin{aligned} & \text{Max } \eta \\ \text{s. t.} & \sum_{k=1}^z x_{jk} \cdot \lambda_k \leq x_{jo} \\ & \sum_{j=1}^n y_{ik} \cdot \lambda_k - \eta \cdot y_{io} \geq 0 \\ & \lambda_k e \eta \geq 0; i = 1, \dots, m; j = 1, \dots, n; k = 1, \dots, z \end{aligned}$

Chart 1 – BCC model

The primal configuration calculates the utilities of the DMU, while the dual configuration calculates the goals for an inefficient DMU to become efficient and to identify the

efficient DMU's that will serve as a reference for the others [12].

b. Two-dimensional representation

Graphical representation has been used since the seminal work of Charnes, Cooper and Rhodes (1978), aiming to demonstrate the position of each DMU in relation to the established efficiency frontier. However, this representation was limited to situations of three variables, be they two inputs and one output, or one input and two outputs. This representation is a powerful tool for decision making, for visualizing DMU's that are outside the efficiency frontier and how to make it become efficient [13].

In a study proposed by Costa, Mello and Meza (2016), two-dimensional graphical representation would encompass multiple inputs and outputs, being possible for both CCR and BCC models. For the BCC model with output orientation, the application is made as follows, as described in Chart 2.

$$\begin{aligned}
 \text{Step 1: } & \text{Min } \frac{\sum_i v_i x_{io} + v_*}{\sum_r u_r y_{ro}} \\
 & \text{s.t. } \frac{\sum_i v_i x_{ij} + v_*}{\sum_r u_r y_{rj}} \geq 1, \forall_j \\
 & u_r \geq 0, v_i \geq 0, \forall_r, i, v_* \in R \\
 \text{Step 2: } & S_j = \sum u_{ij} \\
 \text{Step 3: } & v'_{*j} = \frac{v_* j}{S_j} \\
 \text{Step 4: } & I'_j = \sum_i v'_{ij} x_{ij} + v'_{*j} \\
 & O'_j = \sum_i u'_{rj} y_{rj} + u'_{*j}
 \end{aligned}$$

Chart 2 – Calculation of two-dimensional representation

In step 1 the problem to be solved is described. Step 2 comprises the sum of all the weights of outputs, since the problem used is output oriented. Step 3 concerns the normalization of the outputs. Finally, in step 4, the calculation of virtual inputs and outputs is performed and, later, the graph is plotted.

III. METHODOLOGY

The current research was carried out in some stages, as shown in Figure 2.

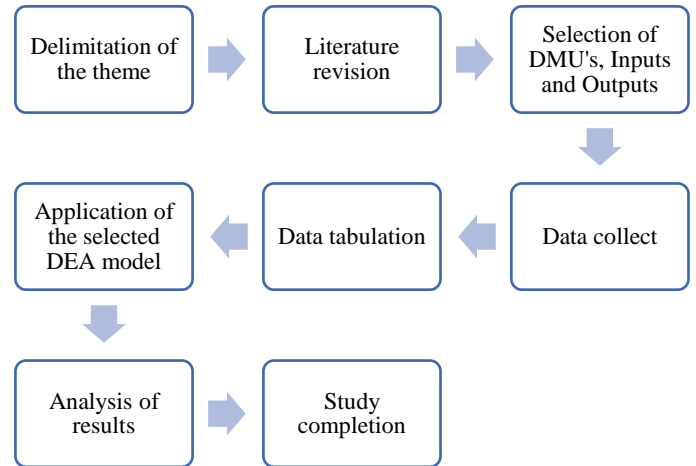


Fig.2: Research steps

The selected DMU's (engineering courses), as well as the inputs (number of entries and size of the faculty) and outputs (number of graduates and course concept) are demonstrated in the transformation model proposed in Figure 3.

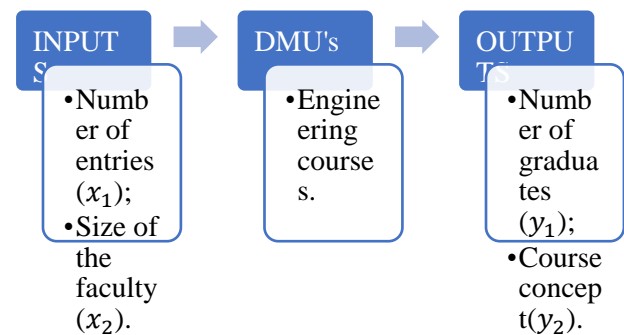


Fig.3: Transformation model

An application of the DEA technique was made, with the DMU's referring to the undergraduate courses in Engineering. All DMU's have the same inputs and outputs. Chart 3 shows the DMU's that will be used.

Acronym DMU	Course	Campus
DMU 2.1	Civil Engineering	C1
DMU 2.2	Civil Engineering	C2
DMU 2.3	Civil Engineering	C3
DMU 2.4	Civil Engineering	C4
DMU 2.5	Electrical Engineering	C1
DMU 2.6	Electrical Engineering	C3
DMU 2.7	Mechanical Engineering	C1

DMU 2.8	Mechanical Engineering	C3
DMU 2.9	Chemical Engineering	C1
DMU 2.10	Production Engineering	C1
DMU 2.11	Production Engineering	C2
DMU 2.12	Environmental and Sanitary Engineering	C4
DMU 2.13	Computer Engineering	C4

Chart 3 – DMU’s for undergraduate engineering courses

Later, after deciding which DMU’s, inputs and outputs would be available, it was possible to collect data. This collection was made on the institutional website of the University, where it was collected from the existing undergraduate courses on the institution’s campuses, the numbers of entries and graduates (from the years 2009 to 2019) and the size of the faculty, and, finally, the concept of the course was collected on the e-MEC website. Table 1 shows the data obtained.

Table 1 – Input and output variables

Acronym DMU	INPUTS		OUTPUTS	
	Number of entries (X_1)	Size of the faculty (X_2)	Number of graduates (Y_1)	Course concept (Y_2)
DMU 2.1	392	13	359	4
DMU 2.2	222	11	191	4
DMU 2.3	164	14	144	3
DMU 2.4	143	14	121	4
DMU 2.5	61	16	25	4
DMU 2.6	65	10	39	4
DMU 2.7	338	13	282	4
DMU 2.8	81	11	59	4
DMU 2.9	286	21	237	4
DMU 2.10	290	15	233	4
DMU 2.11	60	12	37	3
DMU 2.12	23	14	21	4
DMU 2.13	20	20	9	4

The tabulation of data was performed in the EXCEL software, in the form of tables for the best visualization of the collected data and subsequent interpretation. That done, it is possible to apply this information in the chosen model of the DEA. Therefore, for this purpose, the output-oriented DEA BCC model was selected. This choice was made based on the articles selected for reading in the literature review, in which most of the authors used these characteristics, using as a justification the fact that the undergraduate courses observed were of different sizes. With the application of the data in the DEA model, it will be finally possible to carry out the analysis of the results obtained and finalize the study with the conclusion about it.

IV. RESULTS

The central campus, here called C1, has 21 undergraduate courses in total, of which we can highlight the courses that are the focus of the study, Civil Engineering, Electrical Engineering, Mechanical Engineering, Chemical Engineering and Production Engineering. Campus C2 has 6 training courses, highlight Civil Engineering and Production Engineering. On campus C3, among the 7 undergraduate courses, Civil Engineering, Electrical Engineering and Mechanical Engineering stand out. Finally, campus C4 holds 7 courses, with emphasis on Civil Engineering, Environmental and Sanitary Engineering and Computer Engineering.

In this stage, 13 DMU’s referring to the engineering courses of the 4 campuses of the institution will be analyzed. Performing the application in the DEA model, the efficiencies of each DMU, its clearances and the benchmarks are obtained. In table 2, it will be possible to observe these data.

Table 2 – DMU’s efficiency and benchmarks

	Efficiency	Benchmark
DMU 2.1	1	2.1
DMU 2.2	1	2.2
DMU 2.3	0,9590	2.12
DMU 2.4	1	2.6
DMU 2.5	1	2.8
DMU 2.6	1	2.6
DMU 2.7	1	2.1
DMU 2.8	1	2.8
DMU 2.9	1	2.1
DMU 2.10	1	2.1

DMU 2.11	0,8231	2.12
DMU 2.12	1	2.12
DMU 2.13	1	2.13

According to the data obtained, it is possible to realize at the outset that DMU's 2.1, 2.2, 2.4, 2.5, 5.6, 2.7, 2.8, 2.9, 2.10, 2.12 and 2.13 are efficient. Some DMU's may have indicators that point them as efficient, but if they have clearances equal to 0, they are called as highly efficient, the opposite occurs when the clearances are different from 0, being negative or positive, these are called weakly efficient [14]. Table 3 shows the improvements that must be made to achieve efficiency.

Table 3 – Improvements to engineering courses

	Number of entries (x_1)	Size of the faculty (x_2)	Number of graduates (y_1)	Course concept (y_2)
2.1	0%	0%	0%	0%
2.2	0%	0%	0%	0%
2.3	0%	-3%	4%	33%
2.4	0%	-16%	0%	0%
2.5	0%	-13%	70%	0%
2.6	0%	0%	0%	0%
2.7	-8%	0%	0%	0%
2.8	0%	0%	0%	0%
2.9	0%	-52%	9%	0%
2.10	0%	-1%	13%	0%
2.11	0%	0%	21%	33%
2.12	0%	0%	0%	0%
2.13	0%	0%	0%	0%

Thus, it is possible to affirm that the DMU's that are highly efficient are 2.1, 2.2, 2.6, 2.8, 2.12 and 2.13, which correspond to the courses, respectively, of Civil Engineering at campus C1, Civil Engineering at campus C2, Electrical Engineering at campus C3, Mechanical Engineering on campus C3, Environmental and Sanitary Engineering on campus C4 and Computer Engineering on campus C4.

The units considered weakly efficient are DMU's 2.4, 2.5, 2.7, 2.9 and 2.10, which indicate, respectively, the Civil Engineering courses on campus C4, Electrical Engineering on campus C1, Mechanical Engineering on campus C1,

Chemical Engineering on campus C1 and Production Engineering at campus C1.

According to the clearances presented after the application of the model, it is possible to perceive the variables that need improvement. In the Civil Engineering course at campus C4 (DMU 2.4) there was a need to reduce the size of the faculty by 16%. While the Electrical Engineering course on campus C1 (DMU 2.5) requires a 13% reduction in the size of the faculty and an increase of 70% in the number of graduates.

Mechanical Engineering on campus C1 requires an 8% reduction in the number of incoming students. The Chemical Engineering course at campus C1 requires a 52% reduction in the size of the faculty and an increase of 9% in the number of graduates. Finally, the Production Engineering course at campus C1 needs a 1% reduction in the size of the faculty and a 13% increase in the number of graduates.

The units considered inefficient were DMU's 2.3 and 2.11, corresponding, respectively, to the Civil Engineering courses on campus C3 and Production Engineering on campus C2. To become efficient, the Civil Engineering course must reduce 3% of the faculty size, increase the number of graduates by 4% and extend the concept of the course by 33%. The Production Engineering course should expand 21% of the number of graduates and 33% of the course concept.

In view of these improvements presented, Table 4 shows the goals that the units must achieve. These goals are in line with the reduction or expansion improvements shown in the previous table.

Table 4 – Goals of engineering courses

	Number of entries (x_1)	Size of the faculty (x_2)	Number of graduates (y_1)	Course concept (y_2)
2.1	392	13	359	4
2.2	222	11	191	4
2.3	164	13,6	150,2	4
2.4	143	11,8	121	4
2.5	61	13,95	42,6	4
2.6	65	10	39	4
2.7	312,3	13	282	4
2.8	81	10,97	59	4
2.9	286	14,99	259,3	4

2.10	290	14,9	263,03	4
2.11	60	12	44,9	4
2.12	23	14	21	4
2.13	20	20	9	4

It is well known that DMU's 2.1, 2.2, 2.6, 2.8, 2.12 and 2.13 are highly efficient, as previously stated, and, for this reason, do not have goals to be achieved. However, DMU's that have shown themselves to be weak have goals. The Civil Engineering course on campus C4 (DMU 2.4) needs to decrease the faculty size from 14 to 12. The Electrical Engineering course on campus C1 (DMU 2.5) needs to reduce the faculty size from 16 to 14 and increase the number of graduates from 25 to 43. The Mechanical Engineering course on campus C1 (DMU 2.7) needs to reduce the number of incoming students from 338 to 312.

The Chemical Engineering course on campus C1 (DMU 2.9) should reduce the number of teachers from 31 to 15 and increase the number of trainees from 237 to 259. While the Production Engineering course on campus C1 (DMU 2.10), from according to the improvements, it needs to reduce the size of the faculty by 1%. However, as the percentage is very low, the reduction in numerical terms is significantly low, and the number of teachers should remain. In this same course, it is necessary to increase the number of graduates from 233 to 263.

The inefficient units previously seen are Civil Engineering on campus C3 and Production Engineering on campus C2. The first needs to reduce the size of the teaching staff by 3%, again it is a vary low percentage to interfere in numerical terms, keeping 14 teachers. The number of graduates should also be increased from 144 to 150 and the concept of the course should be increase the number of graduates from 37 to 45 and increase the concept of the course from 3 to 4.

Units that have presented goals to reduce the number of incoming students (2.7) and increase the number of graduates students (2.3, 2.5, 2.9, 2.10 and 2.11) must implement incentive policies for the increase of these graduates, thus, it will not be necessary to reduce the number of incoming students. As well as the units that need to increase the Course Concept, they must carry out incentive policies to increase the concept.

The two-dimensional representation of engineering courses is shown in Graph 1, shown below.



Graph 1 – Two-dimensional representation of engineering courses

In this graph it is possible to see that DMU's C and K, which correspond to DMU's 2.3 and 2.11, respectively, despite being close to the efficiency frontier, are not on top of it and, therefore, it is not considered efficient. The rest of the DMU's are on the frontier of efficiency, reaffirming what was said early and, with that, are considered efficient.

V. CONCLUSION

The evaluation of productive efficiency is an important factor in any enterprise, as it is possible to define the opportunities for improvement of an inefficient DMU in relation to an efficient one. A technique that allows the evaluation of efficiency is the Data Envelopment Analysis, created by Charnes, Cooper and Rhodes, in 1978, and its first use has already been directed to the educational field.

This work made use of this tool, evaluating the efficiency of Engineering courses at a Brazilian university. Four variables were used, two inputs and two outputs. In the analysis, 13 engineering courses were evaluated, highlighting 11 as efficient, of these 6 are highly efficient and 5 are weakly efficient, and 2 DMU's are inefficient.

It is worth emphasizing the importance of analyzing efficiency so that managers are aware of the improvements that can be implemented so that a weakly efficient and inefficient unit reaches efficiency. It is suggested, for future work, the application of other existing techniques to carry out a comparative analysis with the current one, in addition to this application of methodology in other educational institutions and future update of the data to analyze the evolution of the courses.

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Linguistics and anthropology: Language, phonemes and writing

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Abstract— *The aim of this article is to discuss, through a bibliographic review, studies from several decades that lead us to understand the close and unquestionable interaction between language, speech, phonemes and the acquisition of formal reading and writing in the Brazilian educational universe. Inspired by theories and scholars like Bergson, Burke, Santos, Titiev, Tolra, Porter, Levinas, Kendon, we investigate the maintenance of educational models that disregard the assumptions of anthropology and linguistics as bases for formal education, molding educational subjects with their characteristics social and linguistic, currently obscured and employed through imposing policies and in school-related divisions and in communicative processes also centered on the school, situations that favor the reproduction of educational, linguistic and social inequalities(Hymes, 1996). A reflection that can be interpreted and studied a lot about the reasons why we are stuck in education.*

Keywords— *Linguistics, Anthropology, Language, Writing.*

I. INTRODUCTION

Among the many theories raised, imagined about the origin of man, this organism constituted of a mass, whose substances condensed in its formation, we know

that they constitute H₂O in a greater proportion, with matter being a small portion that functions as structure, this made up of parts that encompasses almost the entire periodic table known from chemistry, which will sustain this liquid man.

Considering the age of the earth is about a few billion years, its appearance is estimated by an explosion called the Big Bang, which is in an expansion process, and in this process, matter is formed, formed by atoms, molecules, in the constitution of cells, are like a repository of the genetic information of each living being on the planet.

We could base ourselves on other theories, but the proposal is linked to anthropology and linguistics among the theorized aspects inconclusive until then, whose facets of the human being in which language skills builds bridges between cognitive, anthropological, social, mathematics, logic, philosophy and humanities.

II. ANTHROPOLOGY, LANGUAGE AND PHONEMAS

An instrument thus constituted among the linguistic concepts for understanding speech, style, gender, reducing the idealized conflicts of the metaphorical tower of babel, thus allowing communication, establishing speech as an effective means of communication for a better understanding, privilege of the human that the culture and the social were established.

Porter (1993) wrote:

[...] the language is so intimate with existence that it has long been neglected by historians, especially in the sense that little historical attention has been given to other "domestic truths" such as the body, its gestures and clothing, and the everyday objects that people surround themselves with. But thanks to the "new social history", interest in the phenomenology of everyday life and the meaning of things has increased. Such a state of renewed academic inquiry certainly applies to language (Burke & Porter, 1993, p. 13).

Emmanuel Levinas (1906-1995) was a French philosopher who was born in Lithuania, of Jewish origin, brings in his speech the themes:

As for the sensitivity linked to corporeality, it deals with sensation in consciousness, but in order to broaden the concept of subjectivity known until then, to include corporeality in it(Levinas, 2014).

To be continued:

Being the sensation that allows corporeality, it is not a product of the body, but because of the sensitivity of the body that incarnates, while being in the world and in relation to other beings. That through the sensation that we are discovering our relationship as an object through touching, savoring, seeing, feeling(Levinas, 2014).

Sensations, as well as perceptions, pass through the recognition of the body, the interaction of what represents your being, emotional factors of low esteem, inferiority complexes must be combated for the whole that composes such stages in the formation of being. Place them within the context of integration, overcome the meaning of insignificance, realizing their importance with the rescue of the dignity destroyed by the lack of merit. Mazelas inheriting a history in the construction of the population that permeates the collective unconscious in archetypal structures, passed as inheritances of the exile based on the marginal features of the first colonizers.

Each language has different sounds, limited by functional sounds. Their distinctions differ from each other within their meanings, which constitute their phonemes. Hence the importance of phonemes, their sound variations, as these are the makers of a language for its orthographic transcription, thus constituting phonology. What demonstrates that phonemes are the meaning for the beginning of learning for the speech and its sacramenting of symbols in writing, established by phonetics, classifying the sounds emitted by men in the constitution of their phonation organ, classified in two categories, that is, vowels and consonants (Tolra & Warnier, 1993, p. 322).

Linguistic Anthropology comes to demystify linguistic elitism, remembering the anthropological importance of origins in the formation of the phonological apparatus, bringing anatomy as a parameter in its formation, rescuing our descendants, mitigating importance that lead us to prejudices and intolerances. Objectives that in Linguistic Anthropology is to standardize, perform the use of language aiming at cultural, social, historical contributions in what requires the meaning of speech.

According to Henri Bergson (2014):

[...] it was thought that created language and conversely, language, once created, reacted on thought, became clearer, more precise, more capable of forming, retaining, and conserving abstract and general ideas(Bergson, 2014, p. 227).

Just as he replies that the sign is a name given to every phenomenon or object that is perceptible to the senses and that awakens in the spirit the idea of a fact or an object that the senses do not perceive.

Anthropological linguistics works for the knowledge of a language based on sounds to establish its phonology, as it will thus constitute its signs, symbols and its representations. We are left wondering how much in common there is between anthropologists, speech therapists and educators, discussions of the past that make possible valuable future dialogues (Gusmão, 1997). We must talk about the importance of the past for our controversial present, and for our future, who knows how to overcome stigmas and prejudices within a system of writing known to be alphabetical, which has its bases disrespected, a watershed - anthropology as science, speech language pathology and pedagogy as evidence-based practice.

“Oral language researchers demand first of all a means that allows them to record any sounds coming from articulated language that they hear. Only after being recorded in writing can its component parts be analyzed later and compared to other languages spoken by natives. It is observed that the comparative is a requirement for the notification of sounds, as well as the alphabetical learning process, the relationship between sounds and writing, a consequence of registration, which requires contact with the sensibilities of the listener or apprentice.” (Titiev, 1963, p. 323).

There is no way to prove the origin of language, as well as writing as old as humans, always went together, that is, language and human society, from the most remote origin of being. There are many explanations, first it is said that oral language came, the organic evolution linked to speech, always with the question of why this skill did not evolve in other species.

The language is a system of symbols, among several organizations, that involves phonetics (sounds), syntax (grammar) and semantics (meanings).

Despite being present to this day with its interlocutions, it brings within it the primary instinct of primitive memories that reminds us of its desires, desires, permeated within a psychic constitution based analogously between the conscious and unconscious, command

mechanisms of a system sympathetic and parasympathetic autonomous.

It takes us back to the embryonic development phase of our nervous system constituted until then, because we are subject to adaptations, mutations depending on the environment in which we live, which leads us to evolution and innovations as a means of survival.

The listening process goes beyond silence, as this does not exist, just like a body that speaks, through its gestures, movements, expressions, meanings, symbols, signs, that have been composing us over time, forming memories that are defined in that that we represent and are represented.

Whether we like it or not, we are heirs of a collective intelligence, whose periodic table represents the chemical elements that compose us. The knowledge we have acquired through our experiences is added today in translating what we are and what we need for our organic maintenance.

Which brings us to the formation of the brain, constituted its center in the cranial box, but branched by the whole body, like its neurons, in the most diverse purposes, functions that were architected throughout its temporal formation. Bearing something that consists of neural perceptions, in a relationship with the exterior, our visual, olfactory, auditory, gustatory devices developed, composing with the recognition of our skin as the largest organ of the human body, capturing sensations of the environment, being the skin until then only considered a protective coating with several layers of protection, whose hairs are sensory defenders of defense for humans.

It appears that the perception, sensation, begins to encompass concrete realities, leaving its subjectivity of yore, within its composition of qualitative neurons the perceptible, permeable and impervious in his first book the Project of a Psychology Freud (1886-1889). Creator of systems as interlocutor of the thought, empirically perceives that there is a pattern in speech, this in turn with meanings that over time has been translated into what he called interpretations, but, moreover, as an Archaeologist realizes that there are layers as depositions of materials that overlap by deposition, as a quantum of dammed energy, which are touched on in repressions and dreams. Therefore, a systematizer, encoder, systematizer of the thought, whose language is the gateway to such identification of its signs, symbolism and archetypes of archaic records.

Therefore, the more abstract the idea, that is, devoid of attribute, quality, the emptier it is to abstraction,

as well as the idea of being and its extension, since in this representation is represented as an idea of existence. Thus, being a child within the playful and its effort to reach the concrete, through abstractions to the concreteness of the real world.

That said, we move on to the constitution of the brain, its systems developed in an evolutionary process, today referring us out of a binary thinking of thinking, infinite probabilities of learning, thanks to the new segments of the sciences and their specializations, including Fono (sounds), Audi (capturing) Logos (knowledge), a window opens towards the possibilities of capturing, transmitting the differences presented that until recently, linked the bad formations as divine punishments.

As captors, emitters, transmitters, through our cognitions in relation to time and space giving meaning to our existence, the educational project is necessary for reforms, transformations, advanced methodologies so that we can overcome the absolutism of which we are prisoners. Among the diversities presented by researchers, everyone observes that we already bring genetic information from our ancestors, proven scientific evidence, whose stages are part of our human history, so language appears in another dimension, no longer repetition, animal imitation, for new ones. learning concepts that give opportunities to the different, within this line of "normality" imposed on the absolutism of things.

The senses are used in all their dimensions, that is, each one within their capacities of feeling, entering the world of forms, their architecture, geometry, warmth, perceptions refined in favor of the contact of learning, considering their symbols, signs with their etiologies and representations.

According to Santos (1959, p. 100), "our affective states, when communicated by rational means, become empty of life, because experience is excluded". Hence the symbolism from which it rescues in the learning process, leaving pragmatic mimicry.

In the view of Santos (1959, p. 89) "consciousness is more a result, and not a substance, being this a symbolic language of the unconscious". Visions based on the meanings of the symbolic ones of which the first civilizations did not differ from the current ones, which differentiates in distancing from ours that we lose the notion of symbolism, a tradition lost in time by the educational processes of the great mass. Starting from the premise that thought arises as a result of the evolution of our brain, hence the analogy with the symbolic, in turn the sounds, grunts, groans, use of what we call vowels,

appears to writing as a way to sacrament its signs and representations.

According to Santos (1959):

[...] we saw how the voices of the species are predominant, like the growling, mooing and hissing sounds to express a conceptual content, to which the words refer ... the word, which is a verbal sign, therefore also a conceptual sign it acquires a symbolic value, and it is this value that transforms it properly into a symbol, which means that the word, per se, is not a symbol, but only when covered by this symbolic value. The word being only concepts or sign, therefore a technical means of communication. (Santos, 1959, p. 98)

It concludes:

[...] it is so true, that we can build a set of arbitrary signs, with which we translate these contents, such as the language of the deaf and dumb, in which there is no reminiscence of verbal terms. (Santos, 1959, p. 98)

We observe the slowness of customs, cultures, which work contrary to the speed of thought, since it is only used to imitate, replicate and not think. Education is the master spring of all necessary evolution, the engine of change, of the centuries, as shown by the history of mankind.

Writing sacraments the phoned word. This, in turn, is the record, its materiality of meanings, signs, signs, symbols, sculpted in the form of art through the ages, which will constitute representations as records in our memories, provided by thought.

However, we continue to insist on preaching methods that are proven to be unfounded and ineffective by the international scientific community, a fact that has been very expensive for our education, for our children, for our future, whose reading and writing skills have been ranked among the last places in the International Student Assessment Program – PISA(Capovilla & Capovilla, 2010).

We are left with the reflection: What are the reasons that hamper our education as a whole?

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Prevalence of systemic arterial hypertension in users from a family health unit in northern Brazil

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Abstract— Objective: to determine the prevalence of systemic arterial hypertension in health users residing in micro areas covered by a Family Health Strategy in the North of Brazil. Method: Analytical, retrospective and transversal study of quantitative nature. Result: The sample consisted of 241 medical records of patients of both

sexes, 58.92% female and 41.08% male, so that the prevalence of SAH in the female population was significant. According to demographic and socioeconomic variables, the prevalence of SAH among men was significantly associated ($p < 0.05$) with marital status, education and occupation. The prevalence of SAH among women was significantly associated ($p < 0.05$) with marital status and education. However, from the PR calculations, it was found that the prevalence's were not significant, as verified by the 95% CI that included the value 1.0. The results indicated that the prevalence of SAH, in the FHS of Parque Amazônico I, was higher among women, aged 60 or over, with low education, sedentary and with low purchasing power. Conclusion: The results of the research in question show that the occurrence of SAH is more prevalent in females, in individuals over 60 years, who have less education and who do not perform any type of professional activity. The most prevalent associated factors in this research are physical inactivity, obesity and smoking. The most prevalent chronic morbidities reported are Chronic Kidney Disease in men and Coronary Artery Disease in women.

Keywords— Hypertension, Public Health, Epidemiology and Biostatistics.

I. INTRODUCTION

Systemic arterial hypertension (SAH) is a chronic-degenerative disease of multifactorial character, most of the time asymptomatic and with slow and progressive evolution. It compromises the balance of the vasodilator and vasoconstrictor systems, increases pressure in blood vessels and can cause damage to noble organs such as the heart, brain, kidneys and eyes. It can also cause complications like stroke, heart failure and kidney failure¹.

According to the criteria for the diagnosis of arterial hypertension of the Brazilian Society of Hypertension (SBH), it is considered hypertension when blood pressure levels are greater than or equal to 140/90mmHg, without previous use of antihypertensives². In addition, this disease causes approximately 7,1 million deaths each year worldwide. Estimates from the past few years show that 1,400 million people suffer from the disease, of which only 14% can control it³.

In 2000, the prevalence of SAH in the world population was 25% and the estimate for the year 2025 is 29%⁴. For the Family Health Strategy (FHS), the frequency of control ranged from 30% to 53.9%, these rates among the elderly are worse, ranging from 27% to 44.6%⁵.

In this context, this study aims to determine the prevalence of systemic arterial hypertension in health users residing in micro areas covered by a Family Health Strategy in the North of Brazil.

II. METHOD

Analytical, retrospective and cross-sectional study of a quantitative nature carried out in a FHS of Parque Amazônico I, located in the Terra Firme neighborhood, municipality of Belém do Pará, northern Brazil.

The sample universe consists of all patients monitored by the Hypertension and Diabetics Program (HIPERDIA) and residents in the areas covered by the FHS of Parque Amazônico I, corresponding to 538 health users diagnosed with hypertension and diabetes. The population sample included in this research was 241 users diagnosed with SAH, according to the scheduling worksheets, used in this service to monitor and schedule the return of hypertensive patients.

Patients diagnosed with SAH registered and followed up by the HIPERDIA program, regardless of gender, in the age group 18 to 79 years were included. Patients who abandoned the program, died, medical records with incomplete data, change of address and patients who presented only diabetes were excluded.

The statistical treatment sought to identify, by means of absolute and relative frequencies, if the data converge to any differential or if there is a trend in the distribution of these data. The comparisons between the distributions of the variables were made using the chi-square test of trend/adherence, symbolized by the χ^2 , because this test is a hypothesis that is intended to verify whether there is a trend or not in the distribution of the nominal variables and ordinals⁶, for this, a significance level of p-value < 0.05 was adopted.

Statistical analyzes were performed using the Bioestat 5.4 program. To verify the association between the dependent variable (systemic arterial hypertension) and the independent variables of the study, that is, the prevalence ratios (PR) were estimated with respective 95% confidence intervals (95% CI).

Data collection took place between the months of August and October of the year 2016, through a careful analysis of the medical records of the selected patients, according to surveys carried out in the patient care records registered in the HIPERDIA program. A form containing

sociodemographic data was used to organize the data, containing the following study variables: sociodemographic (gender, age group, marital status), socioeconomic (education, monthly income, occupational activity), health-related behaviors (alcoholism, smoking, physical activity) and number of chronic morbidities reported.

The research was submitted to and approved by the Research Ethics Committee of the Institute of Health Sciences of the Federal University of Pará (CAAE: 56846016.5.0000.0018), according to resolution 4.66/2012 of the National Health Council of Ministry of Health. This resolution incorporates, from the perspective of the individual and the communities, the four basic references of bioethics: autonomy, non-maleficence, beneficence and justice, aiming to guarantee the rights and duties that concern the scientific community, the research subjects and the study.

III. RESULTS

The sample consisted of 241 medical records of patients of both sexes, 58.92% female and 41.08% male, so that the prevalence of SAH in the female population was significant. Most patients were 60 years of age or older, that is, there was a 95% probability that most patients were 60 years of age or older. It was found that the proportion of married people was higher, but not significant. Elementary education was the level of education, significantly, predominant among patients.

As for monthly income, it is observed that 17.01% of patients received up to 1 minimum wage, but this trend was not significant. Regarding the occupational situation of the patients, it was observed that the highest frequency of patients aged 60 years or older received government resources, but there was a significant predominance of two other categories: self-employed and paid, as shown in Table 1.

Table 1 – Sociodemographic and socioeconomic characteristics of hypertensive men and women registered at the FHS of Parque Amazônico I, Belém, PA, 2016.

Variables	N	%	P-Value ⁽¹⁾
Sex			
Feminine	142	58,92	0.0056*
Male	99	41,08	
Age Range			
18-29	0	0,00	<0.0001*
30-59	97	40,25	
≥60	144	59,75	
Marital Status			
Not married	18	7,47	0.1622
Married	49	20,33	
Separate	21	8,71	
Widower	38	15,77	
Not mentioned	115	47,72	
Education			
Illiterate	25	10,37	<0.0001*
Elementary School	78	32,37	
High school	18	7,47	
University education	3	1,24	
Not mentioned	117	48,55	
Monthly Income			

Variables	N	%	P-Value ⁽¹⁾
Up to 1 minimum wage	41	17,01	0.1176
> 1 salary	28	11,62	
Not mentioned	172	71,37	
Occupational Activity			
Employee	32	13,28	0.0048*
Unemployed	13	5,39	
Self-employed	35	14,52	
Self-employed	38	15,77	
Not mentioned	123	51,04	

Source: Research protocol (2016).

⁽¹⁾Pearson's Chi-square test for trend. (P-Value <0.05).

*The proportions differ significantly.

According to demographic and socioeconomic variables, the prevalence of SAH among men was significantly associated (p<0.05) with marital status, education and occupation. The prevalence of SAH among women was significantly associated (p<0.05) with marital status and education, as shown in Table 2. However, from the PR calculations, it was found that the prevalence's were not significant, as seen by the 95% CI that included the value 1.0.

Regarding marital status, it was observed that separated men had a higher prevalence in relation to singles. It was found that separated women had a lower prevalence compared to single women. Regarding education, men with higher education had a lower prevalence compared to illiterates, and women with elementary education had a lower prevalence compared to illiterates (Table 2).

Regarding the occupation variable, it was observed that self-employed men had a lower prevalence of hypertension compared to the unemployed. There was no significant association between the prevalence of hypertension among women with an occupational category. However, it was observed that employed women had a lower prevalence of hypertension compared to unemployed women.

It is noteworthy that among men, the frequency of SAH was associated with married (45%), elementary school (62%), employees (33.93%), in addition to those who received help (33.93%). Among women, the prevalence of SAH was associated with married women (36.05%), widows (36.05%) and primary education (63.51%), as shown in Table 2.

Table 2 – Estimates of the prevalence ratio for arterial hypertension in men and women, according to socio-demographic and socioeconomic variables, Belém, PA, 2016.

Variable	Men			Women		
	N (%)	p ⁽¹⁾	PR (IC 95%)	N (%)	p ⁽¹⁾	PR (IC 95%)
Marital Status		0.0293*			0.0008*	
Not married	6 (15,00)		1,00	12 (13,95)		1,00
Married	18 (45,00)		1.10 (0.37 - 3.21)	31 (36,05)		0.94 (0.40 - 2.23)
Widower	7 (17,50)		0.55 (0.16 - 1.88)	31 (36,05)		1.22 (0.51 - 2.92)
Separate	9 (22,50)		1.28 (0.38 - 4.31)	12 (13,95)		0.85 (0.30 - 2.37)
Education		<0.0001*			<0.0001*	
Illiterate	11 (22,00)		1,00	14 (18,92)		1,00
Primary school	31 (62,00)		0.90 (0.39 - 2.05)	47 (63,51)		1.07 (0.50 - 2.27)
High school	7 (14,00)		0.88 (0.28 - 2.72)	11 (14,86)		1.09 (0.40 - 2.95)

Variable	Men			Women		
	N (%)	p ⁽¹⁾	PR (IC 95%)	N (%)	p ⁽¹⁾	PR (IC 95%)
University education	1 (2,00)		0.75 (0.07 - 8.11)	2 (2,70)		1.19 (0.17 - 8.00)
Occupation		0.0065*			0.2921	
Employee	19 (33,93)		2.57 (0.64 - 10.20)	13 (20,63)		0.48 (0.17 - 1.34)
Unemployed	3 (5,36)		1,00	11 (17,46)		1,00
Self employed	15 (26,79)		1.85 (0.46 - 7.48)	20 (31,75)		0.67 (0.25 - 1.78)
Aid	19 (33,93)		2.16 (0.55 - 8.53)	19 (30,16)		0.59 (0.22 - 1.56)

Source: Research protocol (2016).

⁽¹⁾Pearson's Chi-square test for trend. (p-value <0.05).

*There is a trend between the proportions.

N: absolute number; PR: prevalence ratio; 95% CI: 95% confidence interval.

In both men and women, it was observed that the factors associated with SAH and Referred Chronic Morbidities were relevant (p <0.05). PR was calculated for the factors associated with SAH in men and it was found that the prevalence of SAH is not relevant, seen by the 95% CIs that include the value 1.0, except in the case of men with a sedentary lifestyle, which has a lower prevalence of SAH in relation to men who consume alcohol (table 3).

Among women, PR was calculated for factors associated with SAH and it was found that prevalence's are relevant among obese women and among sedentary women, as seen by 95% CIs that do not include the value 1.0. Therefore, these women are about three times more likely to have SAH. Smoking women had a lower prevalence of SAH compared to women who consume alcohol (Table 3).

In addition, a PR was calculated for Chronic Morbidities in men and it was found that the prevalence is nonspecific, as verified by the 95% CI, which includes the value 1.0. Men with Diabetes Mellitus (DM) and with a lower prevalence of SAH compared to men with stroke, the PR was in Chronic Kidney Disease (CKD), as shown in Table 3.

For women, PR was calculated to identify Chronic Morbidities, it was found that the prevalence is not significant, seen by the 95% CI that includes the value 1.0. Women with CKD had a lower prevalence of SAH compared to women with stroke. In addition, it was observed that DM is the most frequent in both men and women, as shown in Table 3.

Table 3 – Estimates of the prevalence ratio of arterial hypertension, in men and women, according to variable factors associated with SAH and referred chronic morbidity, registered at the FHS of Parque Amazônico I, Belém, PA, 2016.

Variable	Men			Women		
	N (%*)	Value p ⁽¹⁾	PR (CI 95%)	N (%*)	Value p ⁽¹⁾	PR (CI 95%)
Factors associated with SAH		0.0007*			<0.0001*	
Alcoholism	19 (19,59)		1,00	5 (4,59)		1,00
Obesity	15 (15,46)		0.47 (0.20 - 1.10)	25 (22,94)		3.00 (1.01 - 8.88)
Smoke	25 (25,77)		0.80 (0.36 - 1.77)	14 (12,84)		1.72 (0.55 - 5.39)
Hyper Sodium diet	13 (13,40)		0.54 (0.22 - 1.32)	17 (15,60)		2.72 (0.87 - 8.44)
Sedentary lifestyle	23 (23,71)		0.42 (0.19 - 0.90)	46 (42,20)		3.20 (1.13 - 8.99)
Others	2 (2,06)		0.63 (0.10 - 3.82)	2 (1,83)		2.40 (0.34 - 16.89)
Referred Chronic		<0.0001*			<0.0001*	

Variable	Men			Women		
	N (%*)	Value p ⁽¹⁾	PR (CI 95%)	N (%*)	Value p ⁽¹⁾	PR (CI 95%)
Morbidity						
Stroke	19 (19,59)		1,00	13 (11,93)		1,00
PAD/CAD	0 (0,00)		-	3 (2,75)		2.46 (0.43 - 13.81)
HF	2 (2,06)		0.84 (0.14 - 5.04)	2 (1,83)		1.23 (0.20 - 7.56)
AMI	14 (14,43)		1.07 (0.44 - 2.57)	8 (7,34)		0.89 (0.31 - 2.51)
CKD	3 (3,09)		1.26 (0.25 - 6.26)	1 (0,92)		0.61 (0.06 - 6.04)
DM	23 (23,71)		0.59 (0.28 - 1.24)	42 (38,53)		1.59 (0.74 - 3.37)

Source: Research protocol (2016).

⁽¹⁾Pearson's chi-square test for trend. (p-value <0.05).

*There is a trend between the proportions.

N: absolute number; PR: prevalence ratio; 95% CI: 95% confidence interval.

Note: Cerebrovascular accident (stroke); Peripheral Arterial Disease (PAD) or Coronary Artery Disease (CAD); Heart failure (HF); Acute Myocardial Infarction (AMI); Chronic Kidney Disease (CKD); Diabetes Mellitus (DM).

IV. DISCUSSION

The results indicated that the prevalence of SAH, in the FHS of Parque Amazônico I, was higher among women, aged 60 or over, with low education, sedentary and with low purchasing power. Similar findings were observed in the National Health Survey, highlighting that the prevalence of SAH in the FHS is predominant among women with socioeconomic difficulties⁷.

Despite the prevalence of SAH among women, an observational and analytical study showed that among patients with SAH, women were more controlled than men, especially younger women, with shorter illness time, who knew the importance of practitioners exercise, with less interruption of treatment, who took the medication at the right time and who received less antihypertensive medication⁸.

In women, the level of blood pressure can be influenced by situations such as the use of contraceptives, polycystic ovary syndrome, pregnancy, hormone replacement and menopause, situations that can lead to a significant increase in blood pressure and the development of SAH. Despite this information, the mechanisms responsible for the differences in pressure regulation between the sexes are not yet fully understood, but they may be involved with the effects of sex hormones in the manipulation of sodium by the renal system⁹.

Other situations may justify this increase in blood pressure in women, such as insertion in the domestic and professional universe. The level of female stress has been

increasing due to the greater participation of women in the labor market, leading to an overload of professional demands with household chores, which may explain the higher levels of stress in women when compared to men, being an important factor for increase blood pressure¹⁰.

In conducting this research, the age group variable showed an association statistically related to SAH in which he is over 60 years old, findings that corroborate data from the World Health Organization¹¹. In continuity, a cross-sectional study with data from the National Health Survey, carried out with 10,211 participants aged 60 or over, found a prevalence of SAH of 66.7%, mainly in women aged 70 or over, with one or more chronic diseases, with overweight and with high waist circumference¹².

In a review of the panorama of hypertension control in Brazil, in population-based studies, the rate varies from 10% to 57.6%. For the FHS, the frequency of control ranged from 30% to 53.9%, and for the elderly, worse rates were observed, ranging from 27% to 44.6%⁵. This estimate leads us to consider that the elderly population has a greater chance of manifesting SAH, compared to the other age groups, according to what the research hypothesis describes.

The present study shows that the education of men and women greatly influences the occurrence of the disease. Thus, among the markers of socioeconomic level, education is the one that best correlates with the frequency and intensity of cardiovascular risk factors¹⁰.

In continuity, it is observed that men with higher education and women with less education have a prevalence of acquiring the reduced disease when compared to the illiterate. Thus, regarding the level of education, the data are similar to the research carried out in a Family Health Unit in Campina Grande, Brazil, where a significant number of hypertensive users (61.2%) with up to five years of schooling were observed, in addition to the fact that the low level of education of the elderly represents high levels of vulnerability to other diseases and infections¹³.

Regarding occupational activity, it was observed in this research that the prevalence of SAH is high in men who work, a situation that suggests that SAH is more prevalent in people who perform some type of occupational activity. Therefore, Braga¹⁴ reports that the highest prevalence of SAH has been observed among unskilled workers, with lower pay and belonging to the secondary and tertiary sectors of the economy.

In addition, another survey compared women, economically active and inactive, and revealed that in the municipality of João Pessoa and Campina Grande, 68% and 67.2%, respectively, of active women had SAH. Among economically inactive women, this percentage was higher with 75.6% in João Pessoa and 81% in Campina Grande¹⁵. Based on these findings, it is highlighted that the domestic stress transmitted by domestic activities, the obligation to care for children, emotional distress due to lack of income and submission to the husband can cause changes in the patterns of the sociodemographic profile of the hypertensive women analyzed.

Another significant variable in the present study was sedentary lifestyle, which is related to a higher prevalence of the disease in both sexes, in this case, the trend among women with a sedentary lifestyle was more likely to present SAH compared to men. Like these findings, other studies revealed that more than 50% of hypertensive individuals did not practice physical exercises, but among them, a study showed the prevalence of sedentary lifestyle among women, with a percentage of 57.5%¹⁶. In addition, this research showed that physical inactivity is the factor that influences survival in hypertension among men, although smoking is more prevalent, as highlighted by a study conducted in Paraná, in which the association avoided and previously dissipated with SAH¹⁷.

In addition, in a study that evaluated the profile of users of three basic health units in southern Brazil, overweight and obesity were present in more than 70% of hypertensive patients, but without distinction between genders¹⁸. The relationship between weight gain and SAH

is directly proportional, that is, the excess of body fat represents the largest single factor related to the elevation of blood pressure¹⁹. In addition, weight gain results in increased sympathetic activity, insulin resistance and hyperinsulinemia. At the renal level, hyperinsulinemia promotes tubular reabsorption of sodium and water and, consequently, vasoconstriction and hypertension²⁰.

This research showed that, among the chronic comorbidities mentioned, Diabetes Mellitus is more frequent in men and women with SAH. The possibility of an association between arterial hypertension and diabetes mellitus is around 50%. Therefore, this condition requires the management of both diseases in the same user, aggravated by the fact that their concomitance potentiates micro and macrovascular damage, causing high cardiac, cerebral and vascular morbidity²⁰.

Kidney disease is associated with hypertension and can worsen kidney dysfunction, in which case, hypertension can take on both the underlying cause and complication of the disease. In the past decade, the incidence of kidney disease attributed to SAH has increased significantly. Therefore, it is evident that strict control of arterial hypertension is important to minimize the progression of CKD, in addition to helping to reduce the risk of cardiovascular diseases frequently associated²¹.

In this sense, without proper identification and treatment, there is a great chance that SAH will maintain its role as an important cause of CKD. Among the factors that can collaborate to increase the incidence of hypertension as a cause of CKD, the following stand out: aspects associated with population aging, increased life expectancy of the population at each age, higher incidence and prevalence of SAH in the elderly population and the increase the average age of patients who start treatment²².

In addition, this research found an important association between SAH and the risk of coronary heart disease among the patients surveyed. These findings are similar to a meta-analysis carried out from 61 studies with more than 1 million adults, in which it was found that patients who had a 20 mmHg increase in systolic blood pressure and 10 mmHg in diastolic risk, the risks fatal episodes related to coronary heart disease were twice as high²³. In addition, in the study by Brunori et al²⁴, it was observed that SAH is an important predictor of coronary risk. Therefore, these findings corroborate studies that claim that arterial hypertension represents the greatest independent risk factor for the development of coronary artery disease²⁵.

V. CONCLUSION

The results of the research in question show that the occurrence of SAH is more prevalent in females, in individuals over 60 years, who have less education and who do not perform any type of professional activity. The most prevalent associated factors in this research are physical inactivity, obesity and smoking. The most prevalent chronic morbidities reported are Chronic Kidney Disease in men and Coronary Artery Disease in women.

In this context, health professionals who follow the HIPERDIA program must know and be trained with these modifiable and influential risk factors for the occurrence of the disease. Non-drug treatment should be valued and included in the routine of these professionals, who must also address strategies for this population to adopt these habits. The proposition of strategies must contemplate the local reality, and it is essential that the health team creates a bond so that there is an extension of care. Professionals should also be supported by health management, to assess local and state needs, to reduce the incidence of the disease.

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Theory of Creative Destruction and Economic Development: a discussion from the perspective of entrepreneurship and sustainable development

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Abstract— *The purpose of this article is to confront the assumptions of the Theory of Creative Destruction, formulated by Joseph Alois Schumpeter in the book Socialism, Capitalism and Democracy, in 1942, with the current stage of entrepreneurial entrepreneurship and development in postmodern society, where globalization of the economy and neoliberalism guide the market and the entire world production system. The basis of the analysis was the book mentioned, however, other theorists who discuss the subject were consulted and served as a subsidy for the conclusion reached about the current theory of the object of the study. The concept of development elaborated by the author does not find support in the formulations of contemporary theorists, for whom planning is a primary step in conducting a company in search of profit.*

Keywords— *Globalization. Neoliberalism. Economic Development.*

I. INTRODUCTION

The Theory of Creative Destruction, also called Creative Destruction, was formulated by the Austrian economist and lawyer Joseph Alois Schumpeter, in his book *Socialism, Capitalism and Democracy* (1942), to explain the contradictions of capitalism in a dynamic and constantly evolving society. The phenomenon of creative destruction occurs when entrepreneurs create new products or new ways of producing, transforming the economy. In this process, promising professions often disappear and, as a consequence, successful professionals temporarily leave the market; having to adapt to the new reality, seeking a new occupation; lose the status previously achieved, and may never again enjoy the prosperity they had. Capitalism generates both pain and pleasure. Pain for those who lose with new technologies and pleasure for those who win with innovations.

This retrospective presented here demonstrates, in practice, the author's statement: before electricity, the manufacturers of candles, chandeliers, lamps and torches, were very successful professionals, because they placed on the market products that were requested by the entire population. With the invention of the incandescent lamp, these props lost their functionality for most users and the future of these entrepreneurs started to be defined by the way each one reacted after the innovation that emerged. On the other hand, the providers of this innovative service, started to have the prosperity deserved, by the population's adherence to this technology.

Tailors and seamstresses have already enjoyed prestige in making the garments that attributed identity, prominence and power to the users of their services. With the pret-a-porter industry, that is, ready-made clothes offered in fashion magazines a competitive prices, these

professionals practically disappeared from the market, having to seek new occupations to survive. The exception, in this case, is for those celebrated in haute couture, whose services are aimed at millionaires who pay very dearly for the exclusivity of the clothing they wear, in events for the few.

Manufacturers of typewriters, manual and or electric, until the middle of the 20th century, occupied an exceptional economic position in the market, in view of the demand for their products. With the advent of the computer, these machines became obsolete and their manufacturers had to adapt to a new concept of production. The same happened with cabinetmakers, after the furniture industry proliferated; with blacksmiths, after the paved roads were occupied by public transport, trucks and passenger cars, instead of trains, at least here in Brazil, where the railways were practically eliminated.

However, not everything is smooth for innovators. Regulatory policies instituted by governments can often create obstacles for certain innovations to reach the market, under the allegation of having to protect what already exists and, in this perspective, economic and political power contribute to the prevalence of backwardness, without consider that such attitudes can also discourage the emergence of new innovation agents.

When addressing the subject, the philosopher and political activist Mikhail Bakunin, quoted by Cordeiro (2011), also argued, that the destructive force of the old is the creative force of the new "to destroy passion is a creative passion".

Distance learning, previously considered to be of the second category, today with the restrictions imposed by COVID 19 on agglomerations and social interaction, tends to replace classroom teaching on a large scale. Some

die to give life to others, who better meet the requirements of society. This is what Schumpeter called Creative Destruction, the essential fact of capitalism, with the innovative entrepreneur as its central protagonist. For him, innovation occurs in the following cases:

- In the introduction of a new good.
- In the introduction of a new method of production or commercialization of the existing assets.
- Opening new markets.
- Conquering a new source of raw materials.
- Breaking a monopoly.

Contemporary economists add to this list an essential element of the innovation economy, which is credit. Without financial innovation, there are no innovative initiatives and, therefore, there is no wealth and employment.

The theme of creative destruction, and the importance it has been playing in the economy, can be explained by the dynamics and the need to develop key sectors to accompany economic growth, such as the logistics sector that is associated with the production flow infrastructure and viability of transactions, as well as, the commerce sector that increasingly includes transactions that arise with globalization itself and the tertiary sector of the economy, strongly driven by urbanization, from the second half of the 20th century.

The globalization and “multinationalization” of capital has given rise to a network of relations linked to the productive sectors of countries that must be synchronized with the dynamics of other nations. These networks of relationships are directly linked to the tertiary sector of the economy because they add the nascent needs of the industrial development itself: financial market, more specialized labor market, technological development, etc. (BIANCO and COLBARI, 2003).

Like the theory he created, Schumpeter was also a controversial figure. Born in the extinct Austro-Hungarian Empire, first half of the century. XIX, he is considered one of the most important economists in history, mainly for his contributions in the theory of economic growth, democracy, business strategies and economic history. His greatest dream in youth was to create the “Exact Economy”, with sufficient scientific rigor to resemble physics, but at the end of his life he convinced himself that it was impossible.

Fluent in five classic and modern languages, with refined manners, promiscuous habits and extravagant tastes, acquired in the aristocratic society he frequented. Even though she did not have financial resources, after

graduating in Law at the University of Vienna in 1904 and having many difficulties to establish herself in the profession, she decided to go and try life in London, where she married Gladys Ricarde-Seaves, a young woman from aristocracy, but older and totally bankrupt, which caused astonishment among the acquaintances, given his reputation as a self-interested conqueror (NASAR, 2012). There, at the age of 25, in 1908, he published his first great work: "The Nature and Essence of the National Economy Theory" and four years later, his famous theory of "Economic Development". Both established their importance as an economics theorist. He worked compulsively, but he knew how to appreciate bohemian life. He was a contemporary of another important economist, Alfred Marshall, (1997), whose main theory was that nature did not leap, reaffirming the need for continuous improvement of procedures, which valued the role of administrators and technicians, unlike him who valued innovative leaps, unexpected and non-linear, for believing that capitalism should be studied from the perspective of productivity and growth, being the maximum expression of innovation, human struggle and pure / simple destruction - all this at the same time (SCHUMPETER, 1942).

He did not take long and returned with his wife to Vienna, where he took up the chair of Anthropology at the University. Accustomed to social coexistence in refined environments, what he gained from classes did not allow him that luxury, he decided to move to Cairo, where he was a lawyer before the Egyptian International Mixed Court and served as finance advisor to an Egyptian princess, staying there until 1909, when he returned to Vienna, to be professor of anthropology once again. There he remained until 1911, when he moved to the University of Graz, capital of the province of Styria, to be a professor of economics, staying there until 1918. At that university he gained a lot of antipathy from his colleagues, for his long-suffering and superior air with which he was treated. . From there, he went to Columbia University (DA COSTA, 1982).

Moving away from teaching in 1919, Schumpeter held the position of Minister of Finance for Austria for ten months, and then became president of a bank in Vienna, which went bankrupt in 1924, causing him to lose all his savings to pay off the bank's debts, for having refused to take advantage of his country's Bankruptcy Law, which could free him from this loss. Without resources, he returned to university life, accepting an invitation from the University of Bonn, Germany, to teach. Before leaving, he married Annie Reisinger, who died in childbirth one year after the wedding (DA COSTA, 1982). He didn't stay long in Bonn. Between 1927 and 1931 he taught at Columbia University and, in 1932, he left the University of Bonn and settled,

definitively, in the United States, in Cambridge, where he remarried Elizabeth Boody, also an economist, with whom he lived until the end. of his life, which took place on January 8, 1950 (DA COSTA, 1982).

Although he was a convinced capitalist and disagreed with Karl Marx's ideas, especially with regard to the theory of value - work, he considered him a brilliant, superior mind, a true genius, as explained in the book *Capitalism, Socialism and Democracy*, hence the economist Paul Samuelson (1982), claim that there were many Schumpeter: the thinker; the lawyer; the horse breeder; the Austrian Minister of Finance; the social philosopher; the

prophet of capitalist development; the economics theorist; the professor of anthropology and economics.

II. SCHUMPETERIAN DEVELOPMENT X SUSTAINABLE DEVELOPMENT

In the view of SCHUMPETER, development does not occur as a result of strategic planning, but because of a break in routine, spontaneous and discontinuous change, capable of breaking the balance, establishing a “new normal” in the life of companies, whose driving force , regardless of its size is the entrepreneur.



Fig.1: Schumpeter waves

The entrepreneurship that Schumpeter talks about is the entrepreneurial, corporate, which can be defined as being a process of identification, development, capture and implementation of new business opportunities, within an existing company. To this end, the company, before making available to the employee or group of them, the author (s) of the innovation proposal, or process transformation, analyzes the following factors: the opportunity; the resources that the organization has and that will be allocated for the exploration of the identified opportunity; and the people, the team that will put all this into practice, that is, corporate entrepreneurs, with the perspective of ensuring that the initiative is successful, bringing the expected benefits to the organization, but also, admitting the possibility of some risk.

By encouraging its employees with these practices, it is necessary to reward them with cash prizes, promotion, study trips and other forms, in order to make them feel motivated to overcome the institutional challenges that are: business competitiveness; the search for competitive differentials; beat the competition; win

customers; and achieving the profitability and productivity necessary to maintain the enterprise, which is not an easy task, because, as a rule, it is difficult for salaried employees to feel the company as their own, no matter how much they enjoy their work and feel valued there.

Unlike this model, social entrepreneurship is based on partnerships, where common interests manifested by the state, social organizations and the community are fused, whose desired end result is the promotion of the social, cultural, economic and environmental quality of life of a given population , from the perspective of sustainability. In this process, the initial idea is to identify a problem that is negatively impacting the population and the search for efficient and effective solutions, capable of generating direct and indirect benefits for the greatest number of people affected, in addition to causing significant changes in the social structure , bringing learning to the entire population involved.

While in entrepreneurial entrepreneurship the focus is on profit, in social entrepreneurship, the main axis is the community, with the preservation of its culture;

introduction and practice of new forms of social insertion; encouraging the adoption of responsible and ethical behaviors; and self-generation of income and work, valuing cooperation over competitiveness; the collective commitment, instead of each one for himself and God for all; training instead of improvisation, social responsibility to all; solidarity and concern for the other; promoting partnerships with social organizations and local governments; the preparation of community agents to act as subjects of development. The social entrepreneur subordinates the economic to the human, the individual to the collective and carries with it a great dream of transforming the current reality.

The differences between corporate and social entrepreneurship is that, while the latter is concerned with improving the company's image and working within established medium and long term rules, strictly following the bureaucracy established with the objective of generating wealth, social entrepreneurship it is concerned with solving social problems and is not directed to the market, but to population segments in situations of social risk (poverty, misery, exclusion, risk of life, unsustainable housing, illness, etc.).

Social entrepreneurs give social problems the same treatment that entrepreneurial entrepreneurs give to businesses, however, their ideas, concepts, methodologies, are collective domain and should be multiplied and adopted in other contexts, while businesspeople keep such information with certain secrecy, as they are considered the soul of the business.

The impacts of business ventures are measured, quantified and priced, according to the profits obtained. The impacts of social enterprises, on the other hand, are not monetized, but are measured according to the benefits brought to the populations involved in them, with their social and economic inclusion, being the protagonists of their transformation. They are, therefore, two different logics.

Likewise, the concept of development thought by Schumpeter, has undergone many variations among the theorists of the subject, being even in dispute, given the multiple understandings about its meaning.

For Kindleberger and Herrick (1997), economic development implies an increase in production accompanied by changes in technical and institutional provisions, in productive structures and in the allocation of inputs by different sectors of production. However, although development leads to an increase in the quantity of goods and services, this does not mean that there is a concern with the satisfaction of the individual. The need for development is much more linked to the objectives of

companies than to the interest in serving human beings. This thought is contained in the propositions of Keynes and Marx (1937; 1938), especially because, according to Johnson (1997), the individual efforts of businessmen to do good, will increase their production costs, making them losers in the race of competition, unless all its competitors are equally concerned with social welfare. In this traditional concept of a company, it is an entity instituted by the shareholders to obtain profits, being, therefore, their equity.

The concept of sustainable development - understood as one that meets the needs of present generations, without compromising the ability of future generations to meet their own needs - was popularized by the Brundtland Report, and has really become an item on the international agenda since the ECO 92; the issue of her environmental protection had been on the agenda since the late 1960s.

Guiding concept of the United Nations Conference on Environment and Development (UNCED in English, but better known as ECO 92, or Rio 92), was defined in 1989. Seen by some authors as eminently political, it is generally agreed that it represented an important moment in political negotiation between developed and developing countries, whose different needs needed (and need) to be made compatible, in the interest of defending the Common Good.

For Barbosa (2012), sustainability is seen from future perspectives, from threats and opportunities, something not so tenuous in the past, as society has little questioned sustainability due to the anthropic action being more reduced and did not cause sensitive damage. Today the concern with sustainability is different, as it is seen that nature is not being able to support and respond adequately to the excessive burden of human actions and their consequences.

Carvalho et al (2015), on the other hand, believes that sustainability concerns some activity that has long-term continuity, while sustainable development is understood as the growth of something or physical or material increase in production. In this way, it is known that sustainable development has been evolving and treating the change process with a main objective that is sustainability itself (SARTORI, 2014).

Environmental sustainability refers to the fact of sustaining ecosystems and their capacity for absorption and recovery from the aggressions suffered by human actions. In addition, environmental sustainability has a wide scope, in which man and the environment are interconnected, not establishing a dichotomy between man and nature (MENEGUZZO, 2009).

Stoffel (2015), reports that economic sustainability is that which covers the allocation and distribution of natural resources within an appropriate scale. In other words, growth patterns must be maintained over time based on manufactured capital to compose the inputs and outputs of the production process, allowing natural resources to be incorporated into the production function. Brasil (2000) points out that sustainability is assessed based on the social sustainability provided by the organization of material life. This social sustainability, as Brasil (2000) says, together with Barbosa (2008) and Stoffel (2015), is related to equity in the distribution of income and goods, allowing equal rights for human dignity and social solidarity. That is, such sustainability is proposed by the fact that all individuals have the minimum rights necessary for a dignified life and that they can enjoy goods, services, natural and energy resources, in order to have well-being, without harming the other. As for ecological sustainability, Sartori (2014), reports that it is consistent with the existence of ecological conditions necessary to support human life without harming future generations, providing well-being for all. This same type of sustainability can be considered as a principle of solidarity with the planet and its wealth, as well as with the biosphere that surrounds it (BRASIL 2000). Regarding political sustainability, Barbosa (2008) and Brasil (2008), argue that this is a prerequisite for the continuity of any long-term action, in addition to the process of building citizenship to guarantee personal and social development. social status of individuals.

The disharmony in the relationship with the environment grew rapidly due to the apogee of capitalism and the process of industrial evolution, with the bourgeoisie, as the dominant class, using natural resources irrationally in the search to expand its goods and wealth, having as its master spring the exploitation of the working class.

Capitalist development took place for years and years without environmental control due to the inexistence or ineffectiveness of bodies responsible for such control and lack of socio-environmental awareness on the part of society, leading to the degradation of natural resources and pollution of soil, air and water resources.

With the globalization of the economy, internal efficiency, global competitiveness, technological innovation, information systems have become demands of the company, putting in check this model that excludes consumers, in the understanding that the business is not limited to capital and this, alone, is unproductive. Without the resources of the land, which is very social and has a natural right, it belongs to all of society, and without the intelligence and work of men, capital does not produce wealth, does not satisfy human needs, does not generate

progress, does not improve quality Therefore, the company must be a human reality, with social responsibility, even if this reduces part of its profit.

In Brazil, from the 1980s of the 20th century, new researchers from different areas of knowledge started to discuss development, under different approaches, in the fields of local development, popular and solidarity economy, public management, social management, social justice and environmental sustainability, reinforcing the idea of being a multidisciplinary theme. In this perspective, even in the 1960s, Celso Furtado, one of the precursors of economic studies, already stated that development is not a simple matter of increasing the supply of goods or capital accumulation, having a set of responses to a project of self-transformation of a human collectivity (Furtado, 1968).

Luiz Carlos Bresser-Pereira (2012), divides recent Brazilian history into three major development cycles: a) the State and territorial integration cycle; b) the nation and development cycle and; c) the democracy and social justice cycle.

- **State and Territorial Integration Cycle** - goes from the Empire to the Old Republic and is marked by national integration and preservation, in addition to the formation of a Republican State, but without its own identity, considering its connection with France, England and the emerging In this cycle, slavery was abolished, without inclusion policies for free blacks being implemented, generating racial inequality still prevailing in the country. In this cycle, wage labor and Asian and European migration wave.
- **Nation and Development Cycle** - It started in 1930, with an effort of economic growth, focused on industrialization, import substitution and the emergence of new social classes in the country, namely: the industrial bourgeoisie; the wage working class and an incipient but growing middle class. These actions were part of the “Pact Nacional Popular de 1930”, during the Vargas dictatorship. The second “1964 Modernizing Authoritarian Pact” was marked by the side effects of the cold war in Brazil; the growing urban urbanization; strong population growth; end of democracy; high concentration of income and accumulation of external debt, in the national developmental logic, without any social policy against poverty and inequality (CORDEIRO, 2011).
- **Democracy and Social Justice Cycle** - Begins to take shape in the early 1970s, and continues today.

Until 2014, it was marked by the strengthening of civil society, with the flourishing of NGOs and social movements; for the redemocratization of the Brazilian State; for participatory democracy and for the struggles and advances in the field of law and in policies for income redistribution; inflation reduction; appreciation of the national currency and, above all, by expanding the conceptual and empirical significance of development, going beyond the economic limits of the debate then in force, with the inclusion of the environment, freedom and social justice.

In general, the main ideological dispute in the economic field throughout the democracy and social justice cycle has been based, on the adoption of more liberal economic policies, as well as on redistributive, pro-welfare social policies, especially those of income transfer and the fight against poverty. There is no failing to recognize that, since the Luiz Inácio Lula da Silva government, the economic model has become less liberal, although maintaining the continuity of many programs of previous governments. However, it was very relevant for the reduction of social inequalities, the programs to fight hunger and the income transfer programs to needy populations (SILVA et al, 2004).

The historic period from June 5 to 16, 1972, was a landmark for the debate on environmental issues in development, when the First UN World Conference on Man and the Environment took place in Sweden (McCormick, 1995). Sustainable development was coined in 1987 by the so-called Brundtland Commission on the UN's environment and world development, building the idea that the environmental, social and economic dimensions must be considered in a complementary and interdependent way in development processes (CORDEIRO, 2014).

The expression Sustainable Development (SD), means a new way of seeing development and society, satisfying human needs, protecting the quality of life and the environment, countering the damage caused to nature by current economic development (MILANEZ, 2003).

In the 2010s, the so-called Rio + 20 took place in Brazil, in the city of Rio de Janeiro, whose central themes, in addition to international governance and poverty reduction, were the Green Economy, defined as the meeting between the economy and human and ecological well-being (ABRAMOVAY, 2012). With the concept in full construction, the green economy and its relationship with the economic can be discussed as follows:

This responds to the growing recognition that achieving sustainability depends almost entirely

on getting the economy right. "It also emphasizes the crucial point that economic growth and environmental management can be complementary strategies, challenging the still common view that there are significant tradeoffs between these. two objectives - in other words, that synergies prevail over compensations (OCAMPO, 2012).

In a debate under construction, tensions permeate the defenders of the green economy and the defenders of other aspects of sustainable development, and even other sectors that are not necessarily environmental. In the international debate, the discussion on sustainable development and the green economy has several protagonists, among them the North American Lester R. Brown and the Polish Ignacy Sachs. Brown (2009) discusses plans in the normative field, drawing attention to strategies that avoid global environmental imbalance. Sachs, in turn, defends the so-called "ecosystem-economics", which states that full and broad development can only be achieved if it joins economic development with increased social equity and environmental preservation (COSTA, 2007).

With the discussions developed from the divergences established, it is clear that the operationalization of a proposal for sustainable development should take as a reference the construction of mediation of strategic criteria that can account for the current state of uncertainty surrounding this issue. Such criteria should guide the management of the elements liable to knowledge at the present time.

For Leff (2003), the construction of such a proposal should not focus the analysis on separation, but on the construction of more integrated and democratic approaches to the perception of environmental issues, providing greater balance between different trends, safeguarding compatibility between development economic and preservation of the environment.

In Brazil, the National Voluntary Report on Sustainable Development Goals, prepared by the Government Secretariat of the Presidency of the Republic and by the Ministry of Planning, Development and Management, presents the path that Brazil is following on sustainable development (BRASIL, 2007) . In practice, these intentions have not been confirmed, because deforestation increases in the Amazon; fires destroy biomes; land grabbing in preservation areas only increases; CONAMA loses strength without the participation of civil society and the existing legislation is not complied with.

According to UNRIC - United Nations Regional Information Center, the 17 Sustainable Development Goals: 1) Eradicate poverty; 2) Eradicate Hunger; 3) Quality health; 4) Quality education; 5) Gender equality; 6) Drinking water and sanitation; 7) Renewable and accessible energy; 8) Decent work and economic growth; 9) Industry, innovation and infrastructure; 10) Reduce inequalities; 11) Sustainable cities and communities; 12) Sustainable production and consumption; 13) Climate action; 14) Protect marine life; 15) Protect terrestrial life; 16) Peace, justice and effective institutions; and 17) Partnerships to implement the objectives, they cannot leave anyone behind. Designed for the 2030 Agenda, the result of the joint work of governments and citizens around the world, its aim is to build a global model to end poverty, promote prosperity and well-being, as well as protect the environment and combat climate change (UNRIC, 2019).

Given this scenario, Sustainable Development can be characterized as a set of policies capable of guaranteeing national income and access to basic rights such as economic security, access to health and education, reducing the impact of increased production and consumption on the environment, enabling a set of factors such as the maintenance of essential ecological processes, the preservation of genetic diversity and the sustainable use of species and ecosystems, thus ensuring equal opportunities for future generations (SARTORI, 2014).

III. FINAL CONSIDERATIONS

The assumptions of the Theory of Creative Deconstruction elaborated by Schumpeter, tends to consolidate itself in the postmodern society, where globalization and neoliberalism determine the behavior of the market. However, their conception of development has long since ceased to represent the thinking of theorists, where planning is an essential factor for businesses to bring the expected results. The historical understanding of this process is essential for the recognition of the present and the possible future directions for the development of the Brazilian nation-state. Economics, which in its view was preponderant in the debate on development, no longer holds the exclusivity of analysis and empirical impact, dividing space with other human sciences and the natural sciences based on ethical principles.

The current cycle of democracy and social justice, which in Brazil has a permanent oscillation, now advancing, now retroacting, has been fundamental for guaranteeing rights, social inclusion, poverty alleviation, access to education at all levels, improvement of the

education system, health, income redistribution through social programs, but the consolidation of all this requires political improvement, with debate in academia and society as a whole.

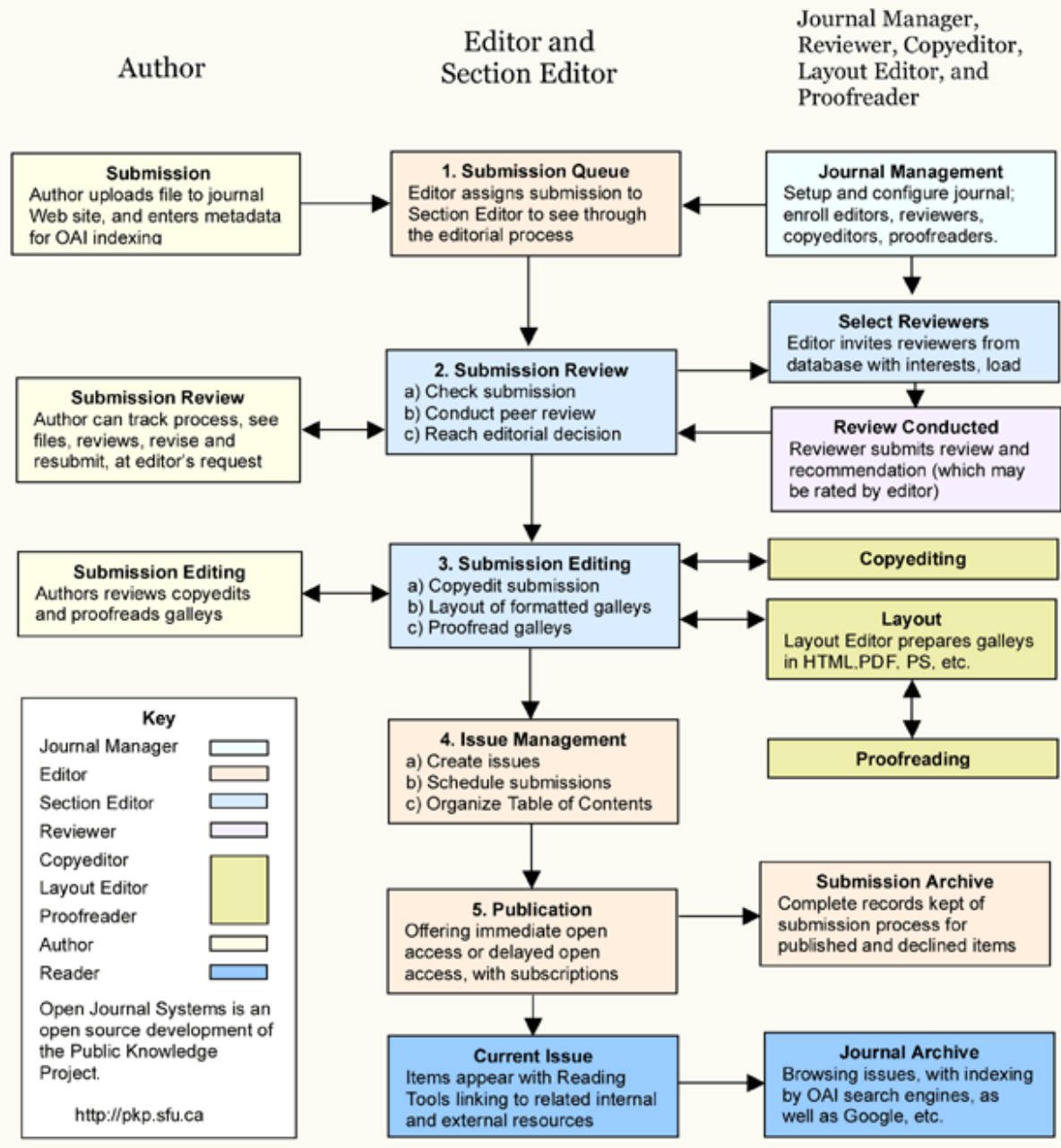
Discussions around a viable sustainable development proposal highlight aspects that need to be addressed, in order to establish new directions for dealing with environmental issues, based on ethical principles, which ensure stable growth, with an equitable distribution of resources, income, guaranteeing a better quality of life for all peoples.

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