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FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-11: 2020 (Nov, 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
Editor-in-Chief
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Sustainable Process Improvement Through Six Sigma in a Glass Manufacturing Environment

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Abstract**—** *In the competitive environment of the 21st century, organizations need cutting edge techniques to maintain their sustainability. Six Sigma is widely used by the process industries to optimize their performance and improve their profitability. The present research aims to improve the productivity of a glass manufacturing environment by optimizing their processes. In this regard, historical data from the knowledge repositories has been scrutinized against the parameters of production efficiency, inspection losses, major breakdowns, held ware, critical defects, and customer complaints, while the Six Sigma tools of the fishbone diagram, cause and effect matrix, Pareto analysis, and failure mode effect analysis (FMEA) are used for the purpose of data analysis. Findings revealed a process variation between the current and the targeted performance. Based on the findings of DMAIC approach, significant factors affecting the glass manufacturing industry are identified. The process has seen an improvement in 2020 as compared to 2019 by 6%. Moreover, a preventive maintenance plan of ManWinwin software has been installed as a preventative measure and resultantly, the breakdown percentage is also reduced by 2%. It is observed that better cooperation and communication between different departments can further lead to productivity enhancement.*

Keywords**— Six Sigma, DMAIC, FMEA , KPI , Pareto Chart , Fishbone.**

I. INTRODUCTION

The growing competition within the current global market is difficulty translating into an unlimited need for the industry's continuing evolution. Therefore, world business is continually looking for a competitive edge because of the growing demands of customer needs and expectations. Quality has a significant role within the business process across the whole organization, to be more efficient and effective within the global market, thus improving productivity and customer loyalty furthermore as an increasing market share.[1]

The production of glass containers is a very complex and demanding procedure that has to be very well equipped and optimally adjusted to produce glass containers that satisfy even the most demanding customers while being competitive on the market. Glass containers have to be maximally light, as well as less expensive. At the same time, they have to withstand maximal mechanical loads, greater internal pressure, thermal shocks (pasteurization), etc. to be able to meet these requirements, improving the quality of glass containers and increased production lines productivity with machines operates 24 hours a day, seven days a week.[2]

A . Six Sigma Definitions

Six Sigma is a management philosophy to systematically reduce variations and improve processes' quality. The concept is widely used in most organizations centered on process improvements and quality initiatives in a sustainable way. Based on an extensive literature review, the following tenets of Six Sigma are identified.[3]

Six Sigma as a metric: Metric definition of Six Sigma is widely recognized as 3.4 DPMO to achieve high quality among products and services delivered to the customers. Six Sigma's metric purpose is based on treating variation as evil to achieve a higher quality level. Six Sigma approach focuses on reducing variation so much that there is 6σ distance between the process target and nearest specification limit [4]

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Six Sigma is a methodology: Improving quality requires a phase-based process management structure that supports high-quality end product or service standards. Six Sigma follows a structured DMAIC (Define-Measure-Analyze-Improve-Control) methodology to streamline quality improvement efforts. Though promoted under the umbrella of Six Sigma, DMAIC is the generic improvement methodology that can be applied anywhere [5]

Six Sigma as a set of statistical tools: One of the reasons that DMAIC is so successful is that it focuses on the effective use of statistical tools. Guidelines for using statistical tools based on different DMAIC methodology phases are proposed by Muralidharan and Hahn. [6]

Six Sigma as a management philosophy: Genetic code of Six Sigma goes well beyond metric definition and DMAIC methodology of Six Sigma. Since Six Sigma evolves from statistical quality control, scientific management, and quality engineering, it is based on core scientific principles instead of rhetoric.[7]

B . The Six Sigma History

Six Sigma's roots as a measurement standard can be traced back to Carl Friedrich Gauss (1777-1855), who introduced the normal curve concept. Six Sigma as a measurement standard in product variation can be traced back to the 1920s when Walter Shewhart showed that three sigma from the mean is when a process requires correction. Many measurement standards (Cpk, Zero Defects, etc.) later came on the scene, but credit for coining the term “Six Sigma” goes to a Motorola engineer named Bill Smith. (Incidentally, “Six Sigma” is a federally registered trademark of Motorola).[8]

In the early and mid-1980s, with Chairman Bob Galvin at the helm, Motorola engineers decided that the traditional quality levels — measuring defects in thousands of opportunities – didn’t provide enough granularity. Instead, they wanted to measure the defects per million opportunities. Motorola developed this new standard and created the methodology and needed cultural change associated with it. Six Sigma helped Motorola realize powerful bottom-line results in their organization – in fact, they documented more than $16 Billion in savings due to our Six Sigma efforts.[9]

Since then, tens of thousands of companies worldwide have adopted Six Sigma as a way of doing business. This is a direct result of many of America’s leaders openly praising the benefits of Six Sigma. Leaders such as Larry Bossidy of Allied Signal (now Honeywell), and Jack Welch of General Electric Company. Rumor has it that Larry and Jack were playing golf one day, and Jack bet Larry could implement Six Sigma faster and with greater results at GE than Larry did at Allied Signal. The results speak for themselves.[10]

Table 1: The Six Sigma History

1777-1855	The basis of the normal curve was established by Carl Frederick Gauss.
1986	Bill Smith evolved Six Sigma in Motorola Company.
1988	Motorola won the Malcolm Bald ridge National Quality Award as the first ever company.
1993	Six Sigma was taken up by Allied.
1995	General electronic started the concept of Six Sigma.
1998	Six Sigma was accepted by Honeywell.
2000	Six Sigma was endorsed by Ford

C . Objective

Study the process variation to identify the gaps between current performance and glass manufacturing KPI for improving, controlling, and achieving the process's stability.

D. Problem Statment

The Problem statement and the reason for doing this study are to define a sustainable process improvement by using Six Sigma tools to identify the variation in the process and factors will affect the stability. This study could be implemented in different private and public sectors, large and small organizations. This study was implemented in A Glass Manufacturing Company, one of the biggest companies producing glass in the middle east. This study was implemented in the short term, six months to one year. A Glass Manufacturing Company needs to improve internal processes to increase efficiency, improve productivity, and reduce wastage of time and cost. There is strong competition in the local and external markets, and the Company needs to be on the same track and keep improving.

II. METHODOLOGY

The methodology used was based on DMAIC, with the following stages: Define, Measure, Analyze, Improve and Control. For each stage, Lean Six Sigma techniques, such as Project Charter, Data Collection Plan, Cause and Effect Diagram. Failure mode effects analysis (FMEA), Pareto Chart, implementation plan and Monitoring-Response-Plan

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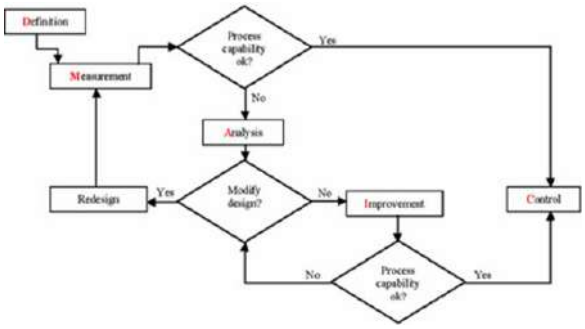

Fig.1: Six Sigma DMAIC information flow

A. Defined

Define is the first phase of the Lean Six Sigma improvement process. During this phase, the project team drafts a Project Charter, plots a high-level map of the process and clarifies customers' needs. By conducting Process Walks and talking to process participants, they begin building their process knowledge. Before moving on to the Measure Phase, the team refines its project focus and ensures they are aligned with organizational leadership goals. Applying project charter for outlines the presenting problem, the target, and the boundaries of a process improvement effort.

B. Mesure

Measurement is critical throughout the project's life since it provides critical indicators of process health and clues to where process issues are happening. As the team collects data, they focus on the lead time of the process or the quality of what customers are receiving. Before moving on to the Analyze Phase, the team defines its measures and determines the current performance or the process's baseline.

Data is one of the most valuable resources today's businesses have. The more information and records you have about your process, the better you can understand your process, wants, and needs. This enhanced understanding helps you meet and exceed your customers' expectations and allows you to create messaging and products that appeal to them.

C. Analysis

the data will give you all the information and based on that information; you will know how to proceed. It is working smart without guessing or using the luck of the draw, this chapter provides the analysis of data and results using Microsoft Excel and Six sigma technicians to identify and analyze our data that affect the stability of the process.

In this phase, you will do data and process analysis and measure the gap preventing you from your goal performance. This will automatically lead you to do a root cause analysis.

This study aims to investigate and find out what are the causes that can affect the stability of the process and what are the root causes.

A cause and effect diagram examine why something happened or might happen by organizing potential causes into smaller categories. It can also be useful for showing relationships between contributing factors. One of the Seven Basic Tools of Quality is often referred to as a fishbone diagram or Ishikawa diagram.[11]

After using cause and effect diagram we used failure modes and effects analysis (FMEA) is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product service.

"Failure modes" means the ways, or modes, in which something might fail. Failures are any errors or defects, especially ones that affect the customer and can be potential.

"Effects analysis" refers to studying the consequences of those failures.

Failures are prioritized according to how severe their consequences are, how frequently they occur, and how easily they can be detected. The purpose of the FMEA is to take actions to eliminate or reduce failures, starting with the highest-priority ones.[12]

After Reviewing our causes and effect diagram and labeling Process Steps and the intended function or functions of those steps, we have Considered the Potential Failure Modes for each component and its corresponding function. We Determine the Potential Failure Effects associated with each failure mode. The effect is related directly to the ability of that specific component to perform its intended function. For each failure mode, we have determined all the Potential Root Causes then For each cause. We identified the Current Process Controls. These are tests, procedures, or mechanisms that you now have in place to keep failures from reaching the customer then Assign a Severity Ranking to each effect that has been identified, Occurrence, and Detection.

Calculate the Risk Priority Number (RPN), which gives us a relative risk ranking. The higher the RPN, the higher the potential risk. it's calculated by multiplying the three rankings together (Severity x Occurrence x Detection) then we can take the decision to select the highest RPN to Develop an Action Plan for improvement and Taking action means reducing the RPN. The RPN can be reduced by lowering any of the three rankings (severity,

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occurrence, or detection) individually or in combination with one another.[13]

The Pareto principle, also known as the 80-20 rule, derived from the Italian economist Vilfredo Pareto's observations about the factor of sparsity, which states that 80% of the effects are coming from 20% of the causes.it will help us into patronize the top causes of our problem and focusing on the most significant[14]

D. Improve

Once they have determined what is causing the problem, it is time for the team to implement plans to resolve the root cause(s). The Improve Phase is where the team refines their countermeasure ideas, pilots process changes, implements solutions, and collects data to confirm measurable improvement. A structured improvement effort can lead to innovative and elegant changes that improve the baseline measure and, ultimately, the customer experience.

Ford Motor Company introduced team Oriented problem-solving or 8D problem-solving methodology in early 1980 (Shafeek, 2018). The 8D was designed to tackle problems that arise in the industrial environment. The objectives of 8D are to identify the root cause of the problem with team effort, implement temporary action to eliminate waste and losses, and a permanent move to avoid reoccurrence and hidden costs. Henceforth, the 8D has become very popular among customers and suppliers because it is useful and reasonably easy to teach to perform systematic analysis to solve an error in the industrial environment.[15]

E. Control

How do we sustain the improvement? With improvements in place and the process problem fixed, the team must maintain the gains and make it easy to update best practices. In the Control Phase, the team develops a Monitoring Plan to track the updated process's success and crafts a Response Plan in case there is a dip in performance. Once in place, the Process Owner monitors and continually updates the current best method[16]

A Monitoring Plan is a data collection plan for checking the ongoing health of the improved process. It lists the measure, the targets for each measure, how each measure will be checked, how, and who will check the measures. It sets the stage for the Response Plan.

The Response Plan establishes a threshold or trigger level for each measure in the Monitoring Plan. When the process performance goes beyond a trigger level, the Response Plan details immediate and long-term actions that will help the process return to and maintain the desired performance[17].

Monitoring and response plans will help us during the control phase. This plan guides all staff to keep in mind the target, how frequent we have to check, the upper/lower trigger point, and the reaction plan. without this plan, we will be lost, and we may go back to our routine where is no monitor, analysis, and improvement for the process[18]

III. RESULT AND DISCUSSION

This chapter provides the significant findings of the research that shows the objective achievement. This research also verified the results of the stability of the process e by applying the Six Sigma tools and techniques (DMAIC): with the following stages: Define, Measure, Analyze, Improve, and Control. For each stage, Lean Six Sigma techniques, such as Project Charter, Data Collection Plan, Cause, and Effect Diagram. Failure mode effects analysis (FMEA), Pareto Chart, implementation plan, and Monitoring-Response-Plan

Understanding the Six Sigma method's essential features, obstacles, and shortcomings allow organizations to better support their strategic directions and increase coaching, mentoring, and training needs. It also provides opportunities to implement six sigma projects better. It integrates the lessons learned from successful six sigma projects and considers further improvements to the six sigma approach. Practical six sigma principles and practices will succeed by refining the organizational culture continuously. Cultural changes require time and commitment before they are strongly implanted into the organization.

The Process stability is one of the most important concepts of the Six Sigma methodology or any quality improvement methodology for that matter. Stability involves achieving consistent and, ultimately, higher process yields through the application of an improvement methodology.

Comparing the situation between 2019 and 2020, we can see a difference after applying six sigma tools. It improves the workflow, changing worker culture, depending on engineering tools to defined problems and finding solutions. Reducing breakdown percentage, keep the process within specification by reducing the variation.

Prioritize the Risks by Sorting the RPN from the Highest Score to Lowest Score. This helps us to determine the most critical inputs and the causes for their failure, and this rustles to the first 7 Potential Effects or Failure cover 64.85% of the Total RPN

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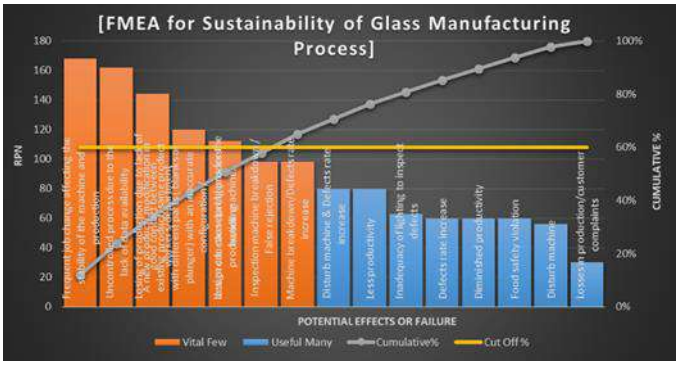

Fig.2: Pareto chart

After prioritizing our effects on the process's stability now, we can understand the cumulative impact of issues. Corrective and Preventive action can be better planned. And now Gives a focused, simple, and clear to find vital few causes. which going to helps us in problem-solving and decision-making.

Controlling the process is the most critical stage after this improvement and stability, and this is the responsibility of everyone who works in the organization. this is teamwork, especially in the glass manufacturing industry are immense with more workers and 24 hours of running the plant and has many factors that can affect the stability

Following monitoring and response plan will help keep checking, recording, and following up if any variation occurred. once these procedures, not the following company will go back as before no data to be recorded and unavailable breakdowns root causes and solutions

IV. RECOMMENDATION

In this study, we have recognized the improvement in the process in general through multifactor, and most of the recommendations mentioned in the methodology section were technical. In general, recording data, analyzing data, finding root causes, improving, and communicating, following up, and taking suggestions from operators related to machines. All help in process stability. I recommend functioning Six Sigma effectively. Six Sigma requires buy-in from everyone involved. It requires a sizable upfront cost to implement and train employees on the methodology of Six Sigma and its execution. Employees of all levels must be trained in the various positions of the methodology as well.

V. CONCLUSION

As shown in this research, improvement can be achieved by implementing FMEA, training for employees, following SOP's, and Total Productive Maintenance.

This research study has shown that Six Sigma can be implemented within the glass manufacturing industry. It has also been shown that Six Sigma can improve analysis procedures to identify variation in the process, which was helpful during the use of the DMAIC approach.

Overall, organizations can benefit significantly from implementing Six Sigma analysis tools into their organizations but determining which tool to use can be complicated. Therefore, a black belt employee will help organizations decide which Six Sigma analysis tool is best for their organization.

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Development of a Strategic Plan for a Retail Company in the Kingdom of Saudi Arabia using Balanced Scorecard

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Abstract— *The sales of the beauty care department in a leading retail company has shown a negative trend due to economic crises, VAT implementation, and introduction of foreigner's renewal fees. The present study aims to identify the problems and develop a 360 strategic plan for the beauty care department. The objective is to enhance department sales and regain the lost market share. Data has been collected from the company data repository (BI) and Nielsen market share. Analysis reveals that strategic decisions like promotion adjustment and introduction of new brands can grow the sales up to 13%. Moreover, the margin of the department has been enhanced by 5% due to the application of blue ocean strategy. Inventory management especially under Covid19 crises is one of the elements, which can be tackled under the financial perspective. Similarly, customer awareness can be created by focusing on flyers and social media. The two segments of higher ticket brands can be used to uplift the basket size of the department and encourage customers to spend more money on these items. Furthermore, Balanced Scorecard is used to develop a strategic plan covering the perspectives of financial, customer, internal processes, and organizational learning. The findings of the study can be beneficial for organizational leaders to enhance the productivity and profitability of their respective organizations in the challenging times of COVID-19.*

Keywords— ***Balance Scorecard, Category Management, Retail Industry.***

I. INTRODUCTION

In one of the biggest retail companies in the Kingdom of Saudi Arabia, when the economic crises happened in 2017, it has impacted all retail companies. Still, the impact on this company was higher. Besides, after VAT implementation beginning of 2018 the decline increased even more, the company was looking for the sales decline on the department level. The biggest decline was coming from Grocery Non-Food and particularly from the Beauty Care department by -20% in Jan 2018 vs. last year, this decline is not totally resulted by the economic crises as the market decline was -7% which means that the company is losing massive market share, management concluded that strategic plan has to be done in Beauty Care department using Balanced Scorecard Model.[1-3]

II. LITERATURE REVIEW

2.1 Retail Background in Saudi Arabia

Retail is an old activity start over 2,000 years back; Mecca was the center of the middle east trade, as Mecca was being visited by all Arabs and engaged in commercial activities (Buying and Selling). The establishment of modern supermarkets in Saudi Arabia was of very recent origin. It dates to 1979, Souks Company, Ltd. in Dhahran was opened, which operated under British management.

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Today, Saudi Arabia's retailing industry is categorized into organized and unorganized sectors. In recent years, the industry has seen the steady growth of large, organized retailers and, soon, Saudi Arabia's retail space will be dominated by these large retail companies. In last two decades, organized and multi-product/multi-outlet companies have expanded aggressively, and targeted consumer segments have responded well. Multi-national retail companies and brands, such as Carrefour, IKEA, LuLu, Extra, have been drawn to Saudi Arabia's growing retail market, and many more international brands are now in the pipeline to enter its market. In Saudi Arabia, the local retail sector is uniquely dominated by family-owned business groups who focus on acquiring exclusivity and franchise agreements with well-known international suppliers and brands. The key players in this arena are Al-Othaim, Al Hokair, Savola Group, Jarir, Majid Al Futtaim, Bin Dawood, and LuLu, which account for roughly 60 percent of the organized retail market.[4]

2.2 10 Strategies to Maximize Store Productivity

1. Embrace Real-Time Retailing.
2. Empower Store Managers.
3. Monitor Store Touch Points
4. Direct Traffic More Effectively Through Better Merchandising
5. Reduce Shrink with On-Shelf Tracking Analysis.
6. Enhance Multichannel Marketing.
7. Create Better Retailer-Supplier Collaboration
8. Leverage Existing Infrastructure and Integrate In-Store Systems.
9. Install Best-In-Class Equipment.
10. Plan for Future Growth.[6]

2.3 Balance Scorecard Model

The Balanced Scorecard (or balance score card) is a strategic performance measurement model developed by Robert Kaplan and David Norton. Its objective is to translate an organization's mission and vision into actual (operational) actions (strategic planning), Balance Scorecard Method has four perspectives:

1. Financial Perspective.
2. Customer Perspective.
3. Internal Business Processes.
4. Learning and Growth.[7]

Balance Scorecard is the method that can transform the strategies into actions in different functions in the organization "Balanced Scorecard is not about strategy; it is about making strategy actionable". [8]

2.4 Balance Scorecard Model

In this study, the authors have adapted the Balanced Scorecard model as a decision-making framework to build a holistic model of RFID-enabled changes throughout retail store operations, including marketing, merchandising, and supply chain management, a Delphi study for 10 consultants and senior managers from leading U.S. retailers, has been conducted. Below is the Balanced Scorecard model that was adapted for item-level RFID:

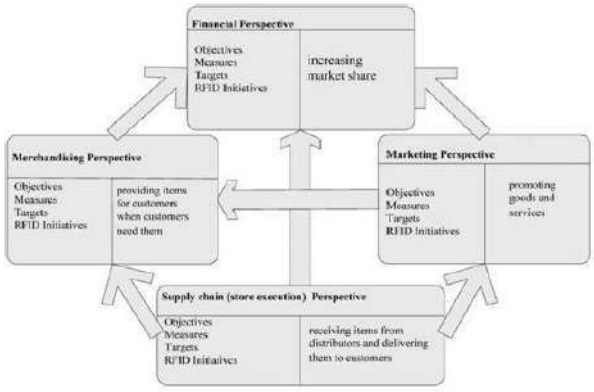

Fig. 1: Item-Level RFID Balanced Scorecard Model

After that authors have indicated the performance measure for each indicator for every perspective of Balanced Scorecard perspectives.[9]

III. RESULTS AND DISCUSSION

A Strategic plan developed for one of leading Retail Company in Saudi Arabia using Balanced Scorecard model, the four perspectives of the model are below, the plan set, and the impact measured for each of them

- Financial Perspective.
- Customer Perspective.
- Internal Processes Perspective.
- Organizational Capacity Perspective.

3.1 Functional Perspective

Sales, Margin, and Inventory; are the three main elements of Category Management, as they are the main KPIs' for commercial, as they directly impact the company Cash Flow, Net Profit and Market Share.

3.1.1 Department Sales

Sales are the most important KPI for any retail company; they influence other KPI's (Margin &

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Inventory). The higher the sales, the higher the market share, leading to higher brand equity, which defines the company value. Below are the main pillars and their impact on department sales.

3.1.1.1 Promotion

It is the primary sales driver for the Beauty Care department, as the data shows that the Beauty Department is the highest promo mix in the company out of over 30 departments. Promotion Tracker file developed, which is the level for the group of SKUs that promoted together to measure the promotion performance. The tracker will help to track offers to know the prices and offers performance for all the promotions which done last year to maintain the same prices to keep the same average sales, and it will also help to know which offers didn't perform well to avoid repeating the same promotion during this year. Below is an example of the promo tracker for Head & Shoulders Shampoo:

Table.1: Promo Tracker (Head & Shoulders Performance)

WK	WK Type	Slot	Offer	VAT Retail	Discount	T. Qsold	T. Sales	Margin %
5	PW	HEAD&SHOULDERS SHAMP 400ML	2	21.90	50%	60,076	624,354	5.0%
9	PW	HEAD&SHOULDERS SHAMP 400ML	1	11.95	45%	35,665	405,264	11.4%
4	PW	HEAD&SHOULDERS SHAMP 400ML	1	11.95	45%	32,867	373,279	11.5%
13	PW	HEAD&SHOULDERS SHAMP 400ML	1	11.95	45%	32,838	373,111	11.4%
12	NPW	HEAD&SHOULDERS SHAMP 400ML	1	10.95	50%	41,206	429,047	5.1%
1	NPW	HEAD&SHOULDERS SHAMP 400ML	1	11.95	45%	34,303	389,758	11.5%
16	NPW	HEAD&SHOULDERS SHAMP 400ML	1	10.95	50%	37,408	389,581	6.0%
20	NPW	HEAD&SHOULDERS SHAMP 400ML	2	21.90	50%	33,492	369,724	5.3%

3.1.1.2 Missing Assortment

The assortment carried in the stores needs to be reviewed and compared against the local market's assortment to cover the gap in the customer needs.

Colour Me is an example of these new brands; it has incremented the category by 700,000 S.R. per Quarter, which is almost 230,000 S.R. per month.

Table.2: Colour Me Performance Sep-Dec (2019 vs 2018)

Segment	2018 Sep-Dec Sales	2019 Sep-Dec Sales	Growth
FRAGRANCE	1,489,540	2,070,299	39.0%
COLOUR ME	733,833	770,652	5.0%
TOTAL FRAGRANCE	2,223,372	2,840,951	27.8%

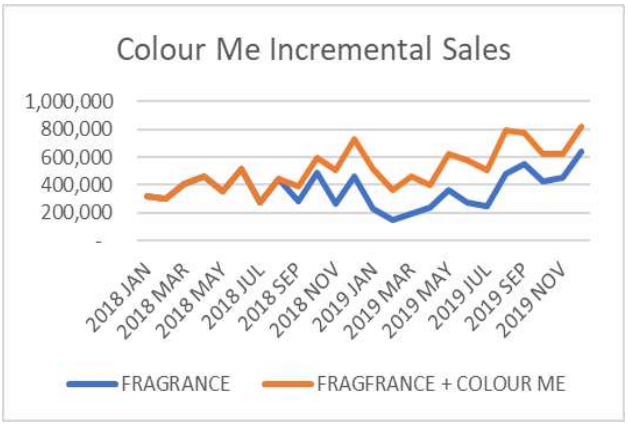

Fig. 2: Colour Me Incremental Sales in Fragrance

3.1.1.3 Availability

Availability has always been an issue in the retail industry, as it is related to inventory, which leads to company cash flow. Carrying the right assortment, getting the right offers is not enough to drive sales; the company must secure stores' availability. Some of the top items run out of stock before the promotion period ends; increasing the forecast for these items can increase the average sellout. But it must be with an exit plan in order not to end up with overstock. Below is an example of one of the Hair Care items; the average sellout increased from 2,000 to 5,000 pieces:

Fig. 3: Amla Deals Weekly Quantity Sold by Pieces

3.1.1.4 Creating Season in Non-Season

All year quarters are full of seasons and events except the first Quarter of the year. The commercial team arranged a meeting with the marketing team; the meeting ended with a new Beauty Event in the First Quarter. Beauty Event positively impacted the department sales growth by 39% compared to last year's same period. In comparison, the total Quarter has shown an increase of 20% vs. the previous year same period.

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3.1.2 Department Margin

The margin represents the profitability of the company. The Beauty Care department is a margin generator department, yet due to the high promo mix, as mentioned earlier, the margin reduced to get competitive prices in the market. Below are the points which have been worked on to enhance department sales:

3.1.2.1 Regular Price Periodic Review

The departments' essential items prices are periodically changes in the market. These items are frequently purchased; customers know their prices, so keeping the prices competitive keeps the company image.[11] Usually, the margin is low in these items to stay competitive. Sometimes the market increases the prices, which is an excellent chance to increase the prices and make additional profit.

Table.3: Periodic Price Review (Fair & Lovely Face Cream)

NEW Description	Peer 1 Price	Peer 2 Price	Current Retail		New Retail	
			Retail	GM%	Retail	GM%
FAIR & LOVELY FACE CREAM	22.95	24.90	21.95	11%	22.95	15%

3.1.2.2 Assortment Differentiation and Exclusivity

One way to get a better margin is to negotiate for a better depth of discount on well-known items while maintaining competitive market prices. Still, it is tough to do due to massive sellout, reflecting on money invested on these items. There is a strategy called Red Ocean and Blue Ocean:

- Red Ocean: it is about competing in the existing market space, beating the competition in this market using this market's demand.
- Blue Ocean: it is about creating uncontested market space and making the competition irrelevant by creating new demand.[12]

Introducing a new brand or creating new demand will help to get out of the red ocean to the blue ocean, no need to invest massively in the margin as these items are mostly exclusive.

3.1.3 Department Inventory

Inventory is the stock carried by the department measured in value (S.R.), which is the total items worthy carried by each department. There is a monthly target for each department, the target classified into:

- Total Inventory.
- Discontinued Items Inventory.

The target is reviewed monthly, and the manager needs to track the inventory throughout the month, as it directly impacts the OTB (Open to Buy). If the target is exceeded, the department will not have the authority to release orders for any item. An action plan is required for all discontinued items (out of range items).

3.1.3.1 Corona Impact

Whenever there is an economic or health crisis, the most impact department is Beauty Care, as it is not an essential department like food (Oil, Rice, Sugar, etc.). If the customer cuts the cost, they will stop purchasing Body lotions and creams other than stop purchasing food items.

Every year, planning and ordering for Ramadan and Beauty Event happen in the First Quarter. Purchasing has been done based on last year's season sellout. Still, unexpectedly, corona took over, and the sales of the biggest season have massively impacted (May):

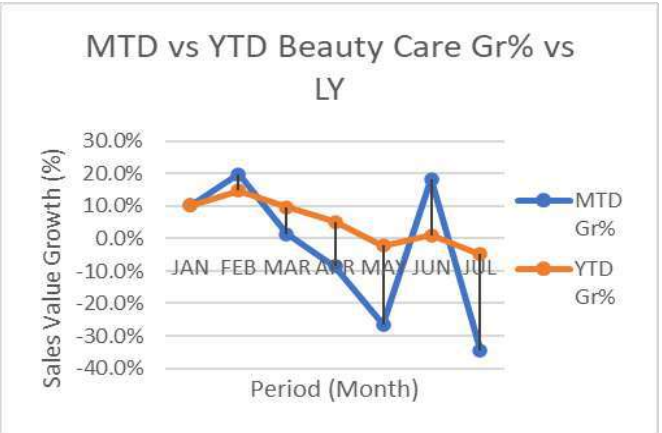

Fig. 4: MTD vs YTD Beauty Care Gr% vs LY

This decline in sales during Apr and May has resulted in having high inventory, which led to having negative OTB. It became a severe issue as the inventory target exceeded by -38M and -24M in Apr and May. Management has decided to stop the purchasing for the entire department; any purchasing should be as a Special order with management approval; multiple actions have taken to reduce the inventory:

- RTV (Return Stocks to Suppliers) or Aggressive Liquidation plan with a 50% discount for the discontinued items (Out of Assortment items).
- Physical Count for some of the brands knows for a high stock loss like perfumes, exercise done on two brands Ogx and Colour Me, which reduces the inventory by 335,000 S.R. away from other brands included.

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- The manager will review all the raised orders, especially for items classified as slow-moving items.

These are the main action taken to reduce the inventory and reach positive open to buy by Jul.

Table.3: Monthly Inventory Value, Target and OTB

MONTH	TOTAL INVENTORY (M S.R.)	INVENTORY TARGET (M S.R.)	OTB (M S.R.)
MAR	159	152	-6
APR	161	123	-38
MAY	153	129	-24
JUN	145	139	-6
JUL	147	151	4

3.2 Customer Perspective

The goal of all retailing process is the customers and their needs. The customers must be satisfied in terms of item assortment (All the customers' shopping list to be fulfilled). Educating the customers about the current assortment and their benefits and making their shopping a magical journey by enhancing the shopping experience (make them spend the maximum time possible in the store), as the more they stay, the more they buy.

3.2.1 Flyer Segmentation

Previously the offers on the flyer were added randomly, which is confusing to the customer. the right decision is to group the items as per the customer's needs. Customers can find all the items within the same category allocated together. They can compare the offers and choose among them easily.

Customers questioned their opinion on whether they prefer to see all related products on the same page, or it is preferable to see the segmentation by the supplier; 89% of the customers strongly agree or agree to see products within the same category allocated together.

3.2.2 New Brand Launch

The most critical lifetime of a brand is the launching period; the more significant the launch, the most likely these items will succeed, below is the main element of a successful new brand launching: Leaflet Artwork.

- Social Media.
- Blogger.
- Secondary Display.
- Promoters & Sampling.

3.2.3 Shelf Presentation

Shelf presentation or shelf display is the way of arranging the items on the shelf and make it easy for the customer to find the product that they are looking for according to the CDT (Customer Decision Tree).

3.2.3.1 Layout and Planogram

The store layout is the allocation for each category inside the stores. Planogram is the allocation of the items within the shelf; each category has it is own Planogram. Layout adjusted to reallocate each category near the related categories. Cooperating with one of the leading companies, the Planogram for Hair Care and Hair color has been defined based on actual studies and customer decision tree.

3.2.3.2 CAT-MAN

As Planogram defines the segmentation for the categories and allocates the items within the category shelves, the CAT-MAN is the branding, shelf dressing, and communication. A customer survey has done; if they can classify the brands to their correct segments, only 22% of the customers were confidently saying that they know all shampoo brands, while 45% of the customers can't classify the brands. The customers asked if they prefer CAT-MAN implementation and whether it will help them find their desired products. 78% of the customers strongly agree that implementing the CAT-MAN will help them select their desired shampoo.

After CAT-MAN implementation, category managers measured the performance. It found that natural segments have driven the growth, and it was grown higher than other stores without CAT-MAN, which means the customers are more aware of the segments and brand positioning.

- Hair Care grows by 15% while all stores increased by 5.6 % for the same period, mainly driven by Natural, Treatment, and Professional segments.
- Hair Color grows by 58%, while all stores increased by 39 % for the same period, mainly driven by the No Ammonia segment. It becomes a Rank #1 segment in the pilot store; however, it is # 3 in all stores, which indicates that the CAT-MAN educated the customers about the No Ammonia segment.

3.3 Internal Process Perspective

Internal processes, the main point of internal process and improvement, make the tasks more efficient and require less time to get the jobs done, especially in retail. The business is dynamic, and every day has it is own challenges. The company needs to be flexible to react accordingly.

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Many company processes have improved as Item Status Change. It is an excellent example of that, as previously, it required a printed form signed by four employees to get it done; if any of them is not available in the office, the signer will delay the task. Currently, this task is automated, and all approves can approve through the system.

The survey participants have been asked about the task that is consuming most of their time, listing a new item has been ranked #1 by 55% of the participant, then BDF calculation has been ranked #2 by 55% of the participant, while price change selected as the least time-consuming.

The participants requested to rank the tasks that need to be improved. Promo plan preparation has been ranked #1 by 55% of the participant, then new listing ranked #2 by 36% of the participants, while again, price change has been chosen as the least time-consuming task by 73% of the participants.

3.4 Organizational Capacity Perspective

This perspective is about the company's ability to grow it is learning and knowledge; it could be through training courses or even experience sharing. The Author surveyed the new joiners in the commercial on whether they received proper training from the company on their daily tasks; and if their manager has shared with them their experiences. Eleven employees participated in this questionnaire, 81.8% of the new joiners have recommended attending the new joiners program provided by the company, but only 45% receive training on their daily tasks.

Employees' survey indicates that the workload is very high, as per 81.8% of the survey participants. In comparison, 18.2% believe that the workload is high. This increased workload in the company could be why the lack of communication between the seniors and the juniors prevents them from sharing their experience.

Fig. 5: Employees Survey (Q1)

Fig. 6: Employees Survey (Q2)

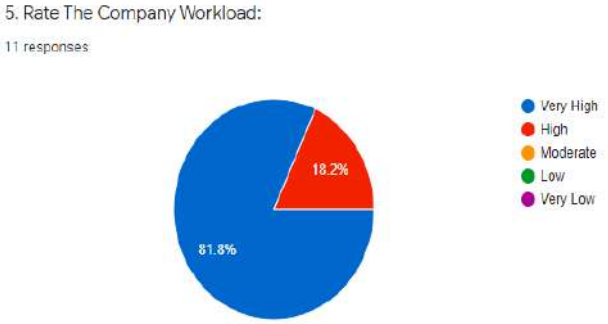

Fig. 7: Employees Survey (Q5)

IV. CONCLUSION AND RECOMMENDATION

Having a higher decline than the market indicated a missed opportunity and that the decline is not only due to economic crises; after setting a plan for the department using the Balanced Scorecard Model, the Author addressed many conclusions and recommendations.

4.1 Conclusion

- There is a gap in the company's assortment compared to market assortment, which reflects on missed sales opportunities; the example of Color Me, Ogx, and Salon Treatment is an indicator of it, these brands as a total are adding 425K incremental sales each month.
- There is a missed sales opportunity for the current assortment sales due to low availability for some critical items. Amla was an excellent example as the average weekly Qty sellout increased from 2,000 to 5,000 pieces.
- Campaigns can drive customers to purchase more if planned well Flyer, Social Media, Display, as first-quarter Beauty Event-driven the sales by 38% during the event and the total Quarter by 20% even when there was no actual season.
- Some of the items considered are slow-moving by supply chain, while the actual situation is that their

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movement impacted due to low stock accuracy Ogx and Colour Me were an example to it with 335K S.R. stock loss.

- Customers prefer to have a segmented shelf presentation to have a more comfortable shopping journey, as 78% of the customers cannot segment the shampoo brands.
- 81.8% of the new joiners have received a general introduction about the company, while only 45% have received daily tasks training.
- All employees consider the company a very high workload, 81.8%, or high workload of 18.2%.

4.2 Recommendation

- Using new selling tools away from promotion like attractive display, promoters, beauty advisers, and CAT-MAN implementation.
- Utilize Promotion Tracker to define the best price and best Qty offer based on historical data to capitalize on every sales opportunity.
- Forecast of some of the critical items needs to be increased based on the mentioned criteria and ensure that it is with an exit plan to reach the items' maximum sellout limits.
- Creating an event can make it refresh when the market is down, driving sales in the low base season, reflecting positively on the full year's performance.
- Increasing the prices for the non-sensitive price items, introducing new items with a higher margin than the category average (Red to Blue Ocean), reviewing top-selling items regular prices, these are the ways to enhance the category front margin.
- Schedule Physical Count exercise for the items, especially high-ticket small items, and the items which can be easily damaged like perfumes to adjust the system stock accuracy.
- CAT-MAN implementation can educate the customer and enhance their shopping experience in the stores. Nowadays, it is trendy to go natural and healthy; it noticed in CAT-MAN stores that Shampoo Natural segment showed higher growth than other stores by almost 20%. While No Ammonia jumped to Rank 1 while in other stores, it is Rank 3 with 27% higher growth in the CAT-MAN store, which indicates that the customers are educated about the items.
- Only 45% of the new joiners have received proper training on their daily tasks; one reason could be that the company is high work loaded company. The employees can't give appropriate attention to the newcomers. Improving the tasks' current process might increase employee interaction and guarantee the experience delivered to the newcomers.

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Early Intervention in Patients diagnosed with Hydrocephalus: A Literature Review

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Abstract**—***Introduction: Hydrocephalus is defined by the increase in cerebrospinal fluid (CSF), the result of dilation of the cerebral ventricles resulting from this accumulation. Spasticity in the upper and lower limbs, postural deviations, irritability, changes in fine and thick motor coordination, personality changes and developmental retardation are some of the signs and symptoms. Physiotherapy plays an essential role in the neuropsychomotor development of these patients. Objective: Understand the performance and benefits of physiotherapy in the early treatment of patients diagnosed with hydrocephalus. Material and Method: The methodology used was an integrative bibliographic review of qualitative character, which aims to demonstrate the contribution of physiotherapy in early performance in patients with hydrocephalus. Conclusion: Physiotherapy plays an important role in the development of patients with hydrocephalus, softening motor sequelae and improving the quality of life of patients.*

Keywords**— *Hydrocephalus, Cerebrospinal Fluid, Pathology Infant, Neuropediatric Physiotherapy.***

I. INTRODUCTION

Hydrocephalus is defined by the increase in cerebrospinal fluid (CSF), the result of dilation of the cerebral ventricles resulting from this accumulation. It changes production, absorption, and circulation generating an obstruction in the drainage of the liquid into the bloodstream and may cause the increase or not of cranial pressure [1,2].

The main clinical consequences of this obstruction are intracranial hypertension, which, for a better prognosis, introduces a peritoneal ventricular shunt system (PVSS), for the deviation of CSF that accumulates in the cerebral ventricles [3]. It is believed that after surgery and implantation of PVSS leads to an improvement in the signs and symptoms caused by the pathology, although signs that tissue damage remains.

This pathology is more in the infant population, where it can happen in two aspects: congenital and acquired. Congenital when it is diagnosed shortly after birth or intrauterine, during prenatal consultations. It can be caused by any disorders during pregnancy, in the course of embryonic development. The acquired occurs after birth caused by trauma sorority and or diseases such as meningitis, trauma tumors [4].

According to [5], hydrocephalus can be classified as communicative, which results from interruption of cerebrospinal fluid circulation in the subarachnoid space or from the deficiency of the absorption mechanism of the spinal brain fluid. And the non-communicating one that indicates an obstruction of the cerebral fluid inside the ventricular system, near the foramen of the fourth ventricle.

The clinical signs that the patient may present are related to increased cranial circumference, spasticity in the upper and lower limbs, postural deviations, irritability, changes in fine and thick motor coordination, personality changes, and developmental retardation, [6].

Physiotherapy plays an essential role in the neuropsychomotor development of these patients, to soften motor and neurological sequelae and thus grant improvement in their quality of life [7]. It aims to create pathways for the anatomy functional pathways of the nervous system, through repetitive and specific movements replacing partially damaged pathways to improve the changes caused by disuse or little activity and lack of stimuli [8]. Physiotherapy in addition to exercising techniques that bring relief to patients can develop exercises that return physical and functional capacity according to the evolution

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of each patient, it is also important that this provides a special moment of empathy and sensitivity, that understands the psychological state and that build a conscious relationship between therapist and patient understanding through performance, the need for competent enforcement [9].

Early physiotherapeutic intervention can help to improve the evolution of treatment and later in the progress of good prognosis of the disease aiming at improving functional and motor skills [10].

Given the theory presented, it can be seen that hydrocephalus is worthy of prominence due to its relative frequency and morbidity, as well as the large number of sequelae it can cause, especially if this patient is of premature birth. The suspicion of diagnosis and confirmation at the appropriate time will provide subsequently effective assistance and rehabilitation, by the appropriate monitoring protocol and conducts.

II. JUSTIFICATION

The justification for this study is related to early diagnosis together with multi-professional treatment where physiotherapy is part and that will provide advances for patient development, resulting in functional independence and quality of life. the actions of family members and caregivers are also highlighted, as they directly contribute to the cognitive and motor development of these patients with hydrocephalus [11].

III. PROBLEMATIC

Can early physical therapy contribute to a better functional prognosis about neuropsychomotor development in patients diagnosed with hydrocephalus? Can this early intervention increase the chances of this patient having a minimal motor and cognitive impairment?

IV. GENERAL OBJECTIVE

This study aims to understand the performance and benefits of physiotherapy in the early treatment of patients diagnosed with hydrocephalus.

4.1 SPECIFIC OBJECTIVES

The specific objectives mention the need to cover how the physical therapy treatment of this pathology can decrease complications and delay in neuropsychomotor development (NPMD);

Present the advances and techniques that physiotherapy have to contribute to the development of patients;

Understand the pathophysiology of the disease, taking into account the importance of family support during treatment.

V. MATERIALS AND METHODS

The methodology used was a qualitative integrative bibliographic review, which aims to demonstrate the contribution of physiotherapy in early performance in patients with hydrocephalus, where a study with explanatory purpose was conducted from March to May 2020, in which literary authorship, scientific articles, and journals were chosen. A search had been carried out in the databases of Lilacs (Latin American Literature in Health Science), Medline (Medical Literature Analysis and Online System), Scielo (Scientific Electronic Library Online), and Google scholar (Google scholar) of the last ten years.

The research included only studies published between 2009 and 2020 and was limited to languages in Portuguese and English., using the keywords according to the classification of descriptors in Health Science (DeHS): physiotherapy in hydrocephalus and its core reports in the English language. Thirty articles were selected, where 20 were excluded because they were not following the proposed theme, or presented a date lower than the established. with the following references: effects of early physiotherapy in patients with hydrocephalus, hydrocephalus, physical therapy in hydrocephalus, and myelomeningocele.

VI. EXPECTED RESULTS

New information regarding advances in treatment and therapy intervention can be found, such as new ways of diagnosing, as well as new methodologies in follow-up for the better advancement of PMD in patients with this pathology.

VII. CONCEPTUAL THEORICH REFERENCE

7.1 PHYSIOLOGY AND PATHOPHYSIOLOGY OF HYDROCEPHALUS

Cerebrospinal fluid (CSF) known as CSF or fluid brain – spinal is found in the subarachnoid space in the brain and spinal cord between the arachnoid meninges and pia mater. This liquid produced by the choroid plexus of the lateral ventricles and subarachnoid spaces acts directly to supply nutrients and remove metabolic residues from nervous tissues and has as function the mechanical protection of the central nervous system (CNS). The balance between CSF

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production and absorption is responsible for keeping liquid volume stable.

Hydrocephalus is characterized by increased CSF volume along with the dilation of the cerebral ventricles. A change in the flow, or consequence of an obstruction of the scandic circulation, which can occur in several sites, in the foramen of Monro, in the Sylvius aqueduct, in the foramen of Magendie, in the foramen of Lucha, or the subarachnoid space.

The etiology may be linked to factors of environmental, genetic origin, or multifactorial inheritance.

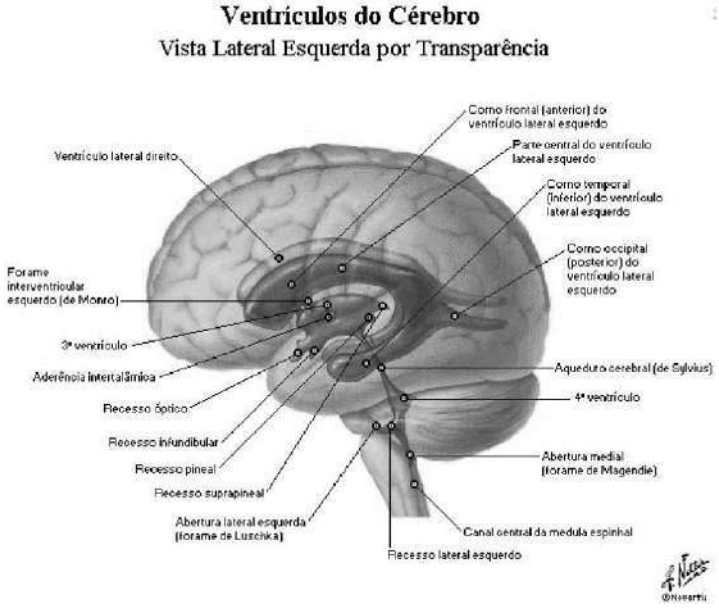

Fig.1: Sagittal section of the brain where it shows the CSF circulation at the beginning of its production passing through the choroid plexus and ventricles until its absorption in the arachnoid villi.
Source: Frank H. Netter (5 ed. 2011)

The pathophysiology is directly linked by an increase in the ventricular cavities due to an increase in the volume of the cerebrospinal fluid as a consequence of the imbalance between the production and absorption of the same, with obstruction of the cerebrospinal fluid in the ventricular system or outside it, or there is an imbalance between the production and resorption of CSF.

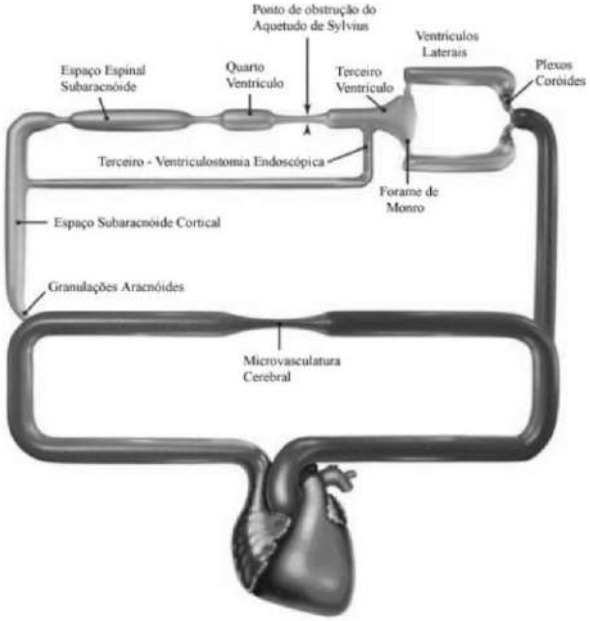

Fig.2: Circulation of the schematic CSF.
Source: Fabbro (2008, apud Rekate, 1994, p.37).

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This pathology has become one of the easiest anomalies to be diagnosed during prenatal care, as it is given according to what is usually found in scans, such as ventricular dilation and the observation of a greater distance between the ventricles, extremities of the lateral ventricles, and cerebral hemispheres (this explanation is defined by the Evans Index). This diagnosis can already be found and visualized from the second trimester of pregnancy.

7.2 CLASSIFICATION OF HYDROCEPHALUS

Hydrocephalus is a pathological quality that has become known for developmentally, especially about treatment. It is the result of an imbalance resulting from the lack of bad distribution of this liquid [3]. Hydrocephalus is divided into Communicative - which is the obstruction or interruption of cerebrospinal fluid flow in the subarachnoid space shortly after leaving the fourth cerebral ventricle. Non-communicating – which results in obstruction of cerebral fluid in the ventricular system, that is, there is no communication of the system with the subarachnoid space. These manifestations are directly related to the patient's age, as well as speed [12].

This pathology can also be congenital or acquired, and in the congenital form, it is diagnosed at birth or even when it is still in the mother's belly. And in the acquired form that can present at any age by various circumstances such as infections, head trauma, brain tumors, stroke, or cerebral hemorrhages.

According to [12], hydrocephalus is caused by the mis adjustment between the production and drainage of the liquid into the bloodstream, and several possibilities cause this pathology to arise, such as:

Brain tumor – tumors cause swelling in brain tissues, becoming weak drainage causing then a buildup of fluid in the cerebral ventricles.

Prematurity – premature babies are more susceptible to the development of hydrocephalus because they are more vulnerable as many parts of the body are still maturing and thus more vulnerable to disease than those born at term.

Meningitis – is an infection of the meninges or membranes that protect and cover the brain. The expansion of this infection can prevent the drainage pathways of the cerebral fluid thus causing hydrocephalus [12].

The improvements that have expanded in the treatment of hydrocephalus have not only occurred in the techniques, but also the virtues of surgeries, imaging diagnosis, and physiotherapy. These contributions allow for a more accurate diagnosis and treatment [13].

7.3 SIGNS AND SYMPTOMS OF HYDROCEPHALUS

The symptoms of hydrocephalus diversify according to age and several factors can influence their appearance. The newborn may present rapid growth of the skull cap with changes in the shape of the skull due to the accumulation of fluid in the cerebral ventricles. The most common findings are: irritability, vomiting, lethargy, looking at the setting sun (looking face down), dilated fontanel (moleira), drowsiness, and delay in the deficit of motor and cervical control due to increased head circumference and weight, disfavoring motor development.

Older children may present with loss of motor coordination, balance, headache, nausea, vomiting, inattention. Neuropsychomotor deficits and developmental delay can occur in several forms as an example of functional limitations. Advances in patients with delayed neuropsychomotor development are directly related to the early diagnosis of hydrocephalus because the sooner it happens, the more likely the patient will be facing multidisciplinary treatment, thus reducing subsequent neurological alterations. The characteristic clinical symptoms are often identified from the second year of life because, in addition to the physical signs, they should take into account the neurological evaluation and the clinical history of the patient [13].

7.4 PHYSICAL THERAPY IN HYDROCEPHALUS

The most used intervention nowadays is surgical intervention, which boils down to the use of a device or valve (shunt), connected to a catheter, whose extremity is introduced into the peritoneal cavity (heart or intestine) to bypass the circulation of the liquor, where it will be absorbed into the bloodstream. On the other hand, physiotherapy can act in various ways to reduce or delay the signs, or symptoms caused by the pathology. Physiotherapy should be performed as early as possible for the stimulation of age-appropriate functional skills and synthesize secondary deficiencies [14].

Physiotherapy directly influences not only the neuropsychomotor development but also on the intrinsic development of the child improving their functional abilities [15].

"The investigation of the evolutionary process of the child and the identification of problems related to its development allows early intervention in evolutionary delays and the implementation of simulation programs for children with developmental disorders. The formal objective of early intervention is to reduce the negative effects of a high-risk history, as many suffer the influence of impoverished experiences, in the family environment and environments such as daycare centers and schools" [16].

Based on the context, physiotherapy has as one of the

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objectives, the reduction of pathological reflex activity to thus normalize muscle tone, facilitating the movement considered normal making it an improvement in muscle strength, range of motion (ROM), flexibility, and improvement in movement patterns and basic motor capacity resulting in improved patient functionality [14].

Early stimulation, also known as essential stimulation for development, aims at the sensory-motor, affective development of preterm babies, and also with the integration of the family member with a newborn [17]. The child with hydrocephalus can often this associated with decreased adipose tissue, decreased muscle tone, the cranium is relatively larger compared to the body, distended abdomen, impaired respiratory function, deficient rib cage. When the therapist initiates early stimulation, it becomes possible for the child to experience normal movements and posture through normalization of muscle tone, favoring the development closer to the considered normal, through a thorough evaluation, identifying possible disorders and thus able to elaborate specific conducts for each patient and then perform an appropriate treatment [18].

Through physical therapy, changes in neuropsychomotor development can be diagnosed, improve posture quality, avoiding abnormal patterns, prevent deformities and contractures, increase hospitalization time, attenuate respiratory changes caused by pathology and hospitalization, normalize and stabilize motor patterns, such as muscle tone and tropism, stimulate and monitor neuropsychomotor development. Parents need to accompany their children during treatment because they will continue treatment according to the guidance passed on by the therapist, the resources used should lead to the same final goal, such as the need to maintain the best positioning for the patient, to improve functional performance and motor behavior, sensorimotor stimulation, among others [13].

Among the many physiotherapy therapy techniques that can be applied in the treatment of the disease, both respiratory and motor, hydrotherapy resources can also be used, because this technique can add a lot to the treatment due to the physical properties of heated water, such as buoyancy, the relief of irritability, hydrostatic pressure of water and the density of water that allows the body to fluctuate. A resource for enriching the patient's treatment, to promote greater functional capacity and consequently a better quality of life for the patient [14].

Another technique that is available and that can be well used to the development of the patient with hydrocephalus is Bobath. The Bobath concept assumes the principle of facilitation of movement through the application of "key control points". The use of adequate and functional movement aims to inhibit abnormal patterns of spastic synergism through the least possible effort, this consequently influenced postural control and the performance of functional activities. The facilitation and inhibition techniques are performed by a physiotherapist through key points, in this technique can also be used the weight discharge, because the same causes pressure and, at the same time, the recruitment of motor units, also has an extremely important role for the release of the other segments that are sustaining so that the other movements are performed [17].

Thorough evaluation and therapeutic diagnosis should be performed to evaluate the general motor status of the patient, elaborating short- and long-term objectives and goals with appropriate treatment plans, to meet the individual needs of each patient. If physical therapy is established early the prognosis of the disease will reach a good evolution, since the hydrocephalus when undergoing physical therapy treatment appropriated when they reach progress in their functional abilities. The physiotherapist's follow-up in the motor learning process is of paramount importance as well as the guidance to caregivers and family members for an evolution in the functional independence of the patient with hydrocephalus [10].

As is known, hydrocephalus is a chronic disease that affects the functionality of patients without their activities of daily living (ADLs). The quality of the domestic stimulus can influence the cognitive development of the patient, as well as in the environment in which he/she is inserted, as well as in the family structure. Therefore, the physiotherapist should be attentive and transmit guidance and information to caregivers regarding the care and stimulation of the patient at home [19].

The advancement of the patient depends on a set of circumstances that were part of the beginning of physical therapy treatment, the impairment of the central nervous system to the action, and the understanding of the caregivers of the patients.

VIII. CONCLUSION

Patients diagnosed with hydrocephalus may present physical and motor restrictions, such as the deficit in cervical and trunk control due to increased head circumference and consequently their weight, due to increased intracranial pressure and may cause neural lesions that will result in motor development. Physiotherapy plays an important role in the development of patients with hydrocephalus, softening motor sequelae and improving the quality of life of patients, using techniques that are available

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such as hydrotherapy, the Bobath concept, in addition to passive joint mobilizations, physical-motor stimulation, muscle stretching, muscle strengthening, training of fine motricity, myofascial massage, diaphragmatic release, gait training and guidance to family members.

The physical therapist's action seeks to promote in a preventive manner and the harmony of neuropsychomotor development of patients with hydrocephalus, through techniques that gradually promote functional improvement and develop psychomotricity and motor control, stimulating the relationship between patient and family, making it necessary also a multidisciplinary team that works and treats each aspect in its particularity, respecting the limit and age of patients, especially during treatment.

It is concluded that the physiotherapist should observe during the treatment which techniques fit and become effective to each patient, observing it in its entirety and not only in their motor impairment. Guide family members and caregivers about the stimuli the patient needs to have a better quality of life. Given the facts addressed, it is clear the importance of physiotherapy for the treatment of patients with hydrocephalus, always requiring scientific studies that develop and bring new techniques to the professional environment.

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The influence of municipal expenditure on the general quality of basic education in Brazil

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Abstract**—** *This study aims to analyze the contribution of the total expenditures committed by the Brazilian municipalities in Infant, Primary and Secondary Education in the general quality of basic education in these municipalities. A Multiple Regression Model was used by means of descriptive and quantitative analysis to estimate the relation between total municipal per capita expenditure and the results of the FIRJAN Municipal Development Index - IFDM-Education. A total of 5.415 municipalities were analyzed in the period from 2005 to 2013. The model as a whole and the variables used (education expenditures in each Brazilian region) were statistically significant, also indicating that 61,62% of the variations in the Education-IFDM were explained by changes in expenses. The results obtained also showed that the Brazilian region whose expenses contribute most positively to the quality of education is the South, followed by the Southeast, Midwest, North and Northeast. Over the years analyzed, it was also possible to notice the evolution of the increase in the expenditures committed with Brazilian education, favoring, in a general way, improvements in the results in the IFDM- Education of the municipalities. Thus, it is possible to conclude that the expenditures committed in education by the municipalities must be continuous. In addition, attention should be paid to the lower efficiency of these expenditures for the North and Northeast regions, since different factors can influence this efficiency and also, directly, the quality of municipal education itself.*

Keywords**— Expenditure, Municipalities, Quality of Education.**

I. INTRODUCTION

Education in Brazil was extolled as a right for all citizens only with the promulgation of the Federal Constitution in 1988, in order to achieve the full development of individuals, preparing them for the effective exercise of citizenship and due qualification required by the market [1].

In order to guarantee the quality standard of Brazilian education, it is organized in a collaborative regime, with the Union responsible for managing and financing federal public institutions, ensuring equalization of educational opportunities, as well as the minimum standard of quality of education for students. States, Federal District and Municipalities guaranteeing them technical and financial assistance [1].

The quality of public education is a global concern, not being restricted to underdeveloped countries, which mostly have education with precarious conditions, high rates of illiteracy, school dropout, age-grade distortion and a high number of children and adolescents outside the classroom class [2].

Education when developed universally, fully and with quality becomes responsible for reversing the vicious picture of social ills, providing improvements in the country's economic development. In this way, there are countless studies carried out in Brazil and abroad in order to ascertain the quality of public teaching through the expenditures invested by governments [3].

In general, the studies analyze education, from the perspective of quality and public spending committed at regional and national level. With reflections that emphasize that education requires primary attention in the face of state investments, as this is responsible for promoting citizenship, social justice, increasing the level

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of well-being of the population and economic development, thus guaranteeing benefits for society as a whole.

Although the literature covers different studies related to the quality of education in Brazil, there are gaps in terms of interregional differences. From this, considering that Brazil is a country with significant regional socioeconomic heterogeneity, as well as the importance of basic education, this study starts from thefollowing question: What is the influence of municipal spending on the general quality of Brazilian Basic Education? Do these expenditures have a different influence on the quality of education in the regions of the country?

Thus, it aimed to investigate the contribution of total expenditures committed by Brazilian municipalities in Early Childhood, Elementary and Secondary Education in the general quality of basic education in these municipalities, as well as investigate the interregional differences in these contributions.

The study is justified, because "if education alone does not transform society, without it, either, society changes" [4]. Therefore, studying education and the efficiency of spending committed in the area of education helps to understand the quality of education offered, which causes changes in society.

This study is relevant for contributing to the theoretical assumption that the quality of basic education is a factor responsible for enabling Brazilians to able to socially participate as well as positively impacting the level of well-being of Brazilians, contributing to economic and social development. Thus, it is necessary for education to be the object of state attention in order to become the driving force for changes in society.

II. LITERATURE REVIEWS

2.1 Brazilian Education

Education as a human right was envisaged in 1948 through the Universal Declaration of Human Rights formulated at the General Assembly of the United Nations – UN [5]. The declaration aimed to ensure that each individual and body of society endeavors to promote the rights and freedoms contained in the declaration through education.

Thus, the Declaration in its article 26 emphasizes that every citizen must have access to free and compulsory education at fundamental and higher levels, aiming at full human development, "guaranteeing education for all is a challenge for the whole of society and a right of the citizen" [6].

This right was conceived for Brazilians only in 1988 through the promulgation of the Federal Constitution, which praised education as a common right for all citizens, aiming at achieving the full development of Brazilians and preparing them for the effective exercise of citizenship and due qualification required by the market as set out in Article 205.

The mandatory and gratuitous nature of Brazilian education is also present in the Statute of Children and Adolescents - ECA (Law nº 8.069/90) [7], Constitutional Amendment nº 14 of 1996 [8], Law of Basic Guidelines of National Education - LDB (Law nº 9.394/96) [9] and the National Education Plan - PNE [10] approved in 2001.

The promotion and incentive of education throughout the Brazilian territory is the duty of the State and families, as stated in art. 208 of that Constitution. Thus, it is up to the Brazilian State to provide compulsory and free basic education from 4 to 17 years of age, extending this right to Brazilians who have not had the opportunity to access education in the stipulated age group. From the age of 17, higher education is foreseen on the merit of passing competitions, such educational organization is ratified by [9].

Brazilian education is divided into basic and higher education, where basic education is composed of early childhood education, elementary and high school. Early childhood education lasts for 5 years with 3 years for the day care center and 2 years for the preschool.

Elementary school has a duration of 9 years, divided into initial years (1st to 5th year) and final years (6th to 9th year). High school, on the other hand, lasts 3 years, while higher education varies by undergraduate area [6].

The Brazilian Constitution provides in its Article 206 that Brazilian education is based on equal access and permanence at school; freedom in teaching and learning; pluralism of ideas; democratic management of public education in the form of law and guarantee of a quality standard.

After all, it is through education that "the citizen is able to take possession of cognitive and formative standards by which he is more likely to participate in the destinies of his society and collaborate in his transformation" [11].

2.2 Competencies and Responsibilities of Each Federated Entity

In order to guarantee the quality standard of Brazilian education, it is organized in a collaborative regime, with

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the Union being responsible for managing the federal education system, financing federal public institutions and ensuring equalization of educational opportunities, as well as minimum standard of quality of education to the States, Federal District and Municipalities guaranteeing them technical and financial assistance [1].

The states and the Federal District act as promoters of primary and secondary education. The municipalities, in turn, work in early childhood and elementary education, ensuring universal access and access to compulsory education for Brazilian citizens as stated in the Federal Constitution of 1988.

In order to guarantee the free, maintenance and development of Brazilian education, it is necessary that the Federal Government invest a minimum of 18% of its tax revenues annually on the states, the Federal District and the municipalities 25% [1].

The rates referring to the Union, states, Federal District and municipalities are levied on the net revenue from taxes, that is, the Union must deduct from the gross tax revenue the portion to be transferred to the states, Federal District and municipalities according to [12].

States, on the other hand, must deduct the portion transferred to municipalities from gross revenue from taxes and transfers. Finally, when it comes to the Federal District and the municipalities, the 25% rate will be levied on all tax revenue (own and transferred) as stated [6].

Brazil has 186 thousand basic education schools, of which 114,7 thousand (61,7%) of which are under the responsibility of the municipalities, 30,6 thousand (16,5%) of the states, 744 (0,4%) of the Union and 39,9 thousand (21,5%) are private, that is, 61,7% of basic Brazilian education is provided by Brazilian municipalities, with 66,1% of schools in urban areas, according to [13]. Which points out that in the last eight years (2008-2016) there had been an increase of 56,9% in the number of schools offering daycare centers and 11,6% in the offer of secondary education in the country.

Fig. 1 shows the evolution in the number of Brazilian schools from 2008 to 2016, highlighting the decrease of 16,89% in schools offering the initial years of elementary school and the 5,32% increase in preschools, 7,59% in schools offering the final years of elementary school and 41,65% of high school. The increase in the number of schools in Brazil ratifies the main axis related to the PNE, the universalization of Brazilian basic education.

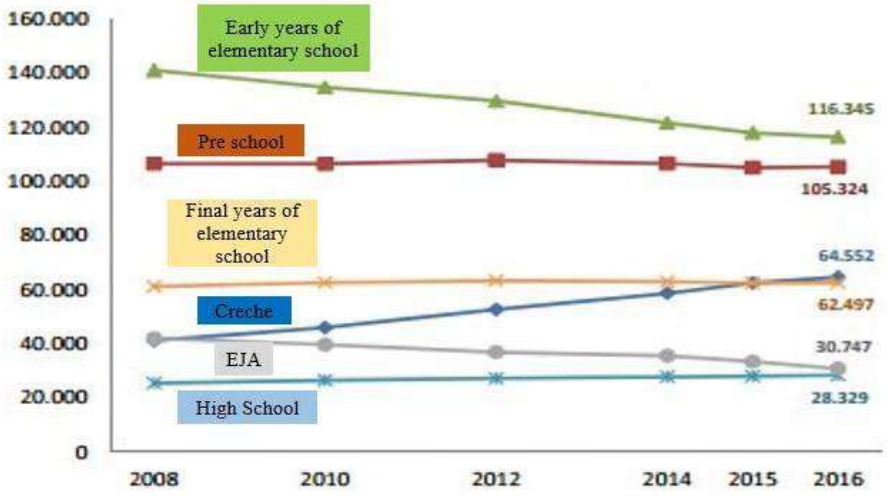

Fig.1: Evolution in the number of schools in Brazil from 2008 to 2016

Source: INEP (2017)

Brazil has 64.500 daycare centers, according to [13], of which 76,6% are located in urban areas and 58,8% are municipal. In rural areas, daycare centers are the responsibility of 97,4% of municipalities. 105,3 thousand units are destined to preschoolers of Brazilians, located 57,4% in the urban perimeters and the majority of the municipalities are competent (72,8%).

In order to sustain and maintain the current education in the country, the Brazilian government invests 5,5% of GDP in basic and higher education [14] allocating increasing amounts in human and budgetary resources in conventional education, as well as facing effectively the serious problem of low average schooling and illiteracy among the population aged 15 and over [15], [16].

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The increasing allocation of resources comes from the idea, according to the authors, that a high level of education of the population generates competitive advantage for the country, prominence in the face of globalization and assistance in technological development. For [2], high schooling generates economic development, improving democracy and citizenship as well as reducing crime in a country.

2.3 Public Investment in Education (2000 to 2015)

According to [14], Brazil allocates higher percentages to education than many developed countries.

However, when it is analyzed in terms of the level of education, there is a large investment by the government in education in the last 15 years.

Table 1 contains information, disaggregated by level of education, regarding the percentage of Total Public Investment in Education in Relation to the Gross Domestic Product - GDP (per student) for Brazil, between 2000 and 2015 [13].

According to Table 1, public direct investment to students increased at all levels of education from 2000 to 2015. In turn, basic education grew 196,24%, with greater investment in students enrolled in high school, with 2.078 BRL invested in 2000 and 6.637 BRL per student, a 219,39% change in public direct investment to the student.

Table.1: Public Direct Investment per Student

Year	Public Direct Investment per Student 1,00 BRL						
	All Levels of Education	Teaching Levels					
		Basic education	Child education	Teaching Fundamental		High school	College education
				Years Initials	Years Finals		
2000	**2.587**	2.154	2.717	2.065	2.163	2.078	23.619
2001	**2.674**	2.229	2.424	2.042	2.357	2.337	23.339
2002	**2.653**	2.198	2.270	2.406	2.270	1.575	21.615
2003	**2.606**	2.189	2.588	2.310	2.188	1.746	18.888
2004	**2.763**	2.363	2.605	2.640	2.440	1.594	17.881
2005	**2.943**	2.495	2.421	2.829	2.632	1.691	19.267
2006	**3.502**	3.042	2.646	3.168	3.459	2.350	19.946
2007	**4.090**	3.562	3.208	3.724	3.931	2.851	21.075
2008	**4.629**	4.089	3.427	4.291	4.575	3.298	19.480
2009	**5.092**	4.477	3.432	4.841	5.054	3.477	21.878
2010	**5.859**	5.151	4.214	5.533	5.545	4.381	23.255
2011	**6.408**	5.583	4.987	5.727	5.742	5.429	24.778
2012	**6.826**	6.056	5.880	6.167	5.924	6.178	22.505
2013	**7.305**	6.471	6.400	6.500	6.429	6.531	25.181
2014	**7.380**	6.569	6.506	6.542	6.559	6.664	24.209
2015	**7.273**	6.381	6.443	6.287	6.271	6.637	23.215

Source: INEP (2017)

Table 2 shows the investments disaggregated by level of education, regarding the percentage of Total Public Investment in Education in relation to GDP [13], for the period from 2000 to 2015.

This table shows an increase in the percentage of total public investment in education in Brazil in relation to GDP over the period, reaching the lowest value in 2000 (4.6%) and the highest in 2015 (6.2%).

These results corroborate the 20th goal of the PNE, which consists of expanding public investment in

Brazilian GDP in 2019 and 10% in 2024. In other words, the Brazilian State allocates increasingly higher percentages of its GDP for education, especially basic education.

Spending per student follows the growth of educational level in most countries, according to [14], spending per student in higher education is 1.9 times higher than with students enrolled in the early years of elementary school. In Brazil, in 2013 the investment was

3.5 times higher.

Altogether (elementary to higher education) USD

5.000 per student was spent in 2013 in Brazil, USD 3.800 of which went to basic education, while for each educational level OECD member countries invest, on

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average, USD 8,4 thousand / student in the initial years of study, USD 9,9 thousand / student in the final years and USD 9,8 thousand / student in high school, as stated by [14].

Thus, Brazil is one of the countries that spends less on students in basic education when compared to other OECD member countries. However, it presents expenses with students in higher education similar to European countries, according to the [14], making it necessary to increase the resources destined to basic education, allocating these expenses more effectively and efficiently.

Table.2: Percentage of Total Public Investment in Education in relation to GDP, by level of Education - Brazil 2000 - 2015

Year	Percentage of Total Public Investment in relation to GDP (%)						
		Teaching Levels					
	All Levels of Education	Basic education	Child education	Teaching Fundamental		High school	College education
				Years Initials	Years Finals		
2000	**4,6**	3,7	0,4	1,5	1,2	0,6	0,9
2001	**4,7**	3,8	0,4	1,4	1,3	0,7	0,9
2002	**4,7**	3,8	0,3	1,6	1,3	0,5	0,9
2003	**4,6**	3,7	0,4	1,5	1,2	0,6	0,9
2004	**4,5**	3,7	0,4	1,5	1,2	0,5	0,8
2005	**4,5**	3,6	0,4	1,5	1,2	0,5	0,9
2006	**4,9**	4,1	0,4	1,6	1,5	0,6	0,8
2007	**5,1**	4,2	0,4	1,6	1,5	0,7	0,9
2008	**5,3**	4,4	0,4	1,7	1,6	0,7	0,9
2009	**5,6**	4,7	0,4	1,8	1,7	0,8	0,9
2010	**5,6**	4,7	0,4	1,8	1,7	0,8	0,9
2011	**5,8**	4,8	0,5	1,7	1,6	1,0	1,0
2012	**5,9**	4,9	0,6	1,7	1,5	1,1	1,0
2013	**6,0**	4,9	0,6	1,6	1,5	1,1	1,1
2014	**6,0**	4,9	0,7	1,6	1,5	1,1	1,1
2015	**6,2**	4,9	0,7	1,6	1,4	1,1	1,3

Source: INEP (2017)

2.4 Efficiency and the Quality of Brazilian Educational Resources

Efficiency had been included as one of the fundamental principles of public administration, through Constitutional Amendment 19 of 1998, at the time of transition from traditional public administration with bureaucracy to an administration more focused on results and on the cost / benefit ratio starting in Brazil the so-called managerial administration [17], [18].

Since then, studies aimed at assessing the efficiency of Brazilian public spending have become more recurrent,

especially aimed at the efficiency of educational resources, after all, according to [19] it is through education that individual gains are generated, which in turn contribute to increased productivity by raising a nation's economic level.

The first work to address this issue was done in the United States in 1966, through the Equality of Educational Opportunity report prepared by James Coleman [15]. In Brazil, the works of [2], [16], [20], [21],

[22], [23], [24], [25], [26], [27], [28], stand out for addressing the efficiency of public spending on education at the national and regional level.

[2] analyzed the determinants of quality in Brazilian education in 2,837 municipalities in the period 1997, 1999, 2001, 2003 and 2005, noting that there was an improvement in the quality of education in the period analyzed.

For [28], the efficiency of public spending on fundamental education in Brazil in 2011 was inefficient, thus requiring improvements in the management of

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resources used for education. In turn, [20], ratify the inefficiency of public spending by Brazilian states on education, at the fundamental and medium level in 2003

The efficiency of resources allocated to education in Minas Gerais state in 2004 was not effective [23], [21] pointed out that the municipalities in Minas Gerais state with the lowest per capita expenditure on education presented more efficient results, a conclusion also found by [22].

In Paraná state, in the period from 2005 to 2009, spending on education proved to be inefficient, with the need for a review by the public administration of the way in which such spending is used [24]. For [26], the most efficient municipalities in Paraná are those with less than

30 thousand inhabitants, but improvements in resource management are still necessary.

In studies carried out in northeastern Brazil, [25] affirms an increase in the inefficiency of Paraíba municipalities from 2007 to 2009. For [16], there was no difference in the inefficiency of spending on education in the cities of Goiás in the period 2005-2009.

The studies analyzed at national and regional level summarize that "to obtain a quality education, the simple application of resources is not enough, it is necessary that they are used in an effective and effective way" [27], making efficient resource allocation essential to ensure quality and equity in education.

III. RESEARCH METHOD

The study can be classified as a research of descriptive analysis, because it seeks to register and analyze phenomena, without the interference of the researcher, being limited to discovering how often a given phenomenon happens, or how a system, method, operational process or reality [29], [30].

As for the approach, this research is characterized as for the collection and treatment of data, as well as quantitative, as it uses techniques and statistical resources analyzes relationships between variables, establishing patterns of behavior [31], [32].

Data on the total expenditure per capita of 5145 Brazilian municipalities in the period 2005-2013 were collected from the National Treasury Secretariat - STN, in order to estimate the relationship between total municipal expenditure per capita in the results from the FIRJAN [33] Index of Municipal Development - IFDM– Education.

The IFDM is a study carried out annually by the FIRJAN System in order to monitor the socioeconomic development of all Brazilian municipalities in the areas of Employment and Income, Education and Health to see if there had been an improvement in the policies adopted by the municipalities [33].

The index, in turn, varies from 0 to 1, subdivided into the classification categories: low (0 to 0,4), regular (0,4 to 0,6), moderate (0,6 to 0,8) and high (0,8 to 1), that is, the closer to score 1, the greater the development of the locality in the analyzed area [33].

To estimate this relationship, we used the Multiple Linear Regression statistical model, with data stacked in the form of a panel and estimated by Ordinary Least Squares - OLS. Thus, it aims to obtain a mathematical function capable of describing the behavior of a given variable in relation to one or more independent variables [34].

The Multiple Linear Regression model with panel-stacked data is able to aggregate a combination of time series with cross-sectional units. Thus, the total analysis data corresponds to the cross-sectional observations i multiplied by t time periods. This allows for a deeper analysis of the data, as there is more generation of information when compared to the use of only the cross section or time series [35], [36].

For these authors, the stacked data considers the specific individual variables, decreases collinearity and allows the study of more complex models such as studies focused on the dynamics of change. In this way, an empirical analysis is enriched.

Using the mentioned technique and the context of this study, the following Multiple Linear Regression equation with stacked data is proposed for analysis:

$$IFDM\_Education_{it} = \alpha + \beta\, ln\, spendin\, g_{it} + \mu_n \sum_{n=1}^{5} RE\, G_n\, ln\, spendin\, g_{it} + \varphi_t \sum_{t=1}^{8} D_t + \varepsilon_{it}$$

Where:

- IFDM_Educationit corresponds to the IFDM values of the municipalities i in the year t
- expendituresit are the values of municipal spending i in the year t
- REGn is a set of dummy variables with a value of 1 for each of the 5 Brazilian regions
- Dt is a set of dummy variables for the years
- α, β, μ and φ are the estimated coefficients
- Eit is the term of random error.

The software STATA 11.0 Statistics / Data Analysis Special Edition was used in order to estimate the

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coefficients and ascertain the existence of a relationship for each individual coefficient.

The general significance of the model is assessed using the f test, which according to the aforementioned authors corresponds to the values of probability associated with the test (Prob > F). There is the possibility of verifying whether the independent variables used are able to explain the variations in the IFDM - Education by means of Adjusted R^2, which corresponds to the degree of adjustment of the observed data regression line, as stated by the authors.

IV. RESULTS AND DISCUSSIONS

4.1 Overview of Brazilian Education

Fig.2 illustrates information about the average IFDM of the Brazilian municipalities analyzed, where the darkest areas on the map correspond to the lowest scores, while the lightest ones correspond to the highest and therefore the best scores. The blank parts of the map refer to municipalities that do not have an IFDM score due to lack of data in the years analyzed. Among the studied variables. In order to statistically validate the coefficients, he performed a t test, which, as recommended by [37], checks the null hypothesis of the absence of statistical significance

The Brazilian Northeast, in particular Bahia, Alagoas, Maranhão and Piauí along with the Midwest region, with highlighting on Mato Grosso, Mato Grosso do Sul and the Federal District, present a higher incidence of average IFDM of up to 0.56, thus characterizing a performance these regions in the IFDM.

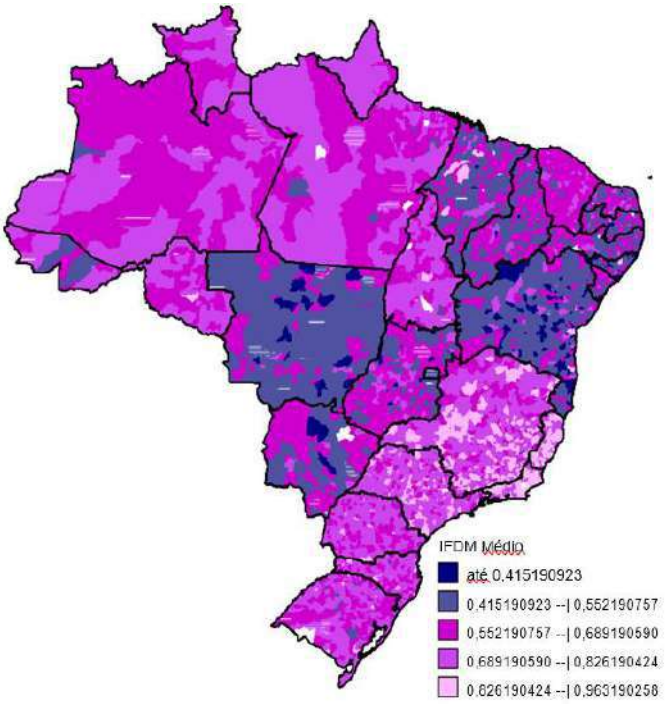

Fig.2: Map of the Average IFDM from 2005 to 2013

Source: Own Authorship through DATASUS software (2018)

Proof of this is that in 2005 the 10 worst Brazilian municipalities in education were from the Northeast, 9 of them from Bahia and 1 from Alagoas. As of 2006, municipalities of Amazonas, Pará and Acre entered the ranking, from which on Bagre – PA could be highlighted, which in 2007, 2008, 2010 and 2011 was the worst municipality in Brazil in terms of education according to the IFDM, with an index of: 0.1930; 0.1805, 0.2469 and 0.2737.

In 2007, 7 of the worst municipalities in education remained those in the Northeast, a fact that was repeated in the following year and worsened in 2009, which again reached 9 municipalities among the 10 worst in education. In 2010, the Northeast had 5 municipalities in the ranking reaching the best mark in 2013 with only 4 municipalities (Ouro Branco - AL, Ibicuí - BA, Jucuruçu - BA and Santa Luzia - BA).

Over the course of the period of study, the São Paulo municipalities stood out among the top 10 in the IFDM score, with the exception of 2007 when the municipality of

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Chapadão do Céu – GO occupied the 10th position with 0.9272.

In 2010, the municipality of Fernão - SP reached the maximum score 1 in the IFDM, which was also achieved by the São Paulo municipalities of Borá, Gabriel Marques, Marinópolis in 2011; Álvares Florence, Borá, Gabriel Marques, Nova Castilho and Tourmaline in 2012; and Floreal, Turmalina, Taguaí and Santa Salete in 2013. Fernão stands out for being the first to reach maximum score and Borá, Gabriel Marques and Turmalina for reaching maximum score in more than a year.

The disparities found in the Brazilian regions portray the existing "two Brazils", which for [33] are divided into South and Southeast on one side and on the other North and Northeast.

Thus, the minimum and maximum values of the scores of the South and Northeast region found in figure 3 that praise this division through the score reached by the municipalities in the region with the best performance (South) with the worst performance (Northeast) in the IFDM - Education.

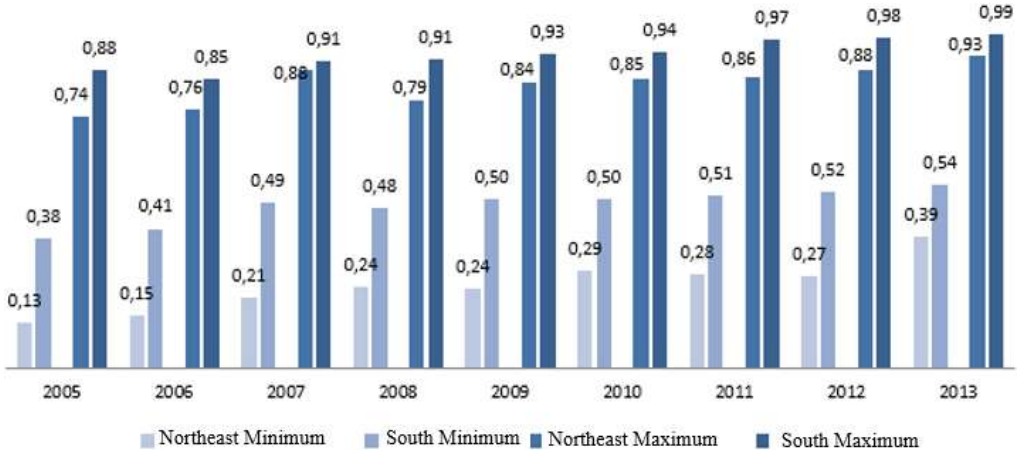

Fig.3: Maximum and Minimum IFDM of the Northeast and South (2005 - 2013)

Source: Adapted from FIRJAN (2015)

In 2005, the South had its lowest score in the IFDM (0,3817). However, it was still 287,64% higher than the Northeast score achieved, which in 2013 assumed a higher value (0,9255), being 106,87% lower than the South score (0,9891).

The wide difference between IFDM scores reaffirms the inequalities between Brazilian regions, providing a picture of the dimension of "[...] the great disparity that still persists in terms of development [33]. For [33], the municipalities with the worst IFDM in 2005 will take 13 years to reach the development standards of the with outstanding municipalities in 2011.

Thus, the expenditures committed in the educational area by each municipality were analyzed together with the score obtained in the IFDM - Education in order to ascertain whether, with the average increase in spending, there was an increase in the score of the IFDM- Education, which corresponds to an increase in the level of Brazilian education.

Fig.4 shows the evolution of spending committed to education and the average score in the IFDM in the years 2005 to 2013, highlighting whether Brazilian children, youth and adolescents received a quality public education through committed spending.

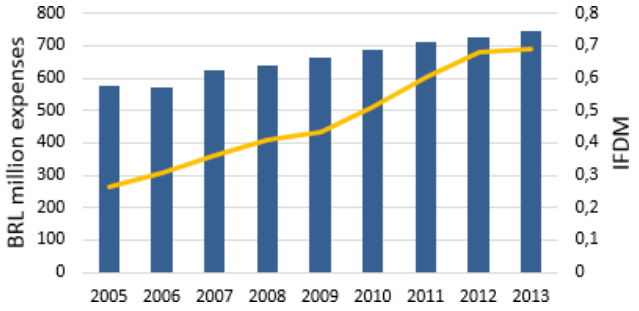

Fig.4: Average evolution of spending and IFDM from 2005 to 2013

Source: Own Authorship (2018)

IFDM has grown since the beginning of the historical series analyzed. It varies by 3,4% per year, reaching the

4.2 Education Spending by Brazilian Region

In order to investigate the social performance of the municipalities from 2005 to 2013, especially in education,

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Stata software was used to analyze the coefficients, robust standard error and significance of each of the variables studied (Table 03), as well as to eliminate possible influences among variables. The South region was the control variable for the model used in this research, which

lowest score in 2006 (0,572 points) and the highest in 2013 (0,746 points). However, for [33] "the indicators that make up the IFDM Education remain far from the goals defined in [10].

Namely, the IFDM has as indicators, the age-grade distortion rate, percentage of teachers with higher education, average daily number of class hours, drop-out rate and the basic education development index - IDEB.

It was only in 2006 that there had been a 4,92% decrease in IFDM compared to the previous year, in the other years only an increase. Regarding spending, in 2006 there was also a decrease of 5,52% compared to the previous year, which in no way detracts from the unique moment experienced by the Brazilian economy from 2005 to 2013, as the GDP increased 35%, there was the generation of formal jobs and 28% increase in average income [33].

For [33], such an environment was conducive to the increase in the collection of taxes destined to the financing of public policies, either through its own collection or through transfers, thus causing greater social action on the part of governments was chosen at random by the software.

The model as a whole and the variables used (education expenditures in each Brazilian region) were statistically significant, indicating that 61.62% of the variations that occurred in the IFDM-Education were explained by the variations in spending, of the 48.222 observations made.

Table.3: Multiple Regression Model Results

IFDM	Coeficientes	Erro Padrão Robusto	P > |t|
Ln gastos	0,3145	0,0010	0,0000
Ln Gastos Norte	-0,0287	0,0003	0,0000
Ln Gastos Nordeste	-0,0303	0,0002	0,0000
Ln Gastos Centro-Oeste	-0,0085	0,0003	0,0000
Ln Gastos Sudeste	0,0077	0,0002	0,0000
Constante	0,4575	0,0061	0,0000
Número de Observações: 48.222 (2005-2013)			
Prob> |F|: 0,0000			
R^2 Ajustado: 0,6162			

Source: Own Authorship (2018)

Over the years analyzed, there was an evolution of the increase in spending on Brazilian education, favoring, in general, improvements in the results in the IFDM - Education of the municipalities.

The Southeast region showed an average increase in the IFDM score, in which for every 1% in the variation of municipal spending in this region, an average increase of 0,0077 is estimated in its score scale.

The other Brazilian regions showed an average decrease in IFDM for each variation of 1% in their spending. The North region showed an average decrease of 0,0287, while the Northeast of 0,0303 and the Midwest of 0,0085, that is, the region that presented the greatest decrease in the IFDM score in the period analyzed outside the Northeast region.

The increase in education spending in Brazil as a whole positively influenced the IFDM by increasing it over the years analyzed. However, when analyzed regionally only in the South and Southeast, it showed growth, as in the Midwest, North and Northeast, it decreased, emphasizing that spending in these regions increased, but there was no increase in the IFDM score.

The results obtained showed that the Brazilian region whose spending contributes most to the quality of education is the South, followed by the Southeast, Midwest, North and Northeast.

Thus, it is necessary that efforts aimed at education in the North and Northeast of the country intensify even more in order to unite Brazil in one, so that Brazilians, regardless of the region they reside in, have access to education basic quality the same way those living in the state of São Paulo have.

These results confirm the findings of [2], who highlights the improvement in the quality of Brazilian education as a whole. However, when analyzed regionally, this panorama changes, as pointed out by [28],

[25] and [20], who state that education spending has

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increased, but that the management of these resources is not efficient at the municipal level impacting the quality of education.

V. CONCLUSION

The study verified the influence of municipal expenditures on the quality of Brazilian basic education, concluding through the applied statistical model, that the variables used (total expenditures per capita) of 5145 Brazilian municipalities in the period from 2005 to 2013 would significantly influence the score of municipalities in IFDM- Education, explaining 61.62% of the variations occurred in IFDM at a confidence level of 99%.

Throughout the analyzed period, it was concluded that the committed expenditures increased, which favored the results in the IFDM-Education of the municipalities, therefore they must be continuously and efficiently managed in order to guarantee quality education from North to South of the country. This did not happen in the analyzed period, since the North and Northeast regions showed less efficiency in these expenses, causing an average decrease in the IFDM score.

It is worth noting that other factors can influence the efficiency of spending committed to education and, in turn, cause reflections on the quality of municipal education offered. Examples could be the high number of students in the public system, high dropout and repetition rate as well as school infrastructure.

Thus, it is suggested to improve the quality of education macroeconomic policies that aim at fiscal balance and efficient management of public resources, especially resources in the North and Northeast so that municipalities can increase in the level of IFDM thus allowing an improvement in the level of development allowing Brazilians to have their needs met.

It also stresses the need to implement policies aimed at maintaining and developing Brazilian basic education, constantly expanding and improving the schools offering public education and student assistance programs, such as psychosocial support.

Finally, it is proposed as a suggestion for future research the in-depth study of the municipalities that stood out positively in the IFDM-Education even though they are located in regions that did not present satisfactory results.

In addition, it is suggested to analyze the nine São Paulo municipalities that obtained higher scores in the IFDM, as a way to assess the way resources are managed and, then, to identify the bottlenecks and potentials for an efficient and quality education in Brazil

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Risk and protective factors for drug use: A scoping review on the Communities That Care Youth Survey

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Abstract**—** *Communities That Care Youth Survey (CTCYS) is a survey of risk and protective factors related to psychosocial behaviors, involving four domains: community, school, family, and peer/individual. The purpose of this scoping review was to evaluate the efficacy of measures of risk and protective factors for drug use by CTCYS, obtained in different cultures and countries, with the aim of cultural adaptation to Brazil. PubMed, SpringerLink, Scopus, and Web of Science were the databases consulted. Besides, we made a consultation with experts in the area and manual search among the references. The study followed the PRISMA protocol. Two reviewers independently undertook the selection and extraction data between January and March 2019, and a third researcher deliberated about the agreements on the process. After applying the inclusion/exclusion criteria, we selected 37 articles. Among the results observed in studies with CTCYS, the pair/individual domain showed the most significant association between risk factors for drug use in several countries: having friends who use drugs or who exhibit antisocial behavior, peer attitudes favorable to use was the highlight. In the other domains, the highest risks were: parenting attitudes favorable to drug use, poor management and family conflict, low commitment to the school, perception of drug availability in the community. The consistency of CTCYS findings in different countries demonstrates the efficacy of this instrument to measure risk and protection against drug use. Therefore, it proved to be a reliable tool for prevention research, which can be used in middle-income countries such as Brazil.*

Keywords**— *Communities That Care Youth Survey, Drug use, Prevention system, Protective factors, Risk factor.***

I. INTRODUCTION

Planning preventive policies increasingly requires the inclusion of risk factor and protection indicators as an essential component in assessing prevention needs, as the main objective of prevention is to anticipate the constitution of the psychosocial problem, minimizing risk factors, and strengthening protective factors (Arthur et al. 2002; Sloboda and Petras 2014). Therefore, it is necessary to develop instruments that allow the measurement of these factors, validly and reliably, to guarantee the planning, monitoring, and evidence of preventive interventions.

In Brazil, the development of preventive strategies, programs, and policies is gradually taking shape, but they still fall short of the international requirements for evidence-based practices (Abreu and Murta 2016; 2018; Pedroso and Juhasova 2018). Among the weaknesses are the few instruments available for measuring risk factors and protection against drug use, violence, and other psychosocial vulnerabilities (Correa 2014). There is the "Brazilian Youth Questionnaire", which has a psychometric validation process (Dell'aglio and Koller 2011) that assesses risk behaviors related to drug use, violence, suicide, and risky sexual conduct. The risk factors considered in it are intrafamily violence, violence

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in the community, conflicts with the law, sexual exploitation, and prejudice. The protection factors evaluated are a support network, access to leisure, spirituality, self-esteem, self-efficacy, and perspectives for the future. It is a long tool, involving many risky behaviors, less focused on drug use. Another instrument is the "Risk and Protection Thermometer", applied in distance courses for the preventive training of public school teachers by UnB (Seidl, Leite and Sudbrack 2014). This instrument, however, does not have a psychometric validation process. We were unable to locate other instruments in our searches.

The Communities That Care Youth Survey (CTCYS) is considered an important tool in the area due to its comprehensive analysis of risk and protective factors and its ability to identify these factors in the territorial extension of the community (Baheiraei, Soltani, Ebadi, Cheraghi, Foroushani and Catalano 2014; Feinberg et al. 2007). It also allows us to acknowledge the prevalence of focused behaviors and how risk and protective factors are shared and interact in the studied population. Thus, based on this tool, it is feasible to build the community profile and, topographically, to map the territorial areas that should be priorities in order to guide the choices to preventive interventions (Arthur et al. 2002; Hawkins 2006).

A synthesis of several longitudinal studies about the etiology of antisocial behaviors in adolescents grounded the construction of CTCYS. Initially, it included measures for 23 risk factors and nine protective factors (Arthur et al. 2002). It was developed and validated in 2002 by North American researchers as a self-report questionnaire for adolescents aged 11 to 18, applied in schools at a class time. Its objective is to conduct a survey of risk and protective factors related to psychosocial behaviors such as alcohol and other drug abuse, antisocial behavior, and violence among young people, involving four domains: community, school, family, and peer/individual (Arthur et al. 2002).

Built-in the context of the Communities That Care (CTC) preventive system, CTCYS assumes the theory of CTC change to compose the strategy of community needs assessment, a fundamental step for the implementation of this system. The CTC developers realized that the success of the system implementation depends directly on an extensive. However, sensitive, valid, and reliable assessment of the community needs because the combination of risk and protective factors is always unique for each territory and needs to be measured empirically, serving as the basis for the planning of interventions (Arthur et al. 2007; Glaser et al. 2005).

Epistemologically, the public health approach founded CTC, incorporating elements of the Social Development Model (SDM). This theory studies antisocial and prosocial behavior by combining ideas of social learning, theories of control, and differential association. It considers that positive bonds with the institutions surrounding the person promote the healthy development of young people in the communities (Brown 2015; Catalano and Hawkins 1996). In general, interventions, whose theoretical basis is the SDM, seek to promote prosocial bonds and reduce antisocial behavior in various stages of development and contexts. Therefore, they seek to enable relationships of reciprocity and to belong by making community involvement rewarding (Arthur et al. 2006; Pérez-Gómez and Mejía-Trujillo 2015). Longitudinal follow-up research has shown the effectiveness of this preventive model in communities (Hawkins et al. 2005; Hawkins et al. 2007).

The original scale of CTCYS shown that "reliability values for most scales are good, averaging about 0.78 across all of the scales. The risk and protective factors are correlated with the problem behaviors as expected, providing evidence of the construct validity of the scales as measures of the specified risk and protective factors" (Arthur et al. 2002, p. 596). The exploratory and confirmatory factor analysis included 121 items for the 29 factors, which resulted in five scales, four of which showed coefficients of internal consistency greater than 0.70, and one scale presented consistency less than 0.60. (Arthur et al. 2002). The scales indicated a good relationship between the factors and the drug use, our object in this review. In another psychometric analysis, it demonstrated consistent results on reliability and validity when applied to different race/ethnicity, gender, and age groups in the United States (Arthur et al. 2007; Feinberg et al. 2007; Glaser et al. 2005), Germany (Groeger-Roth, Frisch, Benit, and Soellner 2015), Iran (Baheiraei et al. 2014b), and Colombia (Mejía-Trujillo et al. 2015), among other countries. Regarding criterion validity, the results were homogeneous when assessing the effectiveness of CTCYS in predicting correlations with drug use in different countries. Considering the evaluation and psychometric properties of CTCYS as an instrument that can measure risk and protective factors, the purpose of this review was to evaluate the efficacy of these measures for drug use, obtained in different cultures and countries, with the aim of their cultural adaptation to Brazil.

II. METHOD

2.1 Study Design

We chose Scoping Review as the method because it is the ideal "tool to determine the scope or coverage of a

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body of literature on a given topic and give a clear indication of the volume of literature and studies available as well as an overview (broad or detailed) of its focus" (Munn et al. 2018, p. 2). The research question that conducted the review was: Which is the efficacy of measures of risk and protective factors for drug use by CTCYS obtained in different cultures and countries? The components of the problem followed the acronym PECOS. Participants were children and adolescents, exposed to the application of CTCYS, without a comparison group (C not applicable), with risk and protection factors such as Outcome measures and mixed studies, with a predominance of cross-sectional studies as a type of studies. We used the description guidelines for reviewing the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) (Moher, Liberati, Tetzlaff, and Altman 2009), without prior submission of a protocol.

2.2 Search tools and eligibility criteria

For this scoping review, we used databases recognized for their scope and focus on the field of health and prevention: PubMed, SpringerLink, Scopus, and Web of Science. Consultation with experts in the area was also an employed strategy, besides the manual search in the references mentioned in the selected articles.

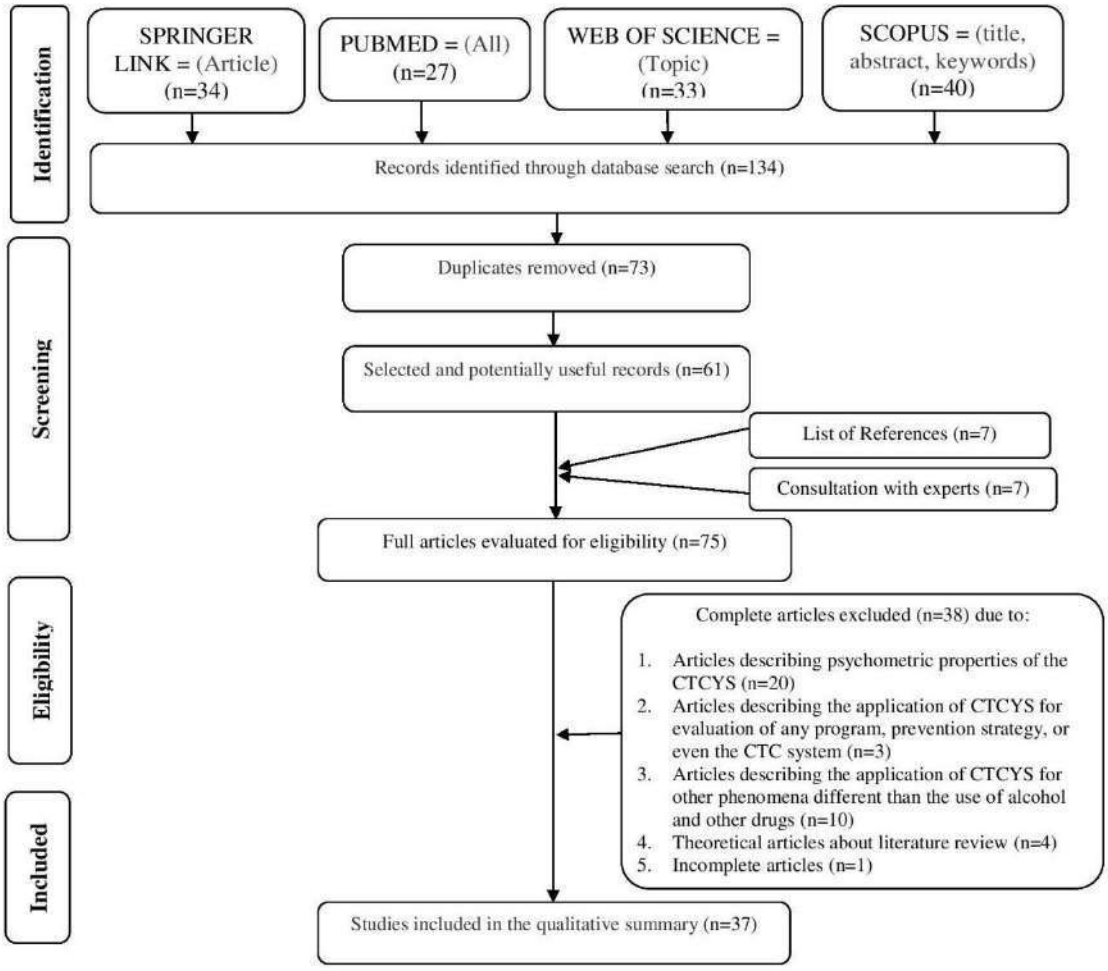

Fig.1: Flow chart of the strategy for the scoping review on CTCYS.

Source: Produced by the authors, based on the Prism Protocol model.

The search descriptor was the full name of the questionnaire in quotation marks. The inclusion criteria were: empirical research that used CTCYS in different countries to research drug use among young people and its association with risk and protective factors. In contrast, the exclusion criteria were: (1) articles describing psychometric validation or cross-cultural adaptations of CTCYS, because the authors produced another study who describes these characteristics and submitted for publication; (2) articles describing the application of CTCYS to evaluate some program, strategy, or prevention system; (3) articles describing the CTCYS applications to

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another phenomenon than the drug use; (4) theoretical articles, literature review; (5) short articles (brief report, for example).

2.3 Data Selection, Extraction, and Analysis

Two independent researchers conducted the search process and called the third arbitrator to decide on the agreement of the process. Figure 1, adapted from the PRISMA Protocol, describes the selection process of the articles, conducted between January and March 2019. We sent the list of selected articles to the CTC International Forum group of experts to check if there were other articles not included due to the search strategies not detecting it.

Initially, the search in the referred databases found 134 studies that referred to CTCYS. Of these, 73 duplicates, leaving 61 articles, adding to the sample seven of it from the manual review of the references and another seven to the suggested by specialists, resulting in 75 articles to evaluation. The application of the exclusion criteria resulted in 37 texts included in this review.

For data extraction, the researchers created a standardized form using the Excel program with these indicators: year of publication, country, objective of the study, sample, design, version of CTCYS, factors, and domains of CTCYS, investigated phenomenon, and outcomes.

III. RESULTS

This section presents the systematization of information on the applicability of CTCYS in studies on risk and protective factors related to drug use behavior, describing the countries of the studies, the methodological designs, and relevant questions about the instrument, such as versions, factors, and domains used. Information on complete data from the 37 studies identified is presented in Table 1, made available in the online supplementary material. We describe the data on the association between risk/protection and drug use in the discussion section, concurrently with their critical analysis.

Among the selected studies, most came from the United States (n=12), the origin country of CTCYS. Another nation most productive was Australia (n=8), followed by Iran (n=4), and Colombia (n=4). Germany, Spain, Ethiopia, Malaysia, and Thailand presented only one article in the scope of this review. The sample included comparative studies, with the United States, who developed the instrument, with Australia (n = 3), and the Netherlands (n = 1). Publication dates ranged from 2004 to 2019, starting two years after developing the first version of the instrument (Arthur et al. 2002).

The most common design was the quantitative approach (n=36), and only one study presented a mixed approach to understanding the phenomena (Chan et al. 2016). Cross-sectional descriptive studies were the most frequent (n=26), followed by longitudinal cohort studies (n=9). Only one identified article used the longitudinal quasi-experimental design (Fagan et al. 2013).

The sample sizes used in the studies varied widely, with the smallest with 324 participants (Kuttler et al. 2016) and the largest with 118,074 (Feinberg et al. 2012). The latter refers to an epidemiological study that compared communities concerning underage drinking. Despite the diversity of countries using CTCYS, the studies conducted with the largest samples (over 14,000 participants) had their locus in the United States. They were generally related to large epidemiological studies developed in this country, except for a study conducted in Colombia with about 50,000 participants.

The original version of the questionnaire was the most used (n=26). However, some countries such as Australia, Spain, Ethiopia, Netherlands, and Thailand, when describing the version of the questionnaire used, mentioned the translation performed but did not refer to any article about cross-cultural adaptation or psychometric validation. The instrument takes risk and protective factors as its main constructs, and in most of the articles, both factors are checked (n=28). However, when the verification was one-sided, most studies (n=8) checked only risk factors, and only one identified protective factors. Regarding the four domains of CTCYS (community, school, family, and peer/individual), the prevalence (n= 22) was the use of the instrument in all its domains. However, according to the objective of the article, some surveys applying only a part of the questionnaire, and others using a part that interested them in making the data analysis.

IV. DISCUSSION

The prevention field has achieved many advances in recent times. However, some gaps remain to be resolved through research on the specificities of the population and their risk and protection profiles, as well as the impact of cultural, social, and political differences between developed and developing countries, among many other challenges (Maguire et al. 2011; Schenker and Minayo 2005). In this direction, it is important to have an instrument such as CTCYS that evaluates the various dimensions involved in risk and protective factors, and that may thus contribute to the consolidation of the theoretical model and evidence-based preventive interventions. Next,

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we present and analyze the results of the research that used CTCYS to check the risk and protective factors for alcohol and other drug abuse, many with similar outcomes in different cultural contexts and countries, although some differences appeared in these findings.

The main correlation was related to age, since, as adolescents progress along the path of formal education, so do the risk rates of drug use. Studies conducted with CTCYS in Colombia (Obando et al. 2014; Zamora et al. 2018), United States (Cleveland et al. 2010; Forsyth et al. 2017; Saint-Jean et al. 2008), Australia (McMorris et al. 2007; Scholes-Balog et al. 2013), and Spain (Larrosa and Palomo 2012), confirmed the theory on the patterns evolution of drug use in the life cycle and the challenges for its prevention (Sloboda and Petras 2014).

Another recurring relationship is about gender. There is a higher prevalence of men, compared to women, in the rates of use of alcohol and other drugs. This correlation was confirmed in studies using CTCYS in Australia (Scholes-Balog et al. 2013), Colombia (Zamora et al. 2018), United States (Morrell et al. 2018; Saint-Jean 2010), Ethiopia (Birhanu et al. 2014), and Iran (Baheiraei et al. 2014b). These data corroborate an analysis of a historical series of data on alcohol use worldwide that confirms that men are more likely to drink than women (Hannah and Roser 2020). However, in a CTCYS survey conducted in the United States, women were more likely to use inhalants (Morrell et al. 2018). In Brazil, there was an increase in the use of alcohol by girls, approaching the standards of boys (IBGE 2016). In the world, UNODC (2019) confirmed that women use more tranquilizers without medical prescription than men, which is a public health problem. Therefore, gender issues are important factors to be analyzed in planning preventive actions.

Regarding the domains related to risk and protective factors, the peer/individual was more prevalent than the other domains (community, school, and family), with significant relation to the use of alcohol and other drugs in CTCYS researches in several countries, such as Colombia (Trujillo et al. 2018; Zamora et al. 2018), United States (Biggar Jr. et al. 2017; Feinberg et al. 2012; Hawkins et al. 2004), Iran (Baheiraei, Soltani, Ebadi, Cheraghi, and Foroushani 2014), and Thailand (Wongtongkam et al. 2014). Specific domains repeated these results, such as the category of "peers who use drugs," evidenced as one of the main risk factors, highlighted in 12 results, involving Australia (Kelly et al. 2012; Scholes-Balog et al. 2013), Colombia (Zamora et al. 2018), United States (Hawkins et al. 2004; Morrell et al. 2018; Oesterle et al. 2012), Ethiopia (Birhanu et al. 2014), Holland (Oesterle et al. 2012), Iran (Baheiraei et al. 2014a; Baheiraei, Soltani, Ebadi, Foroushani and Cheraghi 2017), Malaysia (Chan et al. 2016) and Thailand (Wongtongkam et al. 2014). Similarly, peer attitudes favorable to drug use presented a significant relationship with alcohol and other drug abuse in six articles from different countries, such as Australia (Scholes-Balog et al. 2013), Colombia (Obando et al. 2014; Zamora et al. 2018), United States (Hawkins et al. 2004; Morrell et al. 2018), and Iran (Baheiraei et al. 2017). Transnational studies that compared the reality of Australia with the United States (Hemphill et al. 2011) and one with the Netherlands (Oesterle et al. 2012) found the same shreds of evidence. On the other hand, low perception of risk in drug use was pointed out by Colombia (Trujillo et al. 2018; Zamora et al. 2018), Spain (Larrosa and Palomo 2012), Ethiopia (Birhanu et al. 2014), and Iran (Baheiraei et al. 2017) as a factor that significantly predicts the abuse of alcohol and other drugs among young people. However, in a survey in Thailand, controversial results were found, since 63% of young people who considered the risks of drug use low were less likely to use alcohol (Wongtongkam et al. 2014). Theoretical reviews highlight the importance of peer influence in shaping adolescent identity, associated with approval, advice, and reproduction of peers and friends' lifestyles (Sloboda and Petras 2014).

Another relevant category about the risks for the use of alcohol and other drugs was the interaction with peers who exhibit antisocial behavior, which emerged in the United States (Hawkins et al. 2004; Feinberg et al. 2012), Colombia (Obando et al. 2014), Iran (Baheiraei et al. 2017), Thailand (Wongtongkam et al. 2014) and in both countries in the comparative study between Australia and the United States (Hemphill et al. 2011). On the other hand, favorable attitudes and rewards for antisocial behavior were another significant categories of risk in the samples from Australia (Hemphill et al. 2011), Spain (Larrosa and Palomo 2012), and the United States (Hemphill et al. 2011; Feinberg et al. 2012). However, in Thailand, paradoxically, adolescents with attitudes favorable to antisocial behavior were 60% less likely to use marijuana and 50% less likely to consume alcoholic beverages (Wongtongkam et al. 2014). These studies are related to others in criminology, which associate drug use, antisocial behavior, and delinquency (Murray et al. 2018).

Another important risk category to drug use in adolescence was the attitude of seeking intense sensations, as we have seen in studies in Australia (Scholes-Balog et al. 2013), Colombia (Trujillo et al. 2016), United States (Morrell et al. 2018), Iran (Baheiraei et al. 2017), and Thailand (Wongtongkam et al. 2014). Other review studies have defined pleasure-seeking as one of the main factors

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leading to early drug use by adolescents (Baumeister, and Nadal 2017) and as a risk factor in terms of mental health condition in teenagers (Pinto et al. 2014).

The characteristic of insubordination or rebelliousness was present in the research results in Australia (Hemphill et al. 2011; Scholes-Balog et al. 2013), United States (Hemphill et al. 2011; Oesterle et al. 2012), Netherlands (Oesterle et al. 2012), and Thailand (Wongtongkam et al. 2014) as a risk factor influencing the onset of drug abuse. In turn, in the research conducted in Colombia, insubordination predicted neither drug use nor antisocial behavior (Obando et al. 2014). The positive perception of oneself as "cool" is related to the popularity perceived among peers and usually appears as an important characteristic in the social relation with drug use (Hawkins 1999; Schenker and Minayo 2005). In this review, this result appears in Colombia (Trujillo et al. 2018) and the United States (Biggar Jr. et al. 2017). However, a survey that took into account the results of the United States and also of Australia, in a comparative way, revealed that the students gave little support to the use of drugs as fine or "cool" (Eisenberg et al. 2014).

The family risk factor with the highest rate in the results considers the parental attitudes that contribute to drug use. It was present in the results of six studies conducted with samples from Spain (Larrosa and Palomo 2012), United States (Morrell et al. 2018), Iran (Baheiraei et al. 2017), and Malaysia (Chan et al. 2016). Besides, there are two transnational studies: Australia - United States (Hemphill et al. 2011) and the Netherlands - United States (Oesterle et al. 2012), with evidence in both surveyed countries. The family history of drug use was also present at some extent in the results of a research conducted in Ethiopia (Birhanu et al. 2014), Iran (Baheiraei et al. 2014a; Baheiraei et al. 2017), United States, and Australia (Hemphill et al. 2011).

On the other hand, poor family-management was a risk factor associated with drug use in the results of Australia (Hemphill et al. 2011; Scholes-Balog et al. 2013), United States (Fagan et al. 2013; Hemphill et al. 2011), and Iran (Baheiraei et al. 2017). However, another survey conducted with an Iranian sample presented the opposite result, since, for men, all risk factors were predictors for lifetime tobacco use, except for family mismanagement (Baheiraei et al. 2014a). Another significant risk factor for drug use was the family conflicts, as shown in the results from Germany (Kuttler et al. 2016), Australia (Chan et al. 2013), Colombia (Trujillo et al. 2016), and Iran (Baheiraei et al. 2017). Finally, reinforcing the relation between drug use and antisocial behavior, the family risk factor that considers the parent attitudes that favor antisocial behavior was significant in predicting drug use in Spain (Larrosa and Palomo 2012), Australia, and United States (Hemphill et al. 2011). A meta-analysis investigation of 131 studies corroborates the findings of this review, as it found that "risk of adolescent alcohol misuse is positively associated with the parental provision of alcohol, favorable parental attitudes towards alcohol, and parental drinking. It is negatively associated with parental monitoring, parent-child relationship quality, parental support, and parental involvement" (Yap et al. 2017, p. 1142); these last factors act as protective factors.

In terms of risk factors for the school dominion, low commitment to the school was a significant risk factor for drug use in countries such as Australia (Hemphill et al. 2011; Chan et al. 2013; Scholes-Balog et al. 2013), United States (Hemphill et al. 2011), Iran (Baheiraei et al. 2017), and Thailand (Wongtongkam et al. 2014). The risk factor related to the school failure spectrum was related to the use of alcohol and other drugs in studies conducted in Spain (Larrosa and Palomo 2012), Ethiopia (Birhanu et al. 2014), Iran (Baheiraei et al. 2017), and in collaboration research carried out in Australia and United States (Hemphill et al. 2011), with positive results on this relationship for both countries, and also in research involving only the North American specific context (Morrell et al. 2018). These data corroborate other research on school commitment and student health, which indicates that "students with lower academic commitment were more likely to report ever smoking, drinking alcohol, or misbehaving. Students with lower belonging were more likely to report ever drinking alcohol and engaging in school misbehavior" (Bonell et al. 2017, p. 217).

Regarding the CTSYS community domain, the perceived availability of drugs in the community was an important risk factor. Such ease of access was significant in studies from Australia (Scholes-Balog et al. 2013), Colombia (Zamora et al. 2018), Spain (Larrosa and Palomo 2012), Iran (Baheiraei et al. 2017) and in a transnational study between Australia and the United States (Hemphill et al. 2011), in both countries. In the same direction, the risk factor related to laws and norms favorable to drug use in the community was present in the findings of studies conducted in Australia (Hemphill et al. 2011; Scholes-Balog et al. 2013), Ethiopia (Birhanu et al. 2014), and Netherlands (Oesterle et al. 2012).

Lesser studies have emphasized the protective factors of drug use. The specialized literature has proven their value as moderators of risk factors (Catalano and Hawkins 1996; Hawkins 1999; Souza and Oliveira 2011). Among the articles analyzed in this study, one of them, conducted in Colombia, considered factors that are significant to

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protect, both from drug use and antisocial behavior. In its result, it concluded that the protective factors exert minor influences on the presence of antisocial behavior and drug use compared to the strength of the risk factors (Obando et al. 2014).

As for the community dominion, the literature analysis made a caveat about the protecting factor related to the rewards for prosocial involvement in the community: in a survey conducted in Spain, this factor, when present as a characteristic of teenagers, indicated protection for the drug use (Larrosa and Palomo 2012); on the other hand, in the United States, community rewards for prosocial involvement predicted later drug use, proving to work in the opposite intended direction (Morrell et al. 2018). The opportunities and rewards of school for prosocial involvement proved to be an important protective factor for drug use, evidenced in studies in Australia (Bond et al. 2005), Spain (Larrosa and Palomo 2012), and Iran (Baheiraei et al. 2017). In contrast, this same school-oriented factor in Thailand does not contribute as mediating protective factors against the use of alcohol and illicit drugs, except in the case of marijuana (Wongtongkam et al. 2014).

The protective factors specific to the family domain that deserve mention are family rewards for prosocial involvement, present in results from Australia (Bond et al. 2005), Spain (Larrosa and Palomo 2012), and Iran (Baheiraei et al. 2017). Positive attachment to parents in Australia (Bond et al. 2005), Colombia (Trujillo et al. 2016), Spain (Larrosa and Palomo 2012), and United States (Fagan et al. 2013). For the latter, another US survey presented divergent results, with the perception of maternal affection predicting drug use instead of being a protective feature (Morrell et al. 2018).

The belief in the moral order usually appears in the literature as a protective factor for drug use of the peer/individual domain (Jonkman 2012; Monahan et al. 2014). This review based in CTCYS confirmed this correlation in studies from Australia (Bond et al. 2005; Hemphill et al. 2011), Colombia (Trujillo et al. 2018), Spain (Larrosa and Palomo 2012), and United States (Hawkins et al. 2004; Hemphill et al. 2011; Oesterle et al. 2012). In a survey conducted in the United States, negative beliefs about drug use predicted the use (Morrell et al. 2018), showing contradictory results. In the same way, participation in religious activities was present as a protected characteristic for the drug abuse in results from the United States (Hemphill et al. 2011), Ethiopia (Birhanu et al. 2014), and Iran (Baheiraei et al. 2017), even in countries with different religious beliefs. However, in one United States survey, the result was the opposite, since religious activity revealed drug use in adolescents (Morrell et al. 2018).

The findings here presented, evidenced through the application of the CTCYS, demonstrate an important relation between drug use and antisocial behavior, as well as criminal acts and antisocial behavior. On the other hand, opportunities and rewards for prosocial involvement were protective factors for drug use, being present in the results of various samples, at the community, school, and family/peer domains.

As evidenced by structural checks of the constituent theories of the SDM, involvement with people (family, friends, schoolmates, neighbors) who present antisocial behavior or attitudes that favor it directly affects the beliefs of the individuals about antisocial behavior. A similar protective effect occurs on the opportunities, rewards, and attitudes of prosocial involvement and positive emotional attachments. Socioemotional and cognitive abilities also exercise direct protection over antisocial behavior (Brown et al. 2005).

V. CONCLUSION

In this study, it was possible to verify that CTCYS performs a wide sensitive association between risk and protection factors to drug use in different domains. The selected studies demonstrated an important cultural and economic diversity in the countries that applied the CTCYS. The instrument showed that even in various cultural, linguistic, and ethnic contexts, there were similar results regarding these factors in the correlation with drug use. However, the amount of analysis on the topic is even more noticeable in developed countries. Therefore, there is still a gap to explore the performance of this tool in measuring risk and protection factors in low and middle-income countries.

There was a predominance of assessing risk factors over protectors since only two studies focused exclusively on the latter. Although most research considers both factors, the studies explored the risk further. This insufficient targeting of protective factors can lead to difficulties in using this tool in the context of health promotion programs or strategies. Health promotion has as its constitutive mark the attitude of moving away from the focus of diseases and seeking to enhance the positive aspects already present in the group or the territory. Consequently, knowledge of protective factors is crucial. For that reason, we recommend expanding studies on the protective factors measured by CTCYS that could expand the use of this instrument in the sense of health promotion actions.

It is worth mentioning some possible limitations of this study, which may exclude some articles. This situation may occur due to the search key reach and the choice of bases that limit access to articles. We also have to consider that English is the predominant language of these databases, and we still need to reach articles in other languages. Likewise, the selected search algorithm may not have been sufficient to capture all the articles intended in the outlined objective. We have tried to overcome this gap by consulting experts and referring to the references of the chosen articles. However, we could miss some articles. In this study, the researchers selected to use only scientific articles due to their more homogeneous access and selection. However, we excluded other important sources of information such as reports, book chapters, dissertations, theses, or papers presented in conferences that might have contributed to this analysis. Another limitation to be mentioned is the fact that we did not use the standard protocol to analyze the quality of the studies individually, and we chose to evaluate the results jointly since we intend that the results of this review can support the cultural adaptation of CTCYS for Brazil.

The regularity of the findings in different countries demonstrates the efficiency of this instrument for this type of measurement. It confirms that CTCYS is consistent with the assumptions of its leading theory of change. Its wide use in different regions and cultures makes this questionnaire one of the most effective today for measuring risk and protective factors for youth, especially in drug use. The CTCYS seems to be a concrete, reliable, and exciting possibility for the research field in low and middle-income countries, considering its breadth and sensitivity, bringing useful perspectives for its applicability in Brazil.

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To the International Communities That Care Meeting members.

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Social and Individual Vulnerabilities for Infection of Diseases by Hydro placements in Varzea Communities in the Municipality of Santarém-Pa

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Abstract**—** *The low quality of water associated with the lack of basic sanitation, are some of the main factors that imply the transmission of diseases to the population.* ***Objective:*** *To assess social and individual vulnerabilities for infection by waterborne diseases in floodplain communities in the municipality of Santarém-Pará.* ***Method:*** *This is an epidemiological, cross-sectional, descriptive, analytical study with a quantitative approach, carried out through statistical surveys, transcribed for the SPSS program by performing the X^2 test (Chi-square).* ***Result:*** *All data obtained showed significant p.* ***Conclusion:*** *Socioeconomic factors influence directly or indirectly on the human being's life condition, reflecting on the health and disease process, on the living conditions of riverside communities in the Amazon region.*

Keywords**— Social vulnerability, Water, Water treatment.**

I. INTRODUCTION

According to the World Health Organization, 85% of the population is affected by pathologies acquired from the ingestion of water or food contaminated with their respective pathogens. Thus, the low quality of water associated with the lack of basic sanitation, aggravated by the insecurity of the water coming from the population's supply system, the precarious conditions of hygiene, the very environment and provision of water and floods, are some of the main factors that imply the transmission of diseases to the population [1,2].

The fact that water is distributed irregularly in different regions of Brazil makes it necessary to know how it is arranged, and the environmental conditions in which it is inserted, since these factors can directly influence its quality, making it susceptible to possible contamination [3]. In rural areas and in floodplain communities, the risks of outbreak episodes are higher because of the possibility of contamination of water collections with pits and pasture areas occupied by animals [4].

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Within this context, some microorganisms are related to the transmission of diarrheal infections, including viruses, bacteria and parasites, of which the following stand out: Rotavirus, *Escherichia coli* , *Shigella spp* , *Salmonella spp* , *Vibrio cholerae* , *Giardia spp* , *Cryptosporidium spp* , among others [5] . These pathogens that cause these diseases need water to complete their life cycle, as they find a favorable environment in contaminated waters [6] .

So, it is relevant to study the panorama to which these floodplain communities are inserted, in order to assess the social and individual vulnerabilities for waterborne disease infection in floodplain communities in the municipality of Santarém-Pará

II. METHODS

This is an epidemiological, cross-sectional, descriptive, analytical study with a quantitative approach, carried out through a statistical survey on the vulnerabilities to the occurrence of waterborne diseases in the communities of São Ciríaco , Aramanaí Campus and Urucurituba located on the banks of the Amazon River in the municipality of Santarém in western Pará.

These communities are located on the right bank of the Amazon River, about an hour and a half trip by waterway, from the city of Santarém, in western Pará, with a population of approximately 600 people.

In this study, a form was applied that dealt with socioeconomic data and behavioral risk factors of these individuals, with 111 people arguing.

The information was coded and tabulated *using Microsoft Excel* 8.0 *software* , being evaluated the absolute frequency and relative frequency. Subsequently, they were transcribed to the SPSS program, performing the X^2 test (Chi-square), with a significance level (p) of 0.05 being established, with results presented in tables.

III. RESULTS

Table 1 - Socioeconomic Factors of residents of the Santarém-Pará floodplain communities.

Variables	%	P
Number of residents / residence		<0.0001
Less than 3	16	
4 to 6	67	
6 to 10	15	
More than 10	1	
Family income		<0.0001
1 minimum wage	38	
2 minimum wages	12	
3 minimum wages	1	
4 minimum wages or more	0	
Without fixed income	49	
Degree of Education		<0.0001
Primary	9	
Fund. Complete	28	
Fund. Incomplete	34	
Complete high school	21	
Incomplete high school	6	
Incomplete higher	1	

p: level of significance .

Table 1, presented above, contains the socioeconomic data of the population with regard to the number of residents in each residence, highlighting those between 4 to 6 residents representing 67%, with a significance level of $p < 0.0001$, an important data for that study . Regarding family income, it was observed that the majority, 49%, do not have a fixed income, whereas 38% receive only a minimum wage. When performing the statistical test, it proved to be significant, with $p < 0.0001$. Regarding the education level of the population, the indices of incomplete elementary education stood out with 34%, followed by complete elementary education in 28% of the sample, with significance of $p < 0.0001$ to the statistical test.

Table 2 represents the data on the origin of the water used in the community and the type of treatment carried out to consume it. The rate of 85% refers to water originating in the river and only 2% coming from the well, with a statistically significant level of $p < 0.0001$ being observed for the research . The water used for consumption that is treated with chlorine has 84% prevalence and that which is boiled, 16%. The other forms of treatment were not answered. After the statistical test, a level of $p < 0.0001$ was found, which is relevant to this study.

Table 2: Origin and treatment of water carried out by residents of the Santarém-Pará floodplain communities.

Variables	%	P
Origin of water		<0.0001

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River	85	
Cacimba	0	
Well	2	
Lake	6	
Mineral	0	
Plumbing	10	
Drinking water treatment		<0.0001
Chlorine	84	
Boils	16	
Filter	0	
Does not treat	0	
Others	0	

Source: Socioeconomic form; p *: level of significance.

Regarding the use of drinking water for other purposes (Table 3), it was observed that 65% of residents do not use the same water they consume for other purposes, with only 34% responding to using it. On the statistical test, the level of significance was p <0.0026.

Table 3 - Use of drinking water for other purposes by residents of the Santarém-Pará floodplain communities.

Variables	n%
Yes	34%
No	65%
P*	<0.0026

Source: Form data; p * = level of significance.

In table 4, referring to the forms of water storage, the pot was found to be the most used, totaling 54.95%, followed by the water tank with 41.44 and the thermos with 2.70%. The level of significance, according to the statistical test, is p <0.0001.

Table 4 - Form of water storage carried out by residents of the Santarém-Pará floodplain communities.

Storage	n%
Water Tank	42.34%
Bowl	54.95%
Thermos	2.70%
P*	<0.0001

Source: Socioeconomic form; p *: level of significance.

Table 5 - Frequency of cleaning of the reservoir carried out by residents of the Santarém-Pará floodplain communities.

Frequency	n%
2 times per year	1.8%
Every 3 months	0.9%
Every 2 months	0.9%
1-2 times a month	7.2%
Once a week	32.4%
2 times per week	26.1%
Daily	13.5%
Every gallon change	16.2%
Do not know	0.9%
P*	<0.0001

Source: Socioeconomic form; p *: level of significance.

Table 5, shown above, refers to the data on the frequency of cleaning of the water reservoir, which found that 30.6% of the interviewed residents said they performed cleaning once a week, followed by each change of water. gallon, with a 16.2% index . The coefficient of community members who wash the water storage site twice a week was 14.4%, while 13.5% reported cleaning daily. The test applied to these variables showed a significance of p <0.0001.

IV. DISCUSSION

In riverside communities, it is common to have an average of three or more residents per residence, as shown in the present study (table 1), similar to that carried out by Silva and Moura [7] in four communities in the state of Pará, where a prevalence of 60 was found, 7% of houses with three to five residents. In rural areas, the picture of poverty is more widespread and an equal or greater number of people per household suggests that there is a deficit in the quality of life of residents, associated with low income, poor sanitation, hygiene, water and health care. which reflect on their health-disease process.

As for income, it is noteworthy that most of the research participants reported not having a fixed salary, followed by those who receive a minimum wage and, thus, support large families with insufficient values to meet the basic needs of all, making them vulnerable to environmental conditions [8] . Reality faced by families living in an area where the prospects for employment with a fixed income are minimal.

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And this is not just a condition in the state of Pará, but was also evidenced in a study carried out in the semi-arid region of the Central Sertão do Ceará, where 50% of the participants receive up to half the minimum wage. In view of this, it is noted that individuals with common realities but from different regions are subject to the same living and housing conditions [8]. This aspect is even more evident when related to the educational level of these individuals.

Regarding the level of education of the research participants, no case of illiteracy was registered, unlike the study carried out in two communities on the extreme west coast of Ceará, where there was a total record of 86.7% illiterate [9]. As the data shows, this index is alarming in the Northeast region and contributes negatively to the development of the population as it is a serious example of social and educational abandonment [10].

Another study carried out in the flooded area of the state of Amapá shows a prevalence of 30.9% of people who have not yet finished elementary school, and 19.7% for those who have already finished elementary school, data that corroborate with what was observed in present study [11]. This question leads us to reflect that they have basic educational knowledge, despite living in regions where the difficulties to study are greater with regard to access to school, associated with the low income factor to acquire educational material. Therefore, this knowledge may not be sufficient for them to act as subjects weighted in the community in which they live, based on individual and collective learning.

The use of water directly from rivers is very common in the Amazon region, and permeating this issue, the precarious conditions of sewage collection and treatment are observed, which undoubtedly affect the quality of water resources, sources for many families, for example. account of the content dumped directly under the riverbed, which is worrying when there is a percentage of only 9.4% households in this region, served by an adequate sewage network [12].

Studies conducted by Giatti and Cutolo [12] in the legal Amazon through participatory diagnosis are similar to the results of this study, since in the District of Iauaretê , an indigenous land in the state of Amazonas, most community members claim to use water directly from the river due to the difficulty of transport and the distance to travel to other sources, as may be happening in the floodplain communities, since they are a considerable distance from the city of Santarém.

However, moving to a different regional reality, in the case of other non-urban areas, it may be common to use wells, as in the study by Magalhães et al [13] in the state of Minas Gerais, in which 69.4% of respondents used this medium to capture water, already in this study, the minority has a well in their house, with the peculiarity of regions rich in water resources, such as the Amazon, and even the ease of obtaining water from a nearby natural source, a more viable choice for residents.

As for the particularly urban context in Duque de Caxias, Rio de Janeiro, shown by Freitas, Brilhante and Almeida [14], it shows that 67.29% of the residents are served by a general supply network and 32.27% by wells, differentiating themselves from the present study.

The way in which water is treated or stored is directly associated with the prevention or susceptibility to its contamination by microorganisms , being a configuration of both environmental and behavioral aspects [15].

Despite being a riverside community, there is a positive parameter when compared to areas closer to urban centers, although socioeconomic conditions are not as privileged, as seen before (table 1). Thus, it is possible to observe that the vast majority in this study uses the water chlorination method for its treatment, demonstrating that they have some degree of information on how to treat water, although they do not have a higher level of education. In contrast, Rocha et al [16] shows that 56% of respondents in Lavras, Minas Gerais, do not even use a type of water treatment.

Still in the context of the same state, in Paula Cândido, totaling 55 respondents in the rural area, there is an alarming coefficient of 51 participants (92.7%) not treating the water they drink, against only 4 (7.3%) who use chlorine for treatment. In the urban area, with 17 respondents, the numbers become more favorable, with 15 (88.2%) performing chlorination, and only 2 (11.8%) do not undergo any type of treatment [13].

Corroborating these studies, in Manaus, 146 people (49.8%) do not treat the water they use at home, 113 (38.7%) claim to add the chlorination method, and the boil is listed by 11 respondents (3 , 7%) [17].

The issue of water treatment in floodplain communities demonstrates that even if they do not have a complete or satisfactory education, combined with a low income, these community members choose to prevent themselves, although they may not understand for certain the relevance of using chlorine or the boil for your health and the community, but they have the notion that the water that comes to them may be unclean or contaminated.

In this sense, the procedure adopted by the majority of the population at the study site, the chlorination of water, is efficient in disinfection and in topics such as inactivation

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of bacteria and viruses, stable residual effect, in addition to having low cost, simple handling, availability in the among others [18]. In this way, the highlighted points make it easier for the community to access this method, providing the possibility of better treating water and protecting against various waterborne pathogens.

The present study showed that most residents of the Santarém- Pa floodplain communities do not use their own drinking water for other uses. However, in a study carried out in the community of Ressaca do Congós , in Amapá, it was observed that the water used for consumption by these residents comes from the tap, totaling 96.3% [11].

Corroborating this, in a riverside community in the city of Belém- Pa , 100% of the families stated that they use tap water for domestic use [19] and because this is a region located in the Amazon basin, it is understood that drinking water comes from river being also used for washing clothes, dishes and cleaning the house, becoming a worrying fact, as a microbiological analysis carried out in the hydrographic basin of the Caeté River, in the same state, proved to be outside the parameters of Brazilian legislation, putting at risk the residents of that region [20]. Still in this context, in the city of Parnaíba, state of Piauí, 1.4% of residents use water from wells or rivers to drink, wash clothes and food, increasing the vulnerability of infection by some micro-organism carried by water [21].

In this way, the present results indicated that the residents of these floodplain communities, receive or received some guidance on the use of water that they consume is not the same used for other purposes. With this, it is possible to perceive the mobilization of health professionals regarding water-borne diseases in this region and their concern in preventing this population.

Regarding the storage of water for consumption, the prevalence of smaller water reservoirs was verified in the form of the present study, in this case the 54.95% pot. This corroborates the research by Esteves [19] in riverside communities in the municipality of Belém- Pa , where this same medium was found to be the main form of storage, with 63.64%. Thus, it is understood that the water stored by this means can be designated for the consumption and food preparation of these residents.

Still in this context, in studies carried out by Bernardes and Bernardes [22], in the São Raimundo community of the Juruá river, the choice to store water in pots is due to the fact that it keeps the water fresh for consumption. Situation this can also be preferable for the residents of this research, where electricity is scarce.

Regarding the use of the water tank for storage, it is present in 42.34% of the results, as a second way of retaining water in these communities. But in studies carried out in the Conquista neighborhood of the city of Santarém- Pa , the water tank is the main form of storage, totaling 66.67% [23] since in this location the residents complain about the lack of it most of the day, while that the main source of water for the riverside communities comes from the river, due to its abundance and ease of acquisition.

Although the water tank is a container that allows a greater amount of water to be stored, it was not preferred by the residents, since activities such as washing dishes and clothes can be done on the riverbed.

It is important for this research to emphasize the use of the pot, since this utensil is present in greater number. Thus, it is assumed that this container, because it contains little liquid, allows easier and more frequent cleaning, as it does not take long to dry. In this way, before the water is stored it can be boiled and chlorinated in the right measure, avoiding contamination of these residents. These containers are, therefore, the most suitable for storing water for consumption by these families, due to the flexibility of use.

The conditions under which water is stored can be an immediate determinant of its contamination by pathogens. For example, if the home reservoir is in inadequate conditions, or even the use of an incorrect hygienic technique, and the frequency with which it is performed or not, affect this issue, directly affecting the health of a community [24,25].

In contrast to the results found, in Paraná, both Delbemet al [26] and Tsutsui et al [27], highlight in their work the lack of cleaning of the reservoirs, directly correlating them as a risk factor to the transmission of infectious diseases in both humans and animals.

In the same vein, another survey, carried out in Bahia, shows that of the 20 reservoirs verified, only one (5.00%) receives cleaning twice a year, every six months, while another (5.00%) has never been cleaned, and regarding the other 18 (90%), the interviewees were unaware of the period in which the last cleaning was performed [28].

Therefore, as recommended by the National Health Surveillance Agency (ANVISA), it is pertinent that any water storage location should be cleaned at least twice a year, using bleach and water, diluting them according to the size the reservoir [29].

Results such as those found in the communities studied, demonstrate that the technique of cleaning the water

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reservoir at home ended up becoming a continuous and frequent habit among its residents, as most of them affirm to do it weekly, which appears as a positive point in these locations. , where an association with precariousness and lack of resources is erroneously printed due to the distance from the urban center. And yet, such practice tends to have favorable results with regard to water storage, avoiding its contamination by microorganisms present in the reservoir.

V. CONCLUSION

It is then assumed that socioeconomic factors influence directly or indirectly on the human being's living condition, reflecting on the health and disease process, on the living conditions of the riverside communities of the Amazon region.

As seen in the results obtained in this study, it was also observed that the form of storage, the treatment of water and the maintenance of its integrity is directly related to its quality and consequently the health of the individuals who consume it. Thus, when dealing with geographically and economically disadvantaged communities, it was possible to verify that, positively, they apply prophylactic measures to disinfect water.

Thus, health units are potentially allies in the process of reducing vulnerabilities in these communities, collaborating in the prevention and promotion of health, especially with regard to waterborne diseases, providing guidance and distribution of material for the treatment of water and patients.

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Reliability Analysis in the Software R

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Abstract*— *The reliability study can be used to analyze the times of faults of the equipment and to determine which distribution is adjusted better to the data. There is software that executes this type of procedure, however, most of them are developed for application in the industrial sector, being generally paid and closed. This work aims to develop a code in R software capable of analyzing and determine which distribution is adjusted better to the data, using goodness of fit tests (numerics and graphics). Famous distributions such as Weibull and Lognormal were implemented, as well as complex distributions, such as the Generalized Gamma. For analysis, the code displays results from various tests such as Likelihood Ratio Test (LRT), Kolmogorov-Smirnov (KS) and Chi-square (χ2), in addition to generating graphics of density, accumulated density, reliability, risk and showing the roles of the probability of distributions. All the code was developed in R, as it is a free platform, so it facilitates the work of researchers and companies in the reliability sector. Three sets of equipment failure time data were analyzed, the results found has been coherent and some superior cases when compared with other works and software.

Keywords*— *Data modeling, failure times, probability distributions, R code, survival analysis.

I. INTRODUCTION

The modeling of failure times is important for the study of reliability. Therefore, to model mathematically the studied objects, it is necessary to use the probability distributions that relate a given value of the studied variable with the probability of occurrence (CRESPO, 2005).

According to Haviaras (2005) the distributions most used to model failure times are Exponential, Gamma, Lognormal and Weibull. The analysis consists of selecting the distribution that best fits the failure times (WUTKE; SELLITTO, 2008). After defining the distribution that characterizes the data, it is possible to obtain the reliability function, risk function, density function and the average time to failure (FOGLIATTO; RIBEIRO, 2009)

In general, this modeling is done using software that indicates which distributions best fit the failure times. The software R (R CORE TEAM, 2020) allows the application of numerical and analytical methods, being a differential about software that allows only analytical calculations. Besides, the R software is free, making it easier for users to obtain fault data modeling, usually limited to paid software and developed for restricted environments, such as corporate ones.

Moreover, some methods can be used to determine or to indicate which better model describes the failure time data. These methods can be divided into graphs and numeric. The paper of the probability, for example, is a graphical method in which it linearizes the accumulated density function (FALCETTA, 2000). Regarding numerical methods, there are tests such as AIC (Akaike Information Criterion), Loglik (Log-Likelihood) and LRT (Likelihood Ratio Test).

The objective of the work is to create a function (RELPF) using software R to analyze two groups of failure times and to determine which model is the most suitable. This function contains analytical and numerical distributions, as well as the use of graphical and numerical methods to conclude about the adequation or not of the specified distribution.

II. METHODOLOGY

To perform the RELPF function, it is necessary to supply failure times of a product or equipment. Through these failure times, the reliability analysis is performed.

The R is software and a programming language. It manipulates, analyzes and simulates the probability of the

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data to follow the most diverse models of existing distributions. For this, it is required to install and load packages, such as survival, flexsurv, zoo, sfsmisc, fitdistrplus, weibullness. All this process of installation and/or loading of packages were developed so that it is not necessary to execute manually.

The distributions implemented in RELPF for data modeling were: Generalized Gamma, Gamma, Weibull, Weibull with 3 parameters, Lognormal, Normal and Exponential. It is by means of these distributions that if which verifies the best one if it adjusts to the equipment failure time.

For each distribution, the Maximum Likelihood Method was used to estimate the parameters. The first distribution to be interpreted by the R is Generalized Gamma, later is possible to get the Loglik that serves of measure of adjustment to effect the LRV of the other distributions, with the use of the package flexsurv. Moreover, it is possible to get the AIC of the Generalized Gamma distribution.

In relation to the other distributions, beyond the AIC and Loglik, the LRV was carried through. The LRV serves as a statistical test of the fit quality between two models. In addition, the p-value was performed, it is characterized as a descriptive number for decision making in the tests. In addition, MTTF (mean time between failures), t10 and t50 (the period in which 10% and 50% of equipment fail, respectively) were also calculated. However, of the Weibull distribution of 3 parameters, only its parameters were extracted.

Ahead, the tack tests were carried out. The $\chi 2$ and KS tests had been gotten for all distributions, except for the distribution Gamma Generalizada and Weibull of 3 parameters. These tests can be performed in several ways, then, the results had a small difference from the results of famous software such as ProConf (FRITSCH; RIBEIRO, 1998). However, the studies of FERNANDES (2013) and FERREIRA (1996) were observed and considered to perform $\chi 2$ and KS tests.

Regarding the graphical presentation of the distributions, they are used to show the behavior of the density, reliability and risk of the equipment over time. Only the Generalized Gamma distribution has no graphical representation. Each graph was assembled using functions from the survival and flexsurv packages and generated with simple functions such as the plot.

After that, the paper of probability of the distributions Exponential, Lognormal, Weibull and Normal was configured using linearization functions such as abline, available in the basic libraries of R. For all these generated graphs, had been used functions that carry these graphs to a graphical window, in order to get an easy and organized visualization.

Finally, all numerical information is organized into five tables that are displayed in software R when executing the RELPF function. Table 1 presents the Loglik, AIC, LRV and p-value for all distributions, except in the particularities of the Generalized Gamma and Weibull of 3 parameters. Table 2 presents the parameters, which vary in quantity depending on each distribution. Table 3 shows the t10, t50 and MTTF for the distributions. Finally, Tables 4 and 5 show the results of the $\chi 2$ and KS tests respectively, indicating the rejection or not of the hypothesis.

To validate the RELPF function, the code was tested with three data sets. The first was the study of the failures of an electronic overseer of bottles in a line of production (SILVA; ANDRADE, 2018), with 43 data. The second contains the failure time of 14 optical fiber transmitters (SILVA et al, 2017). These two data sets have different amounts of data with the intention to verify the behavior of function RELPF. The third was a data set provided by Shanker (2016) with 15 data on failure times of an electronic component and has for objective the justification and comparison of data analyzed when comparing with software Proconf.

III. RESULTS AND DISCUSSIONS

To start the reliability analysis using the code, the user must insert the data organized in a column with the failure times of the equipment to be analyzed. From these times, a histogram related to the occurrence of these failures with the time is generated, as shown in Figure 1.

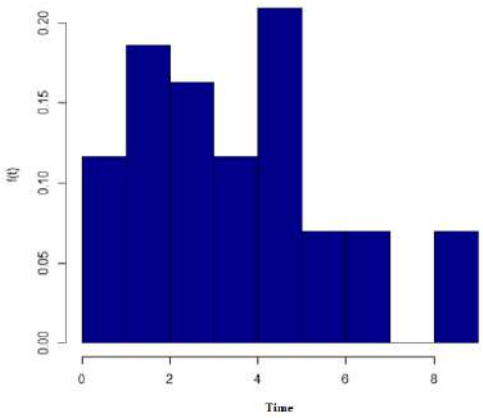

Fig. 1: Histogram generated by the software R of the failure time of electronic overseer of bottles.

Source: Authors.

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Using the survreg, flexsurv and fitdistrplus functions from the library previously installed in the RELPF function, all parameters, shape and/or scale, depending on the distribution, are calculated. These calculations are carried through utilizing the mathematical operations in the software R, the results are stored to be presented to the end of the execution in the Table of the R. Tables 1 and 2 show these parameters for each distribution in relation to the first two data sets tested.

Table 1. Values of the shape and scale parameters generated by the RELPF function of the failure time of electronic overseer of bottles.

Distributions	Shape parameter 1	Scale parameter	Shape parameter 2
Lognormal	1.00647	0.80075	-
Exponential	0.28379	-	-
Weibull	1.64422	3.93472	-
Normal	3.52372	2.16192	-
Gamma	2.12776	1.65611	-
Generalized Gamma	1.52238	-0.65387	1.52561
Weibull 3 parameters	1.62808	3.90628	0.02136

Source: Authors.

Table 2. Values of the shape and scale parameters generated by the RELPF function of the failure time of fiber optic transmitters.

Distributions	Shape parameter 1	Scale parameter	Shape parameter 2
Lognormal	5.49773	0.77844	-
Exponential	0.00311	-	-
Weibull	1.47672	357.52894	-
Normal	321.92857	225.26	-
Gamma	1.95811	164.43926	-
Generalized Gamma	5.64848	-0.28054	0.38932
Weibull 3 parameters	1.05807	272.28662	55.2844

Source: Authors.

Table 3 presents the results of the parameters of the distributions using the fiber optic data by the ProConf software. Comparing Table 2 with Table 3, it is observed that the values are very close, except for the gamma that presents a significant difference.

Table 3. Values of the distribution parameters using the ProConf software for fiber optic failure data.

Distribution	Shape parameter	Scale parameter
Lognormal	5.4977	0.606
Exponential	0.0031	-
Weibull	1.4765	357.5035
Normal	321.9286	233.7633
Gamma	1.586	212.5604

Source: Authors.

Regarding the Gamma, this difference can be justified when comparing the results published by Shanker (2016) with ProConf and the RELPF function. See Table 4. Note that the results of Shanker (2016) and RELPF are very close, the existing differences are due to rounding. Shanker (2016) and RELPF use the maximum likelihood estimate, however, ProConf does not have complex mathematical tools for calculating efficiently for the Gamma distribution.

Table 4. Comparing the values of the parameters of the gamma distribution.

	Shape parameter	Scale parameter
Shanker (2016)	1.442	19.231
RELPF	1.44194	19.10058
ProConf	1.198	24.3493

Source: Authors.

Moreover, the function implemented in R has a precision in decimal places greater than the ProConf software, getting more accurate results. The precision of the decimal places in the R can increase or decrease since the user has control over this aspect. Another important factor is that the RELPF function is able to calculate the parameters for more complex distributions such as the Generalized Gamma and Weibull of 3 parameters.

Observing the values of the parameters for the data of the bottle inspector (Table1) with those generated by ProConf (Table 5) it is possible to see a similarity between

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the results with a greater difference in the Gamma as justified previously. Therefore, the RELPF function can generate good results for all distributions, as much for small how much for great amount of data.

Table 5. Values of the distribution parameters using the ProConf software for data from bottle inspectors.

Distribution	Shape parameter	Scale parameter
Lognormal	1.0065	0.6412
Exponential	0.2838	-
Weibull	1.6445	3.9349
Normal	3.5237	2.1875
Gamma	1.9945	1.7876

Source: Authors.

After obtaining the distribution parameters, it is possible to calculate the mean time between failures (MTTF), the t10 and t50, which vary according to each model. Table 6 shows these values taken directly from the RELPF function for the data set obtained from overseers of bottles.

Table 6. MTTF, t10 and t50 of data from electronic overseers of bottles gotten by the function implemented in R.

Distributions	**MTTF**	**t10**	**t50**
Lognormal	3.76997	2.96401	4.08304
Exponential	3.52372	0.37126	2.44246
Weibull	3.51947	1.00119	3.14851
Normal	3.52372	0.79971	3.52372
Gamma	3.52380	0.57513	1.39406

Source: Authors.

The results for MTTF, t10 and t50 do not need to be generated for the fiber optic data set or compared with ProConf, because they are mathematical operations that use the parameters. As seen previously, the parameters are correct; therefore, the results for MTTF, t10 and t50 are correct and the RELPF function can efficiently calculate them for any data set size.

After the attainment of the parameters of each distribution, is possible to generate the graphs of reliability, risk, density and accumulated density of the distributions. Figures 2 and 3 show the reliability and risk graphs for the Weibull function for the two studies used.

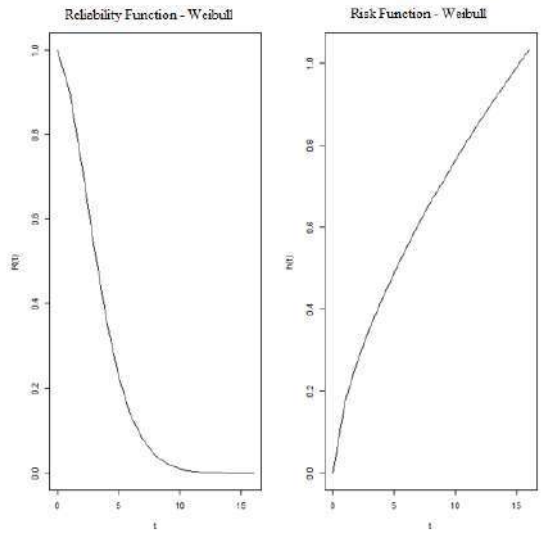

Fig. 2: Reliability and risk graphs for Weibull distribution of failure time for electronic R bottle inspectors

Source: Authors.

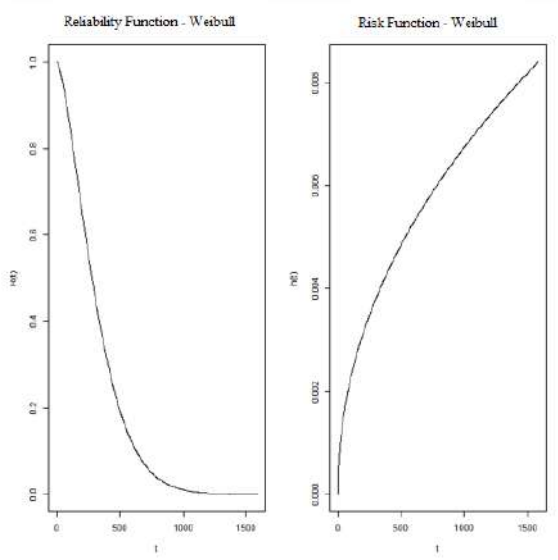

Fig. 3: Density, reliability and risk graphs for the Weibull distribution of the failure time of fiber optic transmitter.

Source: Authors.

Another advantage of the use of software R is the control of the axes of the graph. The RELPF function automatically adjusts these axes according to the data, but the user can still modify them and to modify the scale of the graphs, obtaining a better response compared to other software that do not allow such action.

Ahead, the implemented function performs the LRV, AIC and Loglik tests, in addition to presenting the p-value. Tables 7 and 8 present all this information for each one of

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the distributions of the two analyzed data sets. Moreover, this information is not gotten in some software such as ProConf.

Table 7. Table generated by the RELPF function with the results of LRV, AIC and Loglik for the failure time of the bottle inspectors

Distributions	Loglik	AIC	LRT
Lognormal	-93.32693	195.4134	0.13568
Exponential	-94.84062	191.6812	3.16306
Weibull	-93.39699	190.7940	0.27581
Normal	-95.70671	195.4134	4.89525
Gamma	-93.25909	190.6060	0.08782
Generalized Gamma	-93.25909	192.5182	-

Source: Authors.

Table 8. Table generated by the RELPF function with the results of LRV, AIC and Loglik for the failure time of fiber optic transmitters.

Distributions	Loglik	AIC	LRT	p-value
Lognormal	94.73752	192.3342	9.13289	0.00251
Exponential	97.15928	196.3186	13.97642	0.00092
Weibull	90.58656	185.1731	0.83097	0.36199
Normal	94.16712	192.3342	7.9921	0.0047
Gamma	90.17107	186.7666	2.42445	0.11945
Generalized Gamma	90.17107	186.3421	-	-

Source: Authors.

After the exhibition of all these specific information of the distributions, the code presents for the user the graphical method for verification of the adequacy or not of the distributions by means of the probability paper. In Figures 4 and 5 the papers of the probability of the distributions Weibull and Lognormal for the two analyzed studies are presented.

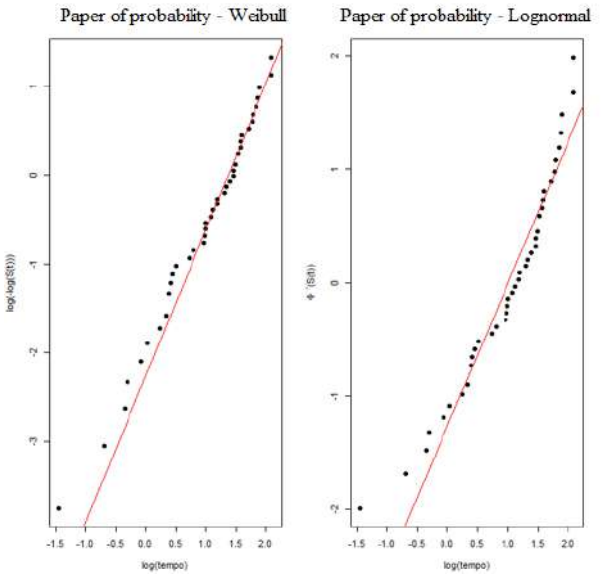

Fig. 4: Papers of the probability of the distributions Weibull and Lognormal for the failure time of the bottle inspectors.

Source: Authors.

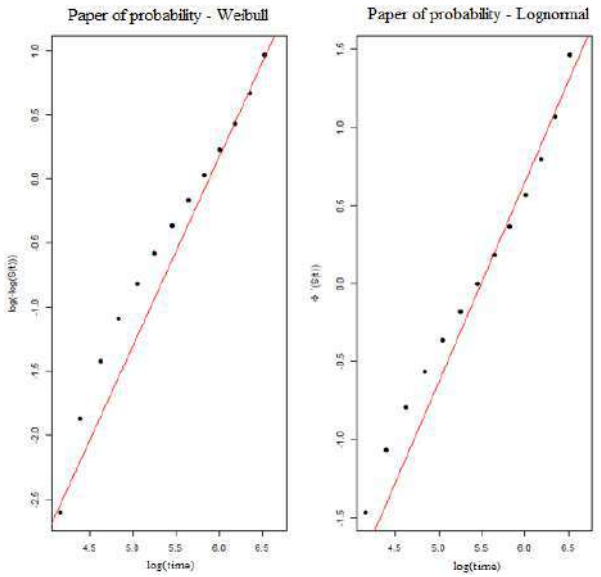

Fig. 5: Papers of the probability of Weibull and Lognormal distributions for the failure time of fiber optic transmitters.

Source: Authors.

The papers of probability of the Weibull and Lognormal distributions differ from ProConf, see Figure 6. The difference is found in the abscissa axis, the RELPF function uses the neperian logarithm of the time, while ProConf uses only time.

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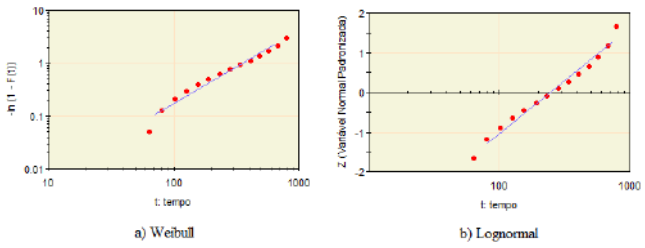

Fig.6: Paper of probability of the Weibull and Lognormal distributions made by the Proconf software for fiber optic data.

Source: Authors.

The last tests for adequacy of the sample to the distributions are KS and χ2 tests, these are presented in two individual tables that show the value of the statistics of the test, beyond indicating if the hypothesis can or not be rejected. Tables 9 and 10 show the results of KS and X2 for data from electronic bottle supervisors. Figures 11 and 12 show for fiber optic data.

Table 9. Result of the χ2 test for the failure time of the electronic overseers of bottle.

Distribution	Statistics X2	p-value X2	Hypothesis
Lognormal	6.31313	0.17695	It cannot be rejected
Exponential	12.88477	0.01185	Rejected
Weibull	1.86555	0.76047	It cannot be rejected
Normal	4.22802	0.37603	It cannot be rejected
Gamma	-	-	-

Source: Authors.

Table10. Result of the KS test for the failure time of the electronic overseers of bottle.

Source: Authors.

Distribution	Statistics KS	D-critic	Hypothesis
Lognormal	0.13212	0.20282	It cannot be rejected
Exponential	0.17752	0.20282	It cannot be rejected
Weibull	0.08723	0.20282	It cannot be rejected
Normal	0.10787	0.20282	It cannot be rejected
Gamma	-	-	-

.

Table 11. Result of the χ2 test for the optical fiber failure time.

Distribution	Statistics X2	p-value X2	Hypothesis
Lognormal	0.14286	0.70543	It cannot be rejected
Exponential	0.14002	0.70826	It cannot be rejected
Weibull	0.39915	0.52753	It cannot be rejected
Normal	2.66742	1.10242	It cannot be rejected
Gamma	-	--	It cannot be rejected

Source: Authors.

Table 12. Result of the KS test for the optical fiber failure time.

Distribution	Statistics KS	D-critic	Hypothesis
Lognormal	0.10039	0.34878	It cannot be rejected
Exponential	0.18029	0.34878	It cannot be rejected
Weibull	0.10253	0.34878	It cannot be rejected
Normal	0.1535	0.34878	It cannot be rejected
Gamma	-	--	It cannot be rejected

Source: Authors.

The KS and χ2 tests have the same objective, however, the χ2 test is more sensitive when used with a larger number of data. This fact can be seen when comparing Table 9 and 10.

Regarding the results of the ProConf software, there are differences due to the way in which the tests are calculated, as there are steps in which the considerations

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vary from author to author. Tables 13 and 14 show the values of the KS and $\chi 2$ tests for optical fiber failure times. Note that the $\chi 2$ statistics and the p-value of the $\chi 2$ test differ from the results presented by RELPF because of the choices of the intervals for the calculation of the observed and waited for frequencies. Concerning KS test, note that the statistics are similar, however, ProConf performed the analysis using the p-value, while the RELPF function used the comparison of the statistics with the critical value.

Table 13. Values of the $\chi 2$ tests of the distributions using the ProConf software for fiber optic failure data.

Distribution	Statistic	p-value	Hypothesis
Lognormal	0,1004	0,3866	It cannot be rejected
Exponential	0,1803	0,1779	It cannot be rejected
Weibull	0,1006	0,386	It cannot be rejected
Normal	0,2078	0,1031	It cannot be rejected
Gamma	0,0878	0,4261	It cannot be rejected

Source: Authors.

Table 14. Values of the KS tests of the distributions using ProConf software for fiber optic failure data.

Distribution	Statistic	p-value	Hypothesis
Lognormal	0,22	0,6405	It cannot be rejected
Exponential	0,42	0,8093	It cannot be rejected
Weibull	0,16	0,6862	It cannot be rejected
Normal	2,13	0,1445	It cannot be rejected
Gamma	0,03	0,8559	It cannot be rejected

Source: Authors.

IV. CONCLUSION

In the reliability analysis, tools that help to determine the fit of the sample distributions are important for decision making, mainly when these choices are made in the industrial sector and have involved cost in the process. By means of the developed code, it was possible to present resulted trustworthy in the modeling of these distributions. The RELPF function showed similar results to ProConf (except for Gamma) and Shanker (2016). It obtained a better quality result for the Gamma distribution when compared to ProConf. Another advantage of the RELPF function was the implementation of more complex distributions, such as Generalized Gamma and Weibull of 3 parameters.

The implementation in the R software was done efficiently. The R allowed greater flexibility for the user to control the results and allowed a better analysis for the user, such as controlling the axes of the graphs and changing their scale. In addition, R is free and open source, extending the accessibility for users interested in performing equipment reliability analysis.

The next step is to optimize the RELPC function with the implementation of new distributions such as Extreme Value.

Beyond extracting more information of the Weibull distribution of 3 parameters. In order to make the RELPF function more complete and to obtain to analyze of efficient form other data that need different distributions to the implemented ones.

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Wavelet thresholding Genetic algorithm approach for Noise Extraction in High-Resolution Industrial Tomography

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Abstract**—***Since the development of Computed Tomography (CT) in medicine, many applications have been emerging among which the use in Non-Destructive Evaluation (NDE) approach has been consolidating in recent years for analysis of inner features in a broad range of industrial components. More recently, this method has also been applied fordimensional measurements in the metrology field. During acquisition stage many artifacts may cause distortions that interfere with the sample edge evaluation, thereby generating errors on the surface determination. In such development, high accuracy is required for its use in metrology and overall volumetric reconstruction. Scatter radiation is a major concern in the image acquisition process, being strongly dependent on the object densities and geometry. A combined approach involving genetic algorithm and wavelet shrinkage is proposed for denoising application, where 2D radiographic projections are filtered prior to the volumetric reconstruction process. The developed algorithm is applied to sample images resulting from tomography procedures that usually produce severe artifacts and is evaluated in terms of Peak Signal-to-Noise Ratio (PSNR). The filtering technique advanced in this paper generates reconstructed volumes with less noise, accurate edges and improved visual perception.*

Keywords**—Computed Tomography, Denoising, Genetic Algorithm, Wavelet.**

I. INTRODUCTION

The availability of objects built volumetrically through Computed Tomography (CT) in industry has brought product development and material evaluation to a new level, thereby leveraging the comprehension of material behavior in fabrication process. Notably, the CT approach enhances the knowledge about volumetric spread of discontinuities, porous patterns, inclusions, shrinkages, voids and flaws. In addition, it can also compare casted object with the projected model, aiming at correcting discrepancies and improving the casting chain.

In industrial field, usually the most used system is the so-called ConeBeam Computed Tomography (CBCT)[1], in which a x-rays tube generates a cone beam that penetrates the object projecting an image onto a Digital Detector Array (DDA). This technique increases the acquisition speed if compared to traditional medical fan beam CT, since it can acquire images in a larger area. However, reducing the acquisition time benefit has the downside of increasing artifacts caused by additional scattered radiation. It is well known that the scattered radiation creates undesired secondary signals, which are responsible for generating spurious components in the CT volume.

A number of different techniques and methods for the suppression of scatter-related artifacts have been proposed, and can be software based only [2], [3], or a combination of hardware and software approaches [4],[5]. The artifacts in industrial CBCT turn out to be more severe than those found in medical fan beam CT, since the industrial components present relatively higher density materials, more complex geometries and due to the bigger acquisition area, more exposed to scatter radiation. Based on these considerations, in this work we propose a combined method for filtering these scatter radiations prior to volume reconstruction, by using wavelet shrinkage [6]while

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selecting the wavelet family and its parameters through a genetic algorithm [7]for each acquired image.

II. METHODS

The CBCT acquisition process consists in acquiring thousands of 2D radiographic projections. The sample object is rotated between the x-rays source and the DDA detector. Each image corresponds to a certain angle. After the acquisition phase, the acquired images are submitted to a reconstruction algorithm which creates the sample digital volume. During the acquisition phase, the DDA detector not only acquires the useful penetrated x-rays, but also the scattering coming from deviated, reflected, diffracted x-rays passing through the object and around it.These scattered x-rays produce false information on the reconstructed volume that will degrade image quality, and may cause artifacts, therefore yielding false defect detection analysis.

The approach developed in this work employs a genetic algorithm to determine the parameters in the noise subtraction method by Wavelet Thresholding (WT).Donoho and Jonhstone[8] presented a method for reconstructing the data of a function contaminated by noise. In this approach, a suitable threshold value is chosen such that wavelet noise coefficients can be discarded. If the chosen threshold value is small, then the estimated signal may still contain noise power, and if the chosen threshold is too large the signal is over smoothened. Finding the optimal threshold value is important in order to achieve the best denoised image.

The wavelet shrinkage function determines how the thresholds are applied to the data. There are two basic wavelet shrinkage functions: the soft and hard thresholding. The hard thresholding approach uses a linear function that keeps only the coefficients above a constant λ, which is normally chosen based on the noise variance.In soft thresholding, on the other hand, the shrinkage operation is accomplished by the non-linear equation

$$thr(h) = \begin{cases} 0 & \text{if } |h| \le \lambda \\ sign(h)(|h| - \lambda) & \text{if } |h| > \lambda \end{cases}$$

This causes the output to be more smoothened and continuous when compared to the hard threshold. A number of different approaches can be adopted in order to establish the threshold λ[9], [10], [11] and [12].

The proposedalgorithm is applied to each acquired image prior to the reconstruction stage. The chromosomes represent the parameters to be used for wavelet decomposition and the coefficient of the wavelet shrinkage procedure. The following wavelet families were adopted: Haar, Daubechies, Coiflets, Symlets, biorthogonal and reverse biorthogonal [13].

The initial population is chosen randomly, totaling 50 individuals, which are submitted to a selection process known as Universal Stochastic Sampling (USS)[7] . In this process, μ equally spaced divisions are used, where μ is the number of required selections, in this case the size of the population. The cumulative probability of each individual being chosen based on their fitness is calculated, and copies of these individuals are made according to the above calculated probability and distributed throughout the divisions, so that individuals that have higher fitness are more likely to crossover than do the other ones. To perform crossover, a pair of parents having a predefined probability P_c is chosen randomly, and from the gene numbers (1, 2, 3 and 4) a random point is chosen, where the genes of the first parent at the chosen point are combined with the last genes of the second parent and vice-versa. An example of this procedure is shown in Fig. 1.

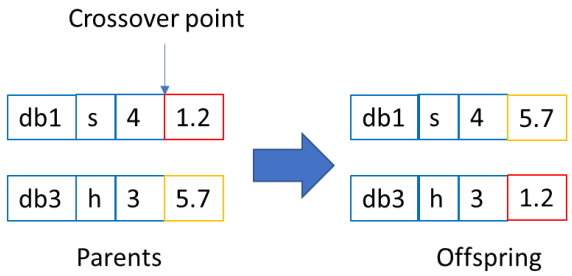

Fig. 1: Crossover illustrative example.

After the crossover, a pair of offspring is generated. These offspring may suffer mutation based on a probability P_m. The individual selected to undergo mutation has a randomly chosen gene replaced with a possible random value. An example of a mutation can be seen in Fig.2.

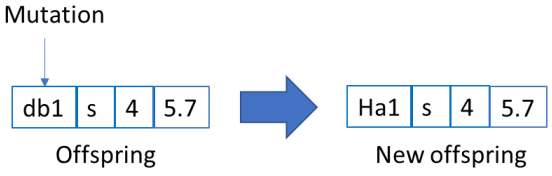

Fig. 2: Mutation illustrative example.

Parents and offspring are evaluated according to the fitness function. The chosen fitness function is the Peak Signal-to-Noise Ratio (PSNR), defined as

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$$PSNR = 10 \cdot \log\left(\frac{S_{max}}{\sqrt{MSE}}\right),$$

where S_{max} is the highest signal strength, given by $S_{max} = 2^B - 1$, where B is the number of bits of each pixel representation and MSE is the mean square error between the two images having size M × N, that is,

$$MSE = \frac{1}{M \cdot N}\sum_{i=0}^{M-1}\sum_{k=0}^{N-1}\left\|S_o(i,k) - S_f(i,k)\right\|^2,$$

where S_o (i, k) and S_f (i,k) denote the gray level at the coordinates i,k regarding the original and filtered images, respectively.

After computing the fitness parameters of all individuals, the one having the highest value is compared to that of the individual that presents the highest fitness value of the previous generation, and the winner is stored. The iteration process is repeated with generation increments up to the generation limit G_{max}= 50.

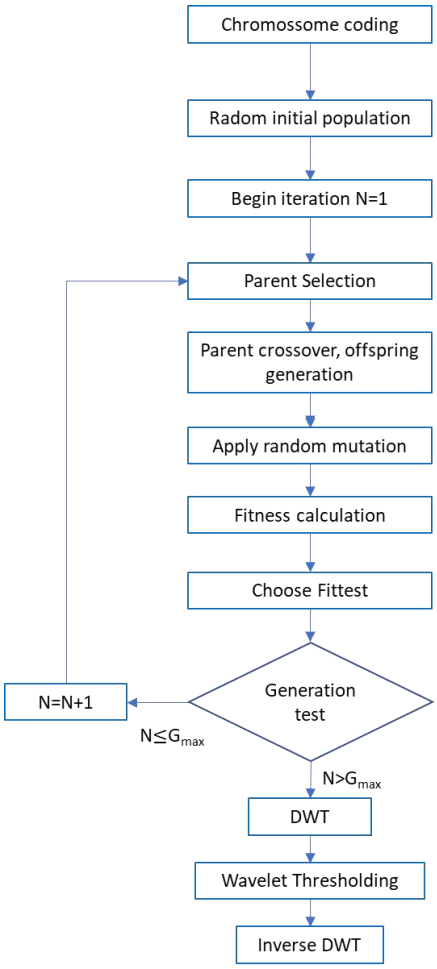

Fig. 3: Flow diagram of proposed algorithm.

Using the fittest parameters, the image is decomposed by applying Discrete Wavelet Transform (DWT) [14], the coefficients are suppressed accordingly, and the filtered image is obtained from the inverse DWT. The proposed denoising process generates a unique filter for each image, aiming at the best PSNR. The 3D reconstruction process starts after all images are filtered. Fig. 3 presents the flow diagram applied to each projection image.

III. EXPERIMENTAL RESULTS

In industrial high energy CT different materials and geometries make them difficult to create a standard template to reproduce noise and artifacts found in typical applications. The test specimen employed in this experiment is composed of 3 different materials: stainless steel, aluminum and polyurethane. These materials have very distinct densities and x-ray responses. Moreover, the specimen has parts with different geometries and thicknesses, namely, (a) stainless-steel screw, essentially cylindrical; (b) aluminum and polyurethane sections, with smooth transition geometry; and (c)sections with more abrupt edges. The scans were carried out by employing a CBCT system using a 200 µm DDA of 400 mm x 400mm and 4 M pixels, 118 kV, 700 µA, 1440 acquired images, 0.5 mm CU filter and 82 µm voxel resolution.

The specimen radiography projection is shown in Fig. 4, where the different densities and geometries are evident. A severe noise artifact can be observed in the CT scan of this specimen presented in Fig. 5. This kind of artifact creates a false surface line that leads to a wrong evaluation of the solid, thereby turning accurate metrology impossible. The noise effects can also be observed in cross-sectional images (or “slices”). Figures 6(a) and 6(b) illustrate the illusion of gain and loss, respectively, of material inside the surface line. Also visible in these figures is the presence of beam hardening artifacts.

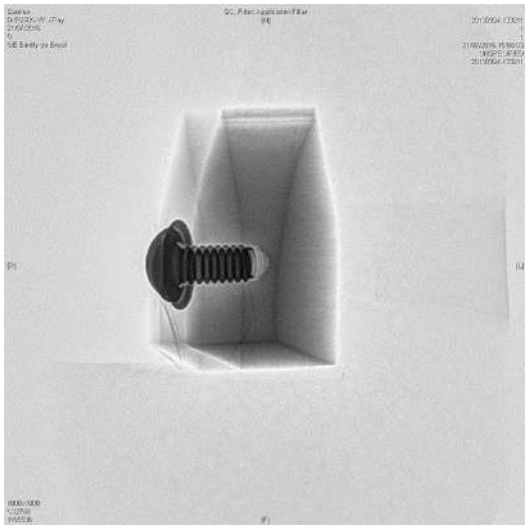

Fig. 4: Specimen 2D radiography.

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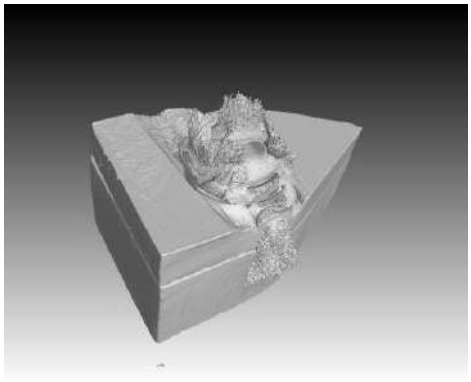

Fig. 5: Specimen CBCT volume result.

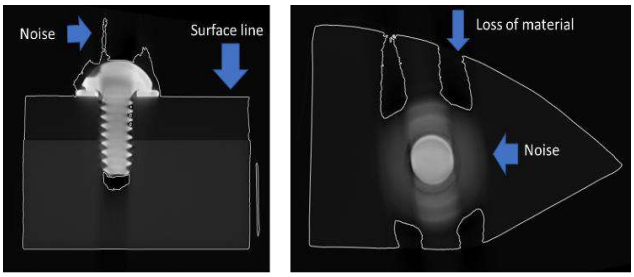

Fig. 6: Slices of the CT scan: (a) Front view slice, with additive noise and line surface indicated;(b) Top view slice, with loss of material and noise around the screw indicated.

The proposed algorithm was applied to each of the 1440 images acquired by the CBCT system. After reconstruction using the Filtered Back Projection algorithm (FBP) [15], the volume generated presented a better visual representation, as displayed in Fig. 7. Figures 8(a) and 8(b) show two slices of the volume in Fig. 7. Compared to the original CT slices (Figs. 6(a) and 6(b)), the surface lines of the resulting images are substantially more accurate, and the gain or loss of material artifacts do not appear so intensely.

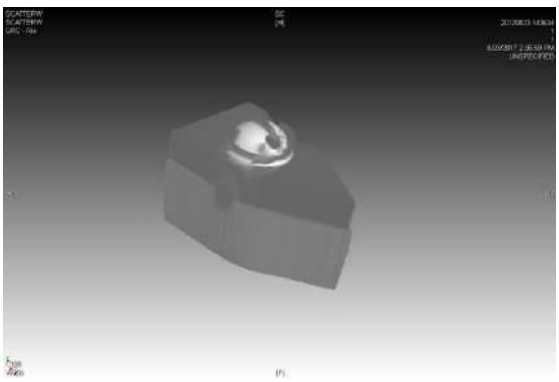

Fig. 7: Test specimen CT reconstruction after filtering by the proposed algorithm.

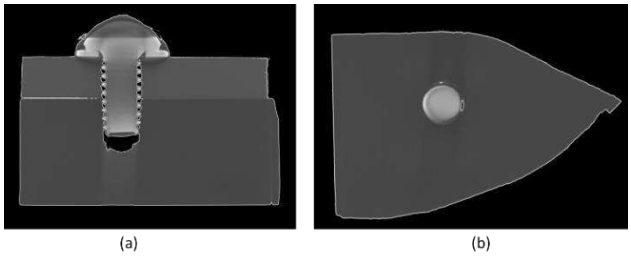

Fig. 8: Slices views obtained from the proposed algorithm: (a) Front view; (b) Top view.

Fig.9 displays the CT volume colored according to the dimensional deviation measured between the original and the corrected volumes. This analysis shows the areas where the proposed algorithm acted to correct the scattered noise. Green areas represent no or small amount of correction, red areas correspond to additive correction and blue areas show subtractive correction.

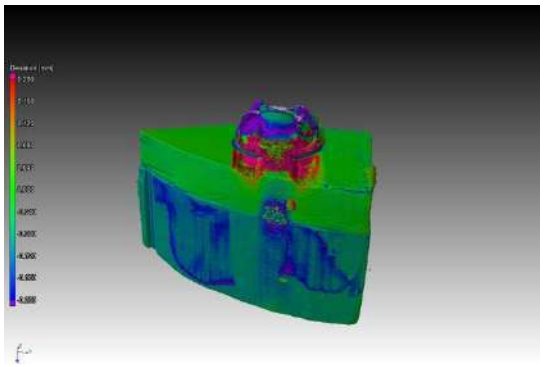

Fig. 9: Comparison between original and filtered volumes using the proposed algorithm.

Differences between the volumes obtained with the original and filtered CT images can be evaluated by comparing the surfaces detected in each volume. Fig. 10 shows the correction statistics applied to the original volume. In this analysis, if both volumes were identical, then the resulting histogram of the dimensional deviations would present only one green peak at 0. Non-zero values at the right-hand side of the zero point indicate that the actual volume contains more material than does the nominal volume in some regions. On the other hand, non-zero values lying at the left-hand side show that the actual volume has less material than does the nominal volume in other regions. As can be observed in Fig. 10, the wavelet denoising approach exhibits excellent performance in regions where subtractive noise contributed more and shows better reduction of the additive noise around the

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screw head, which considerably improves the volume quality.

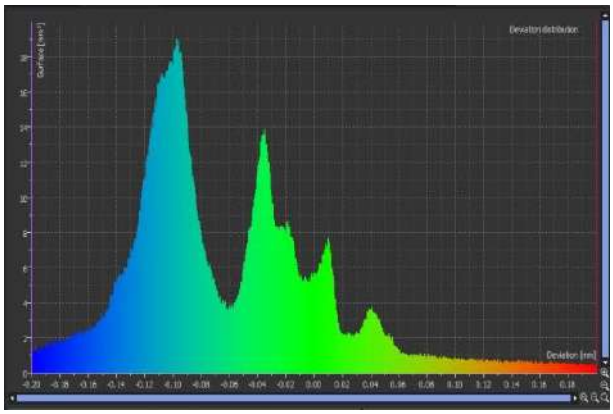

Fig. 10: Histogram of dimensional deviation between original and filtered volumes using the proposed algorithm.

To evaluate the efficiency of the proposed algorithm when compared to other methods, the original volume was also processed with 3 traditional filters, namely, Median [16], Adaptive Gauss [17], and Non-Local Means (NLM) [18]. These three filters where chosen because they are commonly available in commercial CT visualization software and are the most used in noise reduction applications.

The original and filtered volumes were superimposed, and the dimensional deviation histograms calculated.Fig. 11 shows the dimensional deviation histogramfor a 3x3 median filter. There was some noise reduction, but the effect was of small amplitude. Fig. 12 displays the dimensional deviation histogram between the original and filtered volumes using adaptive gauss filter. This filtering technique produced a substantial material reduction, thereby resulting in an increase of the original material loss, yielding an undesired opposite effect. It also removed material from the polyurethane part. The histogram profile shown in Fig. 13 represents the dimensional deviation histogram after applying the NLM filter. The form is similar to that of the median filter, but with larger material reduction.

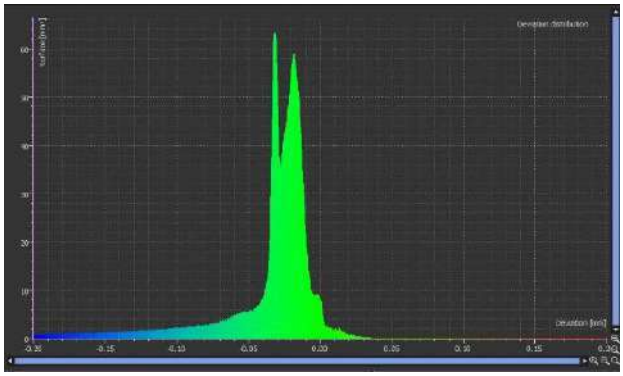

Fig. 11: Histogram of dimensional deviation between original and filtered volumes using Median filter.

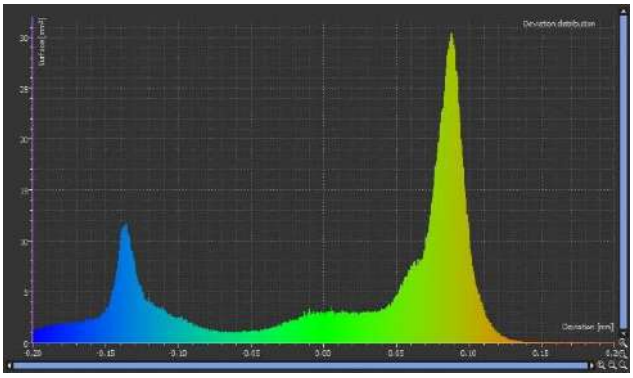

Fig. 12: Histogram of dimensional deviation between original and filtered volumes using Adaptive Gauss filter.

From Figs. 10 to 13, it can be observed that the proposed algorithm showed not only a better performance in correcting both additive and subtractive noise, but also created a more accurate volume with respect to the original object.

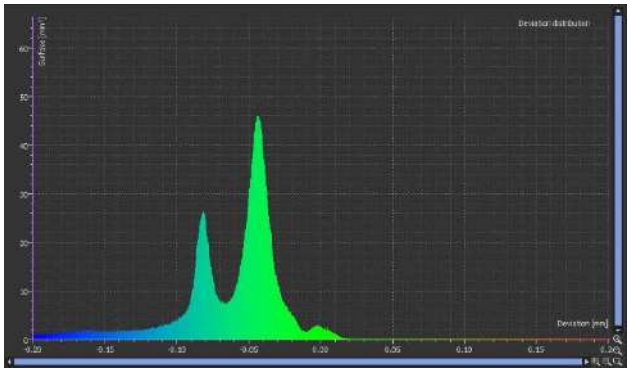

Fig. 13: Histogram of dimensional deviation between original and filtered volumes using NLM filter.

A second dataset was applied in order to analyze the evolution of the noise reduction during an iterative

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process, where the dataset, after a generation run,was used as input of sequential generation runs. The sample was an iron casting that produced severe scattering due to its high density and complex geometry. Different from the test specimen, this sample is made of a homogenous material with thicker and denser walls.

Fig. 14 presents the original volume and Fig. 15 shows the evolution after 4 runs. The visual quality improvement can be seen specially in the center of the sample, where in the original volume seemed almost closed. After some runs it is possible to observe the air between the two sides of the sample.

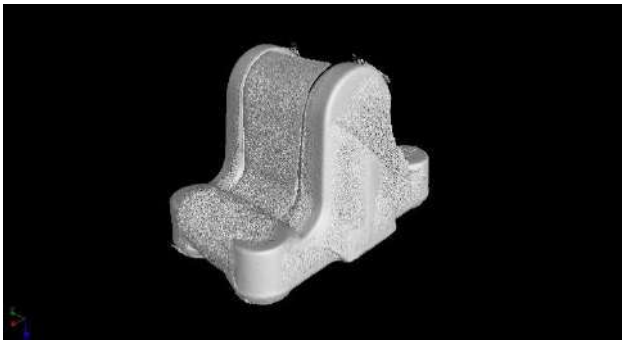

Fig. 14: Iron casting original reconstructed volume.

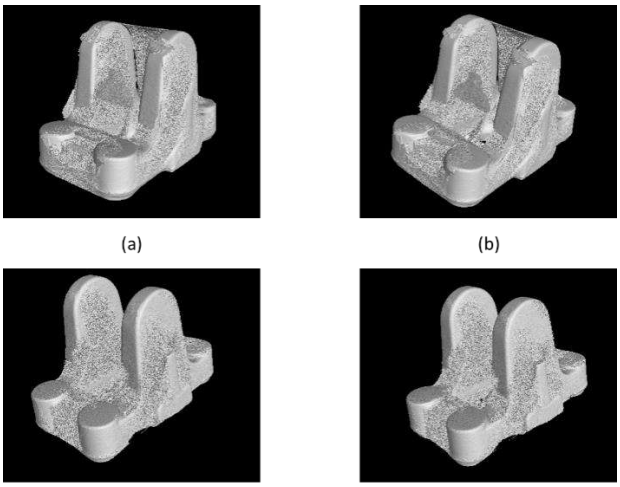

Fig. 15: Evolution of noise reduction.

This same sample was scanned again using a CBCT with the "scatter correct" technology presented by Oliver Brunke[4], which employs a metal grid to measure the scattered radiation during scanning. The measured radiation is, then, subtracted from a second scan without the grid. The result is a better volume with reduced noise power.For each run of the proposed algorithm the gray value histograms of the volumes were computed and then compared to the gray value histogram of the second scan with "scatter correct" CBCT. The result of all histograms can be seen in Fig. 16.

The left peak of each histogram represents the air in the 3D volume. For an ideal noise free volume, there should be, in addition to air, only a second peak representing the iron and between them a valley, with no other gray level. Analyzing the histograms, the "scatter correct" one shows a deeper valley between air and iron, which represents less noise and a better visual perception and a more accurate surface line definition. The original histogram does not show the iron peak nor a valley separation. The first and second runs result in small improvements with the air peak moving to the left-hand side of the histogram, but the third run made an expressive improvement by moving further the air peak and starting to present a separation valley.

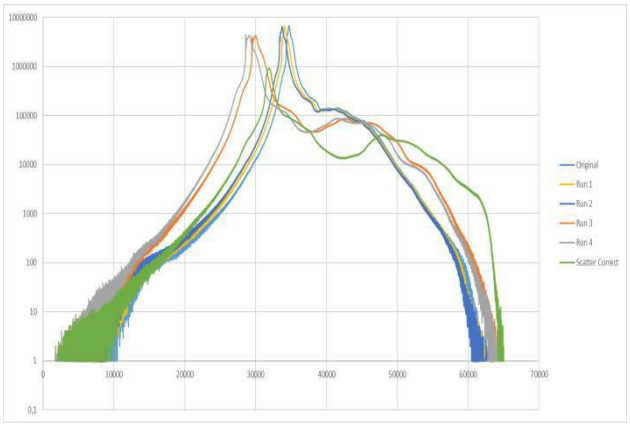

Fig. 16: Gray level histograms of the iron casting.

IV. CONCLUSION AND DISCUSSIONS

The wavelet denoising approach parametrized by genetic algorithm generates a customized filter that adapts for each radiographic projection noise profile. A test object created to increase scattered noise by its geometry and different densities was scanned and evaluated by the proposed algorithm. The final visual quality was strongly improved, and the noise power was decreased to such a level that destructive interference was substantially reduced.Not only the overall quality of the reconstructed volume was improved, but also the edge accuracy and surface line determination were significantly enhanced when compared to the original scan.

When compared to traditional smoothing filtering techniques, the proposed algorithm presented better results by reducing material where there was additive noise and regenerating material where there was subtractive noise. This behavior originates from the optimized filters created for each projected image before reconstruction.

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The denoising behavior during multiple runs has a stochastic nature due to the GA part of the algorithm, where small improvements can be made or significant noise reduction at different stages can be observed. Although there was an important improvement in reducing noise, some noise power remained around the screw head in the test specimen and in some regions of the iron casting sample.

Different datasets where submitted to the proposed algorithm. The objects scanned differ in shape, material, densities, and noise level. In all studies some amount of noise power reduction and material loss correction were achieved, thereby improving visual perception of the volumes, even in cases where there was just a small amount of noise power in the original volume.

During the development of this project, it was also evaluated whether the proposed algorithm would modify the edges in such a way that accurate features measurements would become unfeasible. Scanning objects with known measured features proved that the use of the algorithm did not induce deviation on the expected detected edges and surface lines.

ACKNOWLEDGEMENTS

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The Addition of the Hormone Thyroxine (T4) to the feed to Accelarate the Growth of Bronze Featherback (*Notopterus notopterus*, Pallas 1769)

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Abstract— *Bronze featherback (Notopterus notopterus, Pallas 1769) are freshwater fish whose population in nature has decreased. This population decline is due to fishing activities carried out by local fishermen in the wild that do not consider the size of the fish. As a result, fish that are small and not consumed are also caught. Also often found caught fish that are in the spawning season. Efforts that need to be done to prevent the extinction of these fish in nature are by cultivating fish. One of the weaknesses in current Bronze featherback farming is the slow growth of the fish being kept. To accelerate the growth of fish in this maintenance, it is necessary to try the addition of the hormone thyroxin in the feed given to fish. This research was conducted in Sungai Paku Village, Kampar Kiri District, Kampar Regency, and Riau Province from July to August 2020. The design used in this study was a completely randomized design (CRD) with one treatment and three replications. The treatment used in this study was the addition of thyroxin hormone at different doses given to feed (trash fish) consisting of P1 (0 mg thyroxin/kg feed), P2 (2 mg thyroxin/kg feed), P3 (4 mg thyroxin/kg feed) and P4 (6 mg thyroxin/kg feed). The results showed that the best treatment of thyroxin hormone was 6 mg/kg feed with an absolute weight growth value of 59.96 g, an absolute length growth of 14.3 cm, a specific growth rate of 3%, and a survival rate of 95%.*

Keywords— ***Absolute weight, absolute length, daily weight growth rate, life span, and thyroxin.***

I. INTRODUCTION

Bronze featherback (*Notopterus notopterus*, Pallas 1769) is a type of freshwater fish whose population in nature has decreased. This fish is one of Indonesia's endemic fish that has high economic value (Yulindra et al., 2017; Sukendi et al., 2020). According to Sunarno (2002), high-fat content makes Bronze featherback taste delicious and distinctive. Bronze featherback, apart from being used as consumption fish, can also be used as ornamental fish. The community's demand for this fish is getting higher, while to meet the needs of the community it is still obtained solely from catches in public waters. This causes Bronze featherbacking activity in nature to be so high (Yulindra et. al., 2017).

Fish farming activities are the right solution to be applied to reduce the decline in fish populations from nature and still provide food fish for the community (Anderson et al., 2011 and Benkendorff, 2009). However, in the Bronze featherback culture, the weakness that was found was the slow growth that occurred during maintenance. To accelerate the growth of these fish, it is necessary to try the addition of the hormone thyroxin (T4) in the feed given to domestic fish.

The thyroxin hormone (T4) is a hormone produced by the thyroid gland in addition to the thriyodotironin (T3) hormone which functions in general metabolism and growth (Hoar and Randall, 1969). The function of T4 / T3 has been proven in some freshwater fish that T4 and T3 can stimulate growth, development, and absorption of eggs in the larval period (Lam, 1994). The use of the thyroxin hormone to stimulate fish growth has been carried out in several fish including coral platypus fish (*Xiphophorus*

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maculatus) (Zairin *et al*., 2005), goldfish (*Carrasius auratus*) (Sembiring *et al*., 2015), pond fish (*Hellostoma temmincki* CV) (Defrian, 1998), baung fish (*Mystus nemurus* CV) (Isvarida, 2004), monitor fish (*Rasbora lateristriata* Blkr) (Legimin, 2005), motan fish (*Thynnicthys thynnoides* Blkr) (Sukendi, Putra and Yurisman., 2011) and pawas (*Osteochilus hasselti* CV) (Sukendi, Thamrin and Putra, 206).

II. METHOD

This research was conducted in Sungai Paku Village, Kampar Kiri Sub district, Kampar Regency, Riau Province from July to August 2020. The bronze featherback used comes from the catch of fishermen in the Kampar River with a size of 8-10 cm. Fish are reared in cages (size 1x1x1 m3) which are installed in the ground pond. Fish are fed 3 times a day (morning, afternoon, and evening) at a dose of 5% per weight of biomass. Fish weight and length were measured every 10 days. The fish length was measured using graph paper and fish weight was measured using a Shimadzu ELB600 type analytic chart. To obtain growth data, maintenance was carried out for 90 days. While the research design used, there was a completely randomized design with one treatment, 4 levels of doses (P1, P2, P3, and P4), and three replications. The treatments used were thyroxin hormone, and the dosage levels used consisted of P1 (0 mg thyroxin/kg feed), P2 (2 mg thyroxin/kg feed), P3 (4 mg thyroxin/kg feed), and P4 (6 mg thyroxin/kg of feed). The feed used during rearing is finely chopped trash fish.

The variables measured in this study were the growth in absolute weight determined using the formula: Absolute weight growth = fish weight at the end of the study - fish weight at the beginning of the study, absolute length growth = fish length at the end of the study - fish length at the beginning of the study, Daily Growth Rate (SGR) = Ln fish weight at the end of the study - Ln fish weight at the beginning of the study/time x 100% and survival = number of fish at the end of the study/number of fish at the beginning of study x 100%. Water quality data in the form of temperature, pH, and dissolved oxygen (DO) were obtained by measuring once a week in the morning, afternoon, and evening. Measurement of temperature has using, a thermometer, pH measurement using a pH meter, and DO measurements using a DO meter.

The data on the growth and survival of the fish obtained were tabulated and statistical tests were performed using the SPSS 16 application. The statistical tests used the homogeneity of variances and one-way analysis of variance (ANOVA) tests. If the ANOVA test results showed a significant difference ($P < 0.05$) then a further test was carried out using the SNK test to determine the differences between treatments. The water quality data obtained were tabulated and described.

III. INDENTATIONS AND EQUATIONS

Based on research that has been carried out by raising bronze featherback for 90 days, data on the growth and survival of bronze featherback were obtained. Data on the growth and survival of Bronze featherback were measured as a representation of the effect of the thyroxin hormone treatment that had been given.

3.1. Absolute Weight Growth

The growth in absolute weight of bronze featherback maintained for 90 days of rearing by feeding trash fish added with thyroxin hormone is shown in Figure 1. The highest growth of bronze featherback absolute weight was obtained in sequence at the treatment dose of 6 mg/kg of feed with a value of 59.96 g, followed by treatment with a dose of 4 mg/kg of feed with a value of 57 g, treatment with a dose of 2 mg/kg of feed with a value of 51.22 g, and treatment without the thyroxin hormone with a value of 46.97 g. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it is known that the treatment given had a very significant effect ($P < 0.01$) on the absolute length growth of bronze featherback. The results of further tests using the Student Newman Keuls (SNK) test showed that the absolute weight growth of bronze featherback without thyroxin hormone was significantly different ($P < 0.05$) from bronze featherback that were given the hormone thyroxin 2 mg/kg feed and was very significantly different ($P < 0.01$) with Bronze featherback that were given the thyroxin hormone dose of 4 mg and 6 mg/kg of feed.

The highest absolute weight growth value of bronze featherback *Notopterus notopterus* fish obtained during 90 days of maintenance reached 59.96 g. The high absolute weight growth value of bronze featherback obtained in the treatment of the highest dose of thyroxin hormone (6 mg/kg of feed) is due to the function of the thyroxin hormone, namely in general metabolism and growth and reproduction (Hoar *et al*., 1969; Nacario, 1983, Power et al., 2001 and Heraedi *et al*., 2018). The thyroxin hormone is a hormone produced by the thyroid gland. The thyroid gland functions to form, store, and secrete substances related to the regulation of the metabolic rate (Muslim et. al.,, 2019). This increase in metabolic rate is influenced by the increase in oxygen consumption by fish (Dewi, 2006). Besides, the thyroxin hormone can increase protease and lipase activity in the digestive tract so that it can increase

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protein and fat metabolism in the body (Zairin *et al*., 2005). The factors that influence the activity of the thyroxin hormone are dose, method of hormone administration, food quality, feeding time, and fish size (Tripathi & Verma, 2003; Pebriyanti et al., 2015).

The best dose of thyroxin hormone obtained from this study is the same as the results of research conducted by Sukendi et al., (2011) which stated that feeding mixed with the hormone thyroxin 6 mg/kg of feed resulted in the growth of the absolute weight of motan fish (*Thynnichthys thynnoides* Blkr) the highest with a value of 9.23 grams for maintenance in cages in rivers and 9.13 grams for maintenance in ponds. Whereas for pearl Sepat fish (*Trichogaster leeri* Blkr), feeding mixed with thyroxin hormone at a dose of 6 mg/kg of feed resulted in the highest absolute weight growth of 7.187 grams. Sukendi *et al*., (2013).

3.2. Absolute Length Growth

The absolute length growth of bronze featherback maintained for 90 days by feeding trash fish added with the thyroxin hormone is presented in Figure 2. The highest growth in absolute length of bronze featherback sequentially was obtained at the treatment dose of 6 mg/kg of feed with a value of 14.3 cm, followed by treatment. a dose of 4 mg/kg of feed with a value of 14 cm, a treatment dose of 2 mg/kg of feed with a value of 13 cm, and treatment without the hormone thyroxin with a value of 12.5 cm. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it is known that the treatment given had a very significant effect (P <0.01) on the absolute length growth of bronze featherback. The results of further tests using the Student Newman Keuls (SNK) test showed that the absolute length growth of bronze featherback without thyroxin hormone was significantly different (P <0.05) from bronze featherback given the thyroxin 2 mg/kg feed hormone and was very significantly different (P < 0.01) with bronze featherback given the thyroxin hormone dose of 4 mg and 6 mg/kg of feed.

The high value of the absolute length growth of bronze featherback obtained at the treatment dose of 6 mg/kg of feed was in line with the growth in the highest absolute weight of bronze featherback which was also obtained at the treatment dose of 6 mg/kg of feed. The growth of bronze featherback that is given the thyroxin hormone is influenced by the increase in fish metabolism by the thyroxin hormone. Guyton (1983) states that the main effect of the thyroxin hormone is to increase the metabolic activity of somebody tissues so that the speed of using food for energy is greatly accelerated. Sudrajat et al., (2013) stated that giving the hormone thyroxin to Siamese catfish can increase the length growth of these fish. The absolute length growth value of Bronze featherback obtained at the treatment dose of 6 mg/kg of feed was lower than the absolute length growth value of *Notopterus chitala* fish that were kept in polyculture with tilapia for 6 months, namely 16.5 cm (Samad et.al., 2017).

3.3. Spesific Growth Rate (SGR)

The growth rate of the daily weight of bronze featherback maintained for 90 days by feeding trash fish added with thyroxin hormone is presented in Figure 3. In Figure 3, it can be seen that the highest growth rate of bronze featherback daily weight is obtained in sequence at the treatment dose of 6 mg/kg of feed with a value 3%, followed by treatment with a dose of 4 mg/kg of feed with a value of 2.9%, treatment with a dose of 2 mg/kg of feed with a value of 2.8%, and treatment without the thyroxin hormone with a value of 2.7%. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it is known that the treatment given had a very significant effect (P <0.01) on the growth rate of the daily weight of bronze featherback. The results of further tests using the Student Newman Keuls (SNK) test showed that the daily growth rate of bronze featherback without thyroxin hormone administration was significantly different (P <0.05) from Bronze featherback given the thyroxin 2 mg/kg feed hormone and was very significantly different (P <0.05). <0.01) with bronze featherback that were given the thyroxin hormone dose of 4 mg and 6 mg/kg of feed.

The value of the highest daily weight growth rate of bronze featherback obtained in the treatment of the dose of the hormone thyroxin 6 mg/kg by 3% is in line with research conducted by Isvarida (2003) that the administration of the hormone thyroxin 6 mg/kg of feed can increase the growth of baung fish (*Mystus nemurus*). . However, the value of the daily weight growth rate of Bronze featherback obtained from this study was lower than the value of the daily weight growth rate of the species belida (*Chitala chitala*) which reached 4.54% reared in polyculture with tilapia for 6 months of maintenance (Samad et. al.,, 2017). The best dose of thyroxin hormone obtained in this study is also following the results of research by Sukendi *et al.*, (2013) on pearl Sepat fish where the administration of thyroxin hormone at a dose of 6 mg/kg of feed resulted in the highest daily weight growth rate value of 1.838%, compared with the administration of hormone thyroxin at a dose of 4; 2 and 0 mg/kg of feed, which only resulted in daily weight growth rates of 1.834%, 1.833%, and 1.798%. Furthermore, in motan fish, giving hormone thyroxin at a dose of 6 mg/kg

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of feed resulted in a specific growth rate of 0.6234% in rivers and 0.6153% in ponds, the dose of hormone thyroxin 4 mg/kg of feed resulted in 0.5767% in rivers, and 0.6126% in ponds, the dose of hormone thyroxin 2 mg/kg of feed resulted in 0.5583% in rivers and 0.5587% in ponds, and a dose of hormone thyroxin 0 mg/kg of feed resulted in 0.5344% in rivers and 0,5329% in ponds (Sukendi et al., 2011).

3.4. Survival Rate (SR)

The survival rate of bronze featherback reared for 90 days by feeding trash fish added with thyroxin hormone is presented in Figure 4. In Figure 4 it can be seen that the highest survival rate of bronze featherback sequentially was obtained at the treatment dose of 6 mg/kg of feed with a value of 95%, followed by treatment dose 4 mg/kg feed with a value of 90%, treatment dose 2 mg/kg of feed with a value of 90%, and treatment without the hormone thyroxin with a value of 90%. Based on the results of statistical tests using the analysis of variance (ANOVA) test, it was known that the treatment is given had no significant effect (P> 0.05) on the survival of the bronze featherback.

The highest survival rate of bronze featherback obtained in the treatment of thyroxin hormone 6 mg/kg of feed by 95% was higher than the survival value of bronze featherback reared in polyculture ponds with tilapia for 243 days, namely 47.1% (Rahmatullah, *et.al.* , 2009). belida species (*Notopterus Chitala*) reared in polyculture with tilapia have higher survival value, reaching 100% (Samad *et. al.*, 2017) and the larval survival of Chitala is 98.50% (Hossain et al. , 2006). Sukendi *et al.*, (2020) researched bronze featherback cultivation with different types of feed and stocking density, which found the highest survival rate of Bronze featherback, namely 93.33%. The linear relationship of each measured parameter is presented in Figure 5.

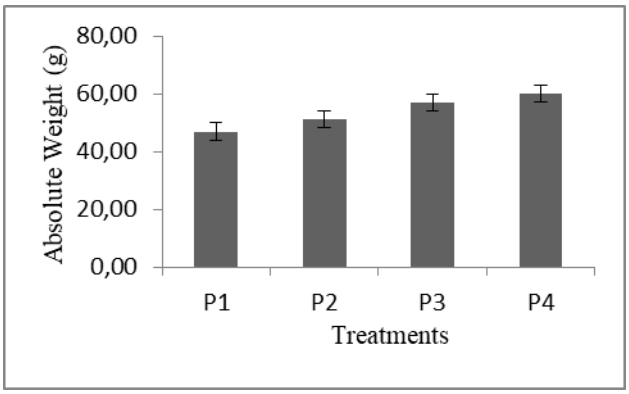

Fig.1: Growth of the absolute weight of Bronze featherback that was given the feeding treatment was added with the hormone thyroxin

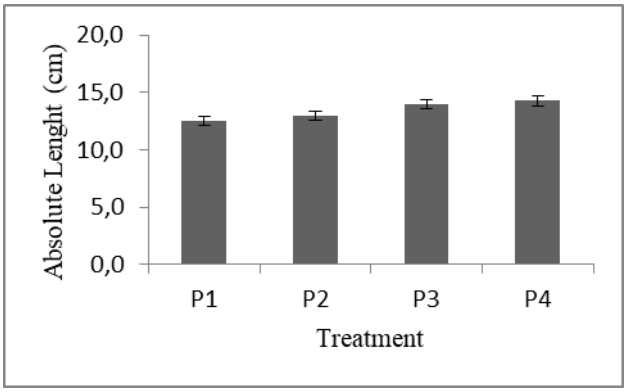

Fig.2: The absolute length growth of Bronze featherback treated with the added hormone thyroxin feed

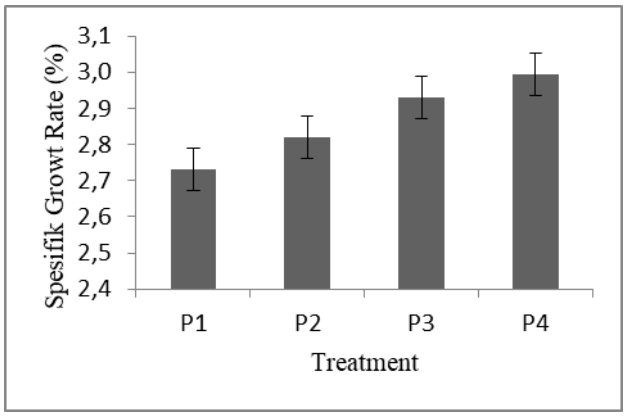

Fig.3: The growth rate of the daily weight of Bronze featherback which was given the feeding treatment was added with the hormone thyroxin

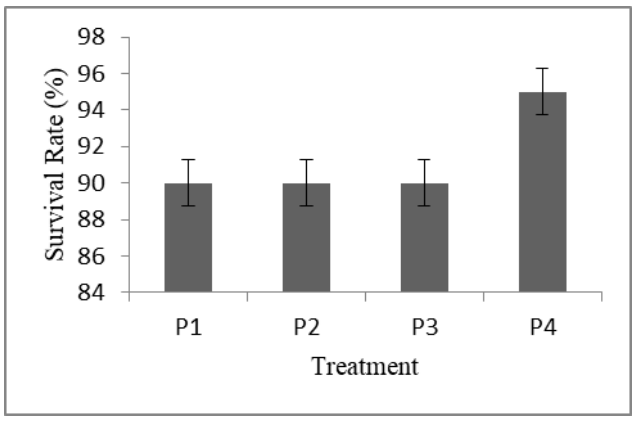

Fig.4: The life span of Bronze featherback which is given food treatment added with the hormone thyroxin

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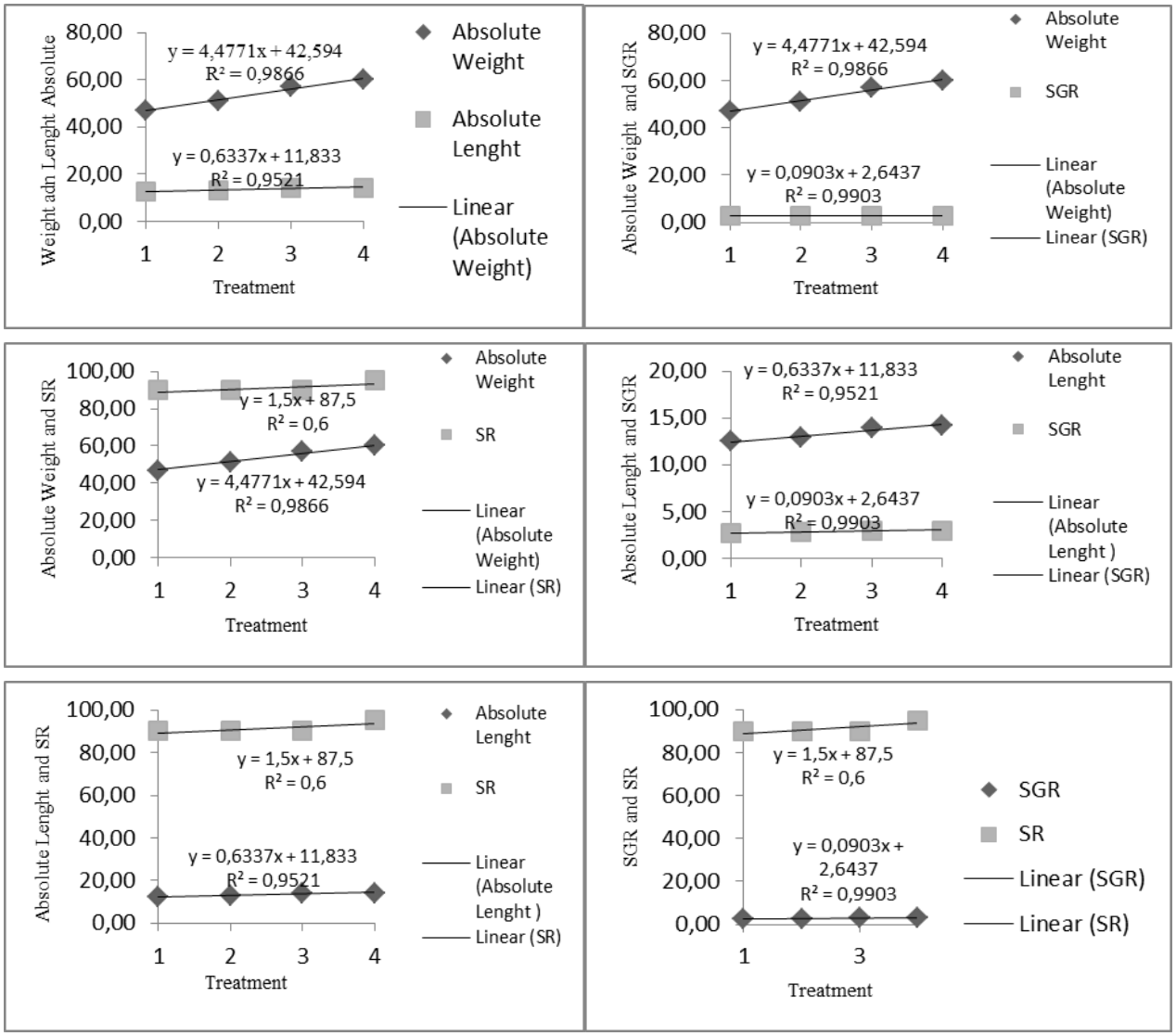

Fig.5: The linear relationship between parameters

3.5. Water quality

The results of water quality measurements for Bronze featherback rearing are presented in Table 1. Table 1 shows that the results of water quality measurements obtained during the cultivation of Bronze featherback are generally still within tolerance limits for fish farming. According to Azila (2010), the range of water quality parameters that can be tolerated by fish is a temperature ranging from 20-30 0C, a pH ranging from 4.0-9.0 and dissolved O2 ranging from 2-8 ppm and the optimum is 5-6 ppm.

Table 1. Value of water quality during the rearing of Bronze featherback

Parameter	Nilai
Tepperature	27-30^{0}C
pH	6,5-6,7
Oxygen	5-6,3 ppm

IV. CONCLUSION

From this study, it was concluded that the growth of Bronze featherback could be increased by giving the hormone thyroxin to trash fish feed. The best dose of thyroxin hormone for growth and survival of Bronze featherback is 6 mg/kg of feed and affects the growth in absolute weight of 59.96 g, absolute length growth of 14.3

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cm, the daily weight growth rate of 3%, and survival rate of 95. %.

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SENSING: An Approach to Establish the First Step to Prepare a CNC Machine for IoT Implementation

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Abstract *— Automation as the procedure is achieved without human assistance has already applied for many enterprises to improve productivity and cost reduction. The computer numerical control machines (CNC) have been implemented in many industrial segments and the monitoring of future fails can avoid delivery time delay, improve flexibility and cost-saving. As a tool of Industry 4.0, the internet of things (IoT) has been applied to introduce predictive maintenance programs. This work aims to investigate the feasibility of an easy monitoring system, using Arduino, and sensors for ultrasonic proximity, and color recognition, as well as an accelerometer as a low-cost alternative to data acquired in a CNC lathe machine facilitating the IoT implementation, and consequently a predictive maintenance program.*

Keywords *— **Arduíno, CNC lathe machine, industry 4.0, IoT, predictive maintenance, sensors.***

I. INTRODUCTION

The search for competitive advantages gave rise to automated machines, called machines with computerized numerical control or, simply computer numerical control machines (CNC). According to [1], CNC machines are capable of performing operations, previously developed with the direct intervention of the operator, obtaining greater precision and less susceptibility to the occurrence of problems of non-conformity of the manufactured components.

According to [2], the use of free hardware platforms, such as Arduino, Raspberry, and others, are easy to use and simplify the task of automating processes.

According to [3], Arduino is a free hardware electronic prototyping platform that allows interaction with the external environment through the use of sensors and actuators. Basically, the Arduino works like a computer that allows the programming and processing of inputs and outputs between the device and the external components connected to it.

The author also reports that Arduino can be used in the development of independent interactive objects or connected to a computer, constantly sending and receiving data according to the schedule. It allows for a multitude of applications, is possible to use it to control light-emitting diode (leds), displays, buttons, switches, motor drives, sensors, or any other device that emits data and allows its control.

When a machine develops a defect or failure, it presents indications of defects in several ways: changes in vibration signals, temperature variation, noise, etc. The monitoring of the condition of industrial machines provides information on the equipment's operating status, which allows planning a maintenance intervention before a failure occurs. As stated by [4], the early detection of failures helps prevent unscheduled breaks and interruptions in the production line.

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Thus, the work aims to present an easy monitoring system, using the Arduino and ultrasonic proximity sensors, color recognition sensors, and accelerometer, to ascertain the need for changing or replenishing soluble cooling oil and the vibration level of the bearings located in a gearbox, being able to identify possible failures, to prepare a CNC lathe machine for internet of things (IoT) implementation. The research work was developed in a Faculty of Industrial Engineering located in Vale do Paraiba, State of São Paulo, Brazil. The work presents itself with a bibliographic review of the important topics and results of tests carried out in the practical field at the Faculty lab.

II. THEORETICAL BACKGROUND

2.1 Automation

Automation can be defined as the technology by which a process or procedure is achieved without human assistance. It is performed using an instruction program combined with a control system that executes the instructions. To automate a process, energy is needed not only to drive the process but also to operate the program and the control system. Although automation can be applied in several areas, automation is directly associated with the production industries [5].

Historically, automation has been going on for a long time, in the mid-18th century, leveraged by the discovery of the steam engine, the industrial revolution took place, which was the biggest reason for the change from a productive system in the manufacturing process to a mechanical process by through the mechanical industry, with the insertion of machines, which increased the yield of labor and production. A qualitative and technological leap that has occurred worldwide in an irreversible and growing way. The various discoveries in conjunction with mechanization have also strengthened change [6].

The first phase of the industrial revolution occurred approximately from 1760 to 1860, with England as the highlight. The second industrial revolution, from 1860 to 1900, was characterized by the assimilation of industrialization in other countries in Europe, the United States, and Japan and the use of new sources of energy such as electricity and the use of oil [6].

From 1900, the third industrial phase began, characterized by the emergence of large industries, multinational and transnational companies, leveraged by the automation of production. The greatest advances in automation came after the second world war, starting in the 1950s. Since then, the chemical and electronics industries have been showing great development.

Automatic systems appeared at the beginning of the 20th century, but semi-automatic systems already existed. Automatic devices were invented due to the environmental need to increase production. The automation must be self-controlled using necessary tools and specific instructions for the execution of a described work [6].

The first computer is a collection of several inventions that allowed the tasks to be carried out as we know them.

Another major evolution of computers was the creation of the electrical numerical integrator and calculator (Eniac), in 1946, by John Mauchly and Presper Eckert, sponsored by the American government, after working for the government, developed Univac.

Some devices that allowed this evolution was used in the first generation of computers, such as vacuum tubes (valves); the second generation of computers was equipped with a transistor; the third was marked by integrated circuits. The evolution of computers continued until the present fourth generation of well-known desktop and personal computers, which use microprocessors.

Servomechanisms, which have also evolved, are devices that convert electrical signals into mechanical movements. This simplified definition allows us to conclude that the servomechanisms have existed for a long time and could operate independently of the computer or the instructions coming from the computerized numerical command, the CNC [6].

For [7], automation is a technology that makes use of mechanical, electrical, electronic, and computer systems to control production processes. And it brings some examples of automation processes in industries:

- automotive assembly lines,
- engine integration - transfer line,
- CNC type machine tools,
- robots.

Three different forms of industrial automation can be identified:

- fixed automation,
- flexible automation,
- programmable automation.

a) Fixed automation:

In fixed automation, the machines are specific to the product to be produced. They produce large quantities of a single product or product with small variations between them. The volume of production is high and the cost of the

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machine too, as it is designed for a specific product. On the other hand, as the volume of production is high, the cost of the product, in general, is low. Such machines are found in motor transfer lines, lamp production, paper, and bottle manufacturing. In this type of automation, care must be taken with the final price of the product, since, as the investment for the purchase of the machine is high, amortization only happens with high sales. Besides, if the product leaves the market due to obsolescence, the investment is lost.

b) Flexible automation:

Inflexible automation the production volume is average and the machine can generally be programmed to produce another product, albeit similar. This automation has characteristics of fixed and programmable automation. The machine must be adaptable to a large number of similar products, and, in this sense, it is more flexible than fixed automation. Flexible automation is used, for example, in an automotive assembly line.

c) Programmable automation:

In programmable automation the production volume is low, but the variety of products is different and high. It is programmatically adaptable. The main examples of programmable automation are CNC machines and industrial robots.

2.2 Industry 4.0

The industry produces goods and services through countless processes seeking to meet the needs of its final consumer with quality to retain customers. For this, it has an important ally - technology - where smart industries are investing in mechanization, automation, and robotization, as well as relying on a set of interconnected data. The purpose of such investments is to ensure that the products developed are produced in the best possible way, reducing costs and/or increasing revenues to maximize profits.

[8] report that the next generation of the industry - called Industry 4.0 - keeps the promise of greater flexibility in manufacturing, along with mass customization, better quality, and better productivity, where smart manufacturing plays a key role.

[9], the first industrial revolution was linked to the field of mechanization, the so-called second industrial revolution referred to the intensive use of electric energy and the third industrial revolution is related to the era of generalized digitalization. Future production contains efficient manufacturing systems where products control their manufacturing process, this is an example of future expectations, so the term "industry 4.0" was established for a fourth industrial revolution.

Industry 4.0 emerged as a proposal for the development of a new concept of German economic policy based on high-tech strategies [10].

[11], the fourth industrial revolution is a transition to the digital transformation of industry, a fusion of the physical and digital worlds that have countless possibilities, so Industry 4.0 is substantially a reformulated approach to manufacturing that makes use of technological inventions and innovations uniting operational, information and communication technologies.

[12], industry 4.0 is part of a relevant discovery by the German government, in which it seeks to present a new model of computerized manufacturing, bringing together the fields of physical and digital processes.

[13], industry 4.0 can be understood as a relevant process, marked by process automation digitization and use of Information Technology tools to manufacture products and services.

The fourth industrial revolution can best be described as a shift from manufacturing logic to an increasingly decentralized and self-regulating value approach, enabled by concepts and technologies like cyber physical systems (CPS), IoT, apple operating system (IOS), cloud computing or additive manufacturing and smart factories, to help companies meet future production requirements [14].

[15], industry 4.0 is associated with digital technologies that have great relevance in the manufacturing process, but that does not limit them in their respective uses. Among these technologies, it is possible to mention the smart factory, big data, the internet of things, and cyber-physical systems.

2.3 Internet of Things

The internet of things, for [16], is a type of communication interface between humans, machines, and objects that innovated in the way of producing, reproducing and using knowledge. According to [17] "is a technological innovation, based on already consolidated artifacts such as the internet and smart objects". Its objective is to create new applications and improve existing ones, according to [18], enabling the integration of information from the virtual and physical environment, thus extending the network to the real world [19, 20].

According to [21], it is a platform that is based on the interconnection of everyday objects. In this perspective, several of the objects that surround us will be on the network in one way or another, for this, radio frequency identification (RFID) - and the technologies with sensor networks will increase to account for this new challenge,

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thus, information and communication systems will be invisibly, however, incorporated in the environment that surrounds us [22].

[23] explains that the internet of things refers to a network of objects that have a built-in technology - usually sensors and microprocessors - and that can interact with each other either by sending or receiving information both internally and externally. Thus, according to [24], the internet of things will create a world where physical objects will be perfectly integrated into the information network to the point of being able to offer advanced and intelligent services to human beings.

[25] point out that the internet of things goes beyond smart homes and connected devices - it means getting to know the physics in real-time and remotely - and today, with the increasing expansion of smartphones, it is possible to use its built-in sensors to monitor the environment anytime, anywhere.

[26] and [27], the internet of things generate more opportunities for the business. With the introduction of these new technologies, such as radio frequency identification and intelligent computing, it became possible to create new applications and business systems involving the most different sectors, such as logistics, production, transportation, the environment, services, among others [28]. This evolution creates systems that go beyond the interconnection of individual things, being able to provide joint and collaborative services [29].

III. METHOD AND MATERIAL

3.1 Type and Scientific Approach

The present work used theoretical, qualitative, and applied research. For [30], in qualitative research there is a dynamic relationship between the real world and the subject not translated into numbers, the natural environment is the direct source for data collection and the researcher is the key instrument. The interpretation of the phenomena and the attribution of meanings are basic in the qualitative research process. It is descriptive and does not require statistical methods and techniques. Regarding applied research, [31] reports that such research is motivated by the need to solve concrete and existing problems in the research environment. Applied research, therefore, has practical purposes, different from pure research, which is motivated by curiosity and the desire to research.

3.2 Method and Material

Two methods were used for the elaboration of this work, being the open project tool to carry out the research schedule and elaboration of the tasks to be done and the Arduino software for programming the sensors.

The materials acquired for the preparation of the project were:

- (Arduino) Mega 2560 R3 CH340 + USB Cable for Arduino,
- Jumpers - Male / Female - 40 Units of 30 Cm,
- TC TCS230 RGB Color Sensor Module,
- Accelerometer and Gyro 3 Axis 6 DOF MPU-6050 GY-521,
- HC-SR04 Ultrasonic Distance Sensor Module,
- Diffuse Led 3mm Red - 10 units,
- Diffuse Led 3mm Green - 10 units.

The work was produced by 4 researchers of industrial engineering course, from a Faculty located in Vale do Paraíba in the state of São Paulo, Brazil, carried out thorough research in the Faculty lab. The research was conducted in a period of 4 months.

In the sequence, more data will be presented, and then results are presented and discussed.

3.2.1 Objective of the Application

Many industrial machines use refrigerant oils to cool the tools being used. The quality control and oil level are done manually by the machine operator, this monitoring process for changing or refilling the oil is extremely important because if it is not done correctly it can cause serious problems, such as tool breakage. Another factor to watch for is the breakage of the bearing unexpectedly, as so far, many machines do not have a wear indicator for this part.

To demonstrate the application and assembly of a monitoring system to control the level and tone of the soluble oil and vibration of the bearings located in the gearbox of a CNC lathe machine, an Arduino model mega 2560 board and ultrasonic proximity sensors, leveling and accelerometer were purchased.

The HC-SR04 ultrasonic proximity sensor, shown in Fig. 1, will be used to control the machine's refrigerant oil level and will emit a sound wave that, upon encountering an obstacle, such as the oil level, will bounce back towards the module and as soon as these waves are dissipated in the pointed direction of the sensor, the calculation data will be generated to measure the distance between the sensor and the detected oil.

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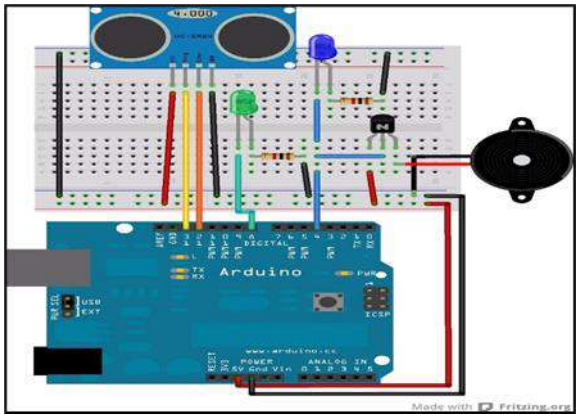

Fig. 1: Ultrasonic Distance Sensor Module HC-SR04. Source: [32].

The color sensors register the color of a surface, illustrated in Fig. 2, it can accurately detect subtle color differences. After emitting light towards the objects to be tested, these sensors calculate the chromaticity coordinates, that is, the amount of green, blue and red color that the object contains based on the reflected radiation, and compare them with chromatic reference values previously stored. If the chromatic values are within the set tolerance range, the switching output will be activated, turning on the led light according to the programmed tolerance set for each tone.

Therefore, these two sensors mentioned above aim to communicate to the operator the ideal time to change or refill the oil.

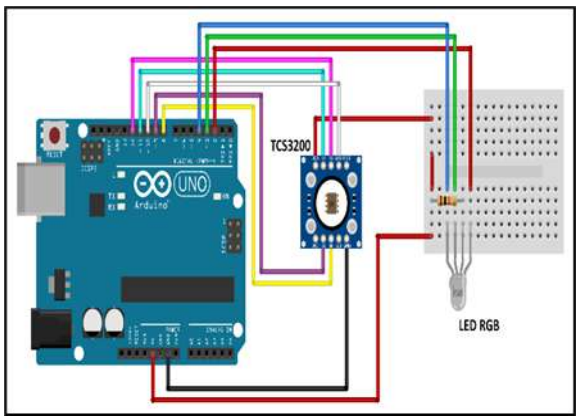

Fig. 2: Color Sensor Module RGB TCS230. Source: [32].

The accelerometer sensor, shown in Fig. 3, will be responsible for indicating the vibration index emitted by the machine's bearings, located in the gearbox, the vibration signal will be constantly captured by the sensor, the vibration being within acceptable parameters will keep the green led on, informing that the bearing It's working correctly. Otherwise, the red led will light up indicating that the vibrations are out of specifications, warning the operator that it is time to carry out predictive maintenance.

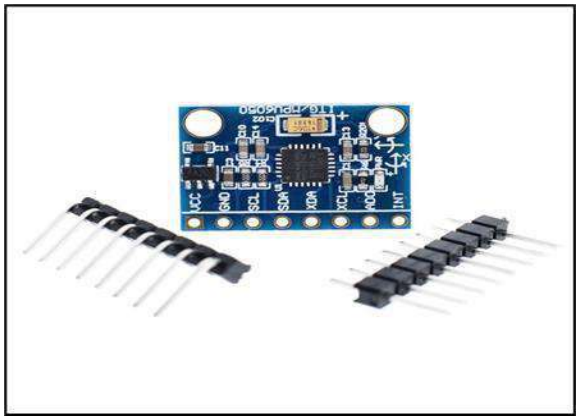

Fig. 3: Accelerometer. Source: [32].

IV. RESULTS E DISCUSSION

This sensing research was conducted to validate the application of specified sensors to support the introduction of a predictive maintenance program for a CNC lathe machine, Fig. 4. The parameters to be collected and controlled and the specified sensor was:

- Level of cooling oil: Ultrasonic distance sensor HC-SR04,
- Dusty of cooling oil: TCS230 RGB Color Sensor,
- Vibration in the transmission gearbox: Accelerometer Sensor.

Firstly, the software library was downloaded in the beginning. Compatible programming was conducted for Arduino application, and in the sequence, the three tests were conducted as the following detailed described.

Fig. 4: CNC lathe machine. Source: [33].

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4.1 Ultrasonic distance sensor HC-SR04

The first test was done with the proximity sensor, known as the US sensor. The tests were carried out with the aid of a 30 cm ruler to verify the sensor measurements. Noting that everything was in agreement, the sensor was calibrated at a distance and pointed at a container filled with liquid, thus creating three types of variables, namely: full, medium, and empty. Then 3mm Diffuse leds in green and red were used, each led was programmed to the light color, being green for the full variable, red for empty and when the sensor identified the median variable, both leds would light.

Fig. 5, 6, and 7 illustrate the results of the programming.

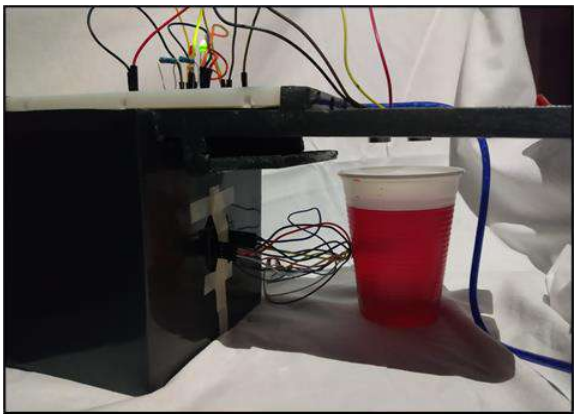

Fig. 5: Test succeded in the condition full.

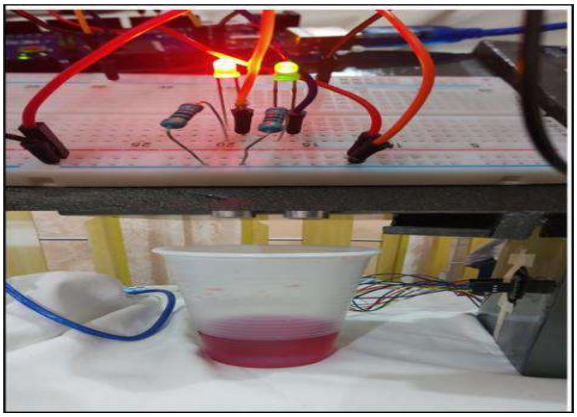

Fig. 6: Test succeded in the condition middle level.

Sources: Authors.

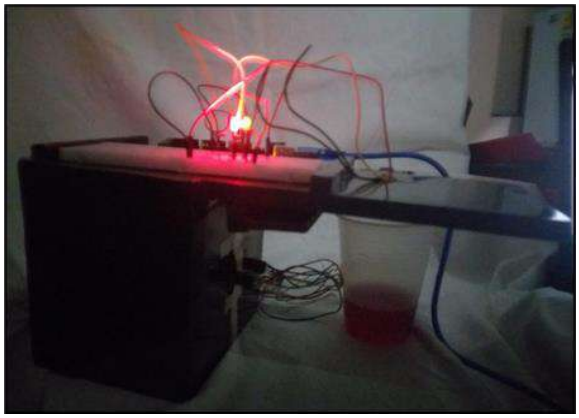

Fig.7: Test succeded in the condition empty.

4.2 TCS230 RGB Color Sensor

For the color sensor test, three containers with liquid of different shades were reserved, from the lightest to the darkest, according to Fig. 8, 9, 10, and 11 following. Initially, the color was referenced and the data was read, then we analyzed a darker color, checking the data again, thus creating the limits for reading the values obtained from the primary colors, separating into 3 variables: "good", "regular "," bad ". We use leds, where the green color means that the oil status is good, the green and red color flashing simultaneously indicate that the oil status is regular, and finally the red color indicating that the oil status is bad, according to the parameters defined in the Arduino programming. For the tests to be carried out with the containers in the same position, a wooden support was developed. This support has the function of fixing the sensor and the containers in a single position.

Fig.8: Test succeded for different colors sets.

Firstly, the standard colors were set, using three different patterns in a scale from lightest to darkest, this procedure was necessary to calibrate the sensors and check the response to what was programming in the Arduino.

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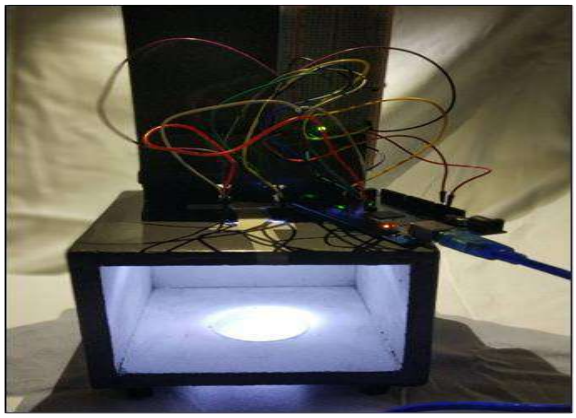

Fig.9: Test succeeded to verify the correct color set.

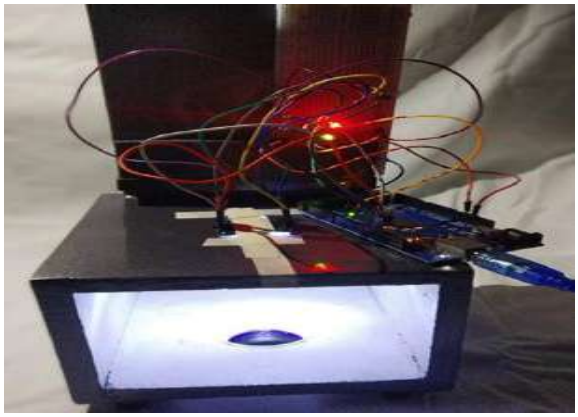

Fig.10: Test succeeded to verify the acceptable color set. Source: Authors.

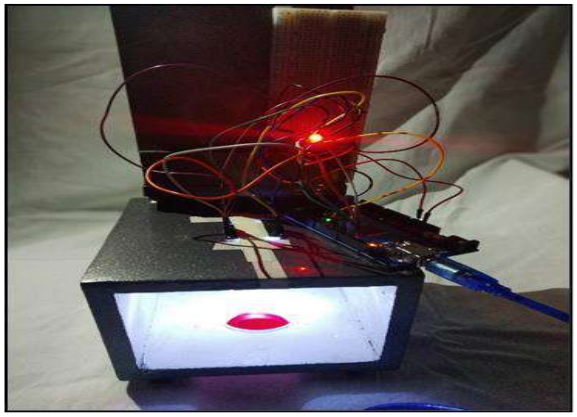

Fig.11: Test succeeded to verify the rejected color set.

4.3 Accelerometer Sensor

Two types of analysis were performed using the propellers of a fan. The first test was done with the fans on, the vibration captured by the sensor-generated data that was programmed to be considered acceptable (balanced condition) and thus, turn on the green led, indicating the balance situation, as shown in Fig. 12. For the second test, a wooden block with calibrated weight was attached to one of the fan propellers to promote a specified unbalance, to make them rotate out the balance axis. In this condition as the out-axis rotation (unbalanced condition) resulted in the vibration to be much higher than the first balanced condition, the sensor then captured these results by immediately lighting the red led, illustrated in Fig. 13.

Fig.12: Vibration signal captured in the balanced condition. Source: Authors.

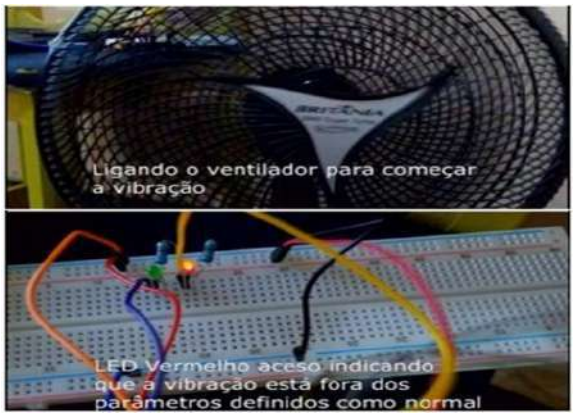

Fig. 13: Vibration signal captured in the out balanced condition.

In this work, it was presented the method and the results obtained through experimental tests that sought to enable the implantation of sensors that could communicate the operator of a machine the level and quality of the emulsion cooling oil used in the process, and the vibration index of the bearings located in the gearbox, to make this operator. The experimental results demonstrated the feasibility of implanting the sensors since all tests were satisfactory. To monitor the shades in industrial oils, the programming must be done according to the manufacturer's specification, due to a possible shade variation.

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For the results obtained from the accelerometer, the analysis of this record allows determining changes in the operating condition of mechanical equipment, be it motors, transformers, bearings, caused by failures, or natural wear of the parts.

The use of new metrics and the collection of vibration signals on simultaneous axes will allow further investigation of the results obtained in different operating conditions with failures.

V. CONCLUSION

This work aimed to present an easy monitoring system, using the Arduino and ultrasonic proximity sensors, color recognition sensors, and accelerometer, to ascertain the need for changing or replenishing cooling oil and the vibration measurement for bearings in the gearbox, being able to identify possible failures, to prepare a CNC lathe machine for IoT implementation, as a part of a predictive maintenance program. As shown, the application of the specified sensors was successfully demonstrated.

The researchers had presented a way to introduce the data acquisition using a low-cost solution, in this case by the application of the Arduino, and specified sensors that are easily reached on the internet and that give a reasonable accuracy to prepare a CNC lathe machine to IoT application.

This research has as limitations: the number of tests conducted before sensing to be applied in the didactic CNC lathe machine, the necessity to checking the limits established for the outputs of acquired values as well as must be validated in a real application using the IoT communication interface to generate the data in the cloud, and a bigdata treatment followed by machine learning approach to the predictive maintenance implementation.

For future works, the researchers strongly recommend the implementation of this solution in different CNC machines, conduct the investigation considering the sensing full implementation, validation of the acquired data, consolidation of bigdata, and machine learning during a representative period of the machine operation.

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Social Interaction and the use of Space in the traditional activities of Kampung Naga

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Abstract**—** *Indonesia has a diversity of landscapes and communities. This creates a diversity of lifestyles that reflect the identity of the area or a place. This identity is also reflected in the form and how people carry out the traditions that have been existed from generation to generation. Kampung Naga, as one of Indonesian traditional village has its own uniqueness characteristics. This can be seen from the culture, traditions, interactions and spaces created by these traditional activities. Therefore, research is needed that has the aim of finding out how the traditional activities of the Kampung Naga produce social interactions in certain spaces. By using descriptive explorative methods and descriptive analysis and assisted by behavior mapping, will explain the interactions and spaces in traditional activities. The output of this study is to determine the interactions that occur in every traditional activity in Kampung Naga.*

Keywords**— Activities, Social interaction, space, tradition.**

I. INTRODUCTION

According to Amos Rapoport in his book entitled "House Form and Culture" (1969), space is not only the result of physical strength or a single causal factor but is a consequence of all the socio-cultural factors seen in a broad view. There are three forms of culture, and one of them is a form of culture in the form of an activity or patterns of human action, which can also be called a social system (Koentjaraningrat, 1979: 186-187). Culture is a complex collection of knowledge, art, beliefs, morals, laws, traditions (customs), and any other abilities or habits acquired by humans as members of a society (Kroeber and Kluckhohn,1952). Koentjaraningrat (1987: 187) states that tradition is the same as customs, concepts, and rules that are solid and strongly integrated into a cultural systemin a culture that regulates human action in the socio-cultural field. Therefore, it can also be seen that traditional ceremonies are a form of an activity carried out in the traditions of a society. The activity itself contains four main things, namely the actor, a group of people who carry out an activity; kinds of activities, namely the activities of a group of people; place, where the activity takes place; and the time the activity took place, when the activity took place (Bechtel and Zeisel, 1967). In the use of space in traditional activities, the use of space by the community can be grouped into three, namely the micro space scale where the space formed by the relationship between space in the house, the meso space scale that is formed by the relationship between activities in the house and activities that occur within the house, yards, and macro space schemes are formed by the existence of links between activities in the yard and public places in the village (Haryadi &Setiawan, 1995). Social interaction is a general form that results from social processes because social interaction is the main condition for the occurrence of social activities. Social interactions the starting point of social events, and social interactions have a specific purpose (Sumarti, 2015). In achieving these goals people will act and react with others. In social interaction, there are humans, communicate in the form of language, symbols that are meaningful in a time dimension to achieve certain goals. In traditional societies, relationships or forms of social interaction do not only occur among humans. Where people believe that social groups are

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divided into two, namely supernatural and human, and are divided into three categories of "world" or "space" (Rukmi,2016). This supernatural social group is described as God, ancestors, spiritual figures, or parents who have died. Indonesia is an archipelagic country that contains more than 17,000 islands with around 261.8 million population spread across Indonesia. With a variety of forms and landscapes, Anda large population resulting in ethnic, religious, and cultural diversity. Therefore, Indonesia has a very diverse cultural heritage and a different pattern of life which is formed from this diversity. The culture that continues to be repeated will be attached to and reflect the identity of the region. With the development of technology and the exchange of information regarding views, thoughts, and culture from outside Indonesia, it has resulted in the fading of the identity inherent in Indonesia. There are various traditional villages that are part of Indonesia's identity that need to be preserved for their own uniqueness, one of which is Kampung Naga. Kampung Naga is in a hilly area with an area of 2(two) hectares and is administratively located in Salawu sub-district, Tasikmalaya Regency, West Java. This village is one of the villages that is famous for its culture that is still attached to the community. Kampung Naga is designated as a Cultural Heritage Area, Tourism Allocation Area, and District Strategic Area from the point of view of social interest in 2011-2031Tasikmalaya Regency Spatial Plan. Rituals, ceremonies, and beliefs regarding the rules in managing the existing space are still being carried out. This can be seen from how people live in harmony with nature. This activity originated from the previous Kampung Naga community which is still being maintained and obeyed until now. Hereditary beliefs, ceremonies that are still being carried out as well as interactions between existing communities show that socio-cultural factors have a relationship with the spatial structure in Kampung Naga. Therefore, research is needed to study how social interaction and spatial use in the traditions of the people of Kampung Naga are to maintain the identity of Kampung Naga as a part of Indonesian culture.

II. METHODOLOGY

This study uses a descriptive exploratory method. This descriptive method is a problem-solving process by describing or describing the state of the research object. And exploratory research aims to explore broadly the causes or things that influence the occurrence of something based on facts in the field.

The variables used are based on the theory of human activity (Bechtel and Zeisel, 1967), the theory of elements of traditional ceremonies as traditions (Koentjaraningrat 1980: 241) and how culture has a relationship between the environment and the humans of Rapoport (1969). The research variables can be seen in the following table:

Table.1: Research Variable

Purposes	Variable	Sub Variable	Source
Identify the traditional activities in Kampung Naga	Activities	Activities in traditions	-Bechtel and Zeisel (1967) -Koentjaraningrat (1980)
Identify the social interactions in traditional activities in Kampung Naga	Social interactions	Social interactions in traditions	-Sumarti (2015) -Rukmi (2016)
Identify the use of space in traditional activities in Kampung Naga	Space	Space in traditions	-Rapoport (1969) -Bechtel and Zeisel (1967)

The data collection method consisted of a primary survey. The primary survey consists of observation and interviews. Observation, namely recording, sketching the situation, and documenting the study area, mapping the study area, and identifying existing spaces. Furthermore, interviews were conducted with research informants regarding traditional activities in Kampung Naga with the data required were actors, location, time, activity objectives, activity processions, objects/tools used and types of activities carried out.

Determination of respondents as research informants using snowball sampling technique where the sampling technique with the help of key informants, and from this key informant will develop according to the instructions.

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The informant is then determined according to the direction of the key informant so that later they get the desired information and are right on target. In this study, the research informants started from village government officials in Kampung Naga, then met with tour guides who were native residents of Kampung Naga. The guide tour took the researcher to meet *Kuncen* as the key informant. Furthermore, the tour guide who always accompanies researchers met with several village communities as informants who have lived in Kampung Naga.

The analysis used is descriptive analysis and analysis using behavior mapping. According to Ittelson (1970), behavior mapping generally follows a procedure consisting of 5 (five) basic elements, namely: A basic sketch of the area or setting to be observed; A clear definition of the forms of behavior to be observed, counted, described and diagrammed; Inform a clear plan of time when the observations will be made; Clear systematic procedures should be followed during observation; Efficient coding/tagging system to make observation work more efficient.

Behavior mapping includes a map of the reality or plan of an area in a human location and an area showing human activity, observations of the behavior of space users/buildings based on Place-Centered Maps as well as physical trace and Person-Centered Maps. In this study, the place centered map method was used to see how humans organize themselves in a particular location (Sommer et al, 1980). This survey technique aims to find out how humans or groups of people use, use or accommodate their behavior in a certain time and place. In this technique, the first step that must be taken is to sketch a place or setting, including a physical element that is thought to affect the behavior of the user of the space. Researchers can use base maps that have been made previously. Then within a certain period of time, the researcher recorded the various behaviors that occurred in that place by describing the symbols on the base map that had been prepared.

III. RESULTS AND DISCUSSION

Tradition can be defined as an idea, belief or habit, and rules or norms from the past and has a certain meaning. The customs in question can be in the form of traditional ceremonies arranged by customs. Traditional ceremonies in Kampung Naga are held according to a series that has been passed down from generation to generation and are held either individually and collectively or communally. There are 9 traditional ceremonies carried out by the community.

1. Traditional Activities

The people of Kampung Naga carries out various ceremonies which are a form of community cultural inheritance. The ceremonies in Kampung Naga have both individual and communal importance. Individual ceremonies such *slametan padi, lahiran, pernikahan, kematian*, and *bangun rumah*. Communal ceremonies, namely the *hajat sasih, khitanan* and *gerhana*. The ceremony is carried out as an illustration of gratitude for the sustenance that has been given by God.

1.1 *Hajat Sasih*

The *hajat sasih* ceremony is a pilgrimage ceremony to the ancestral grave for men and the activity of making *tumpeng* or *numpeng* for women. The purpose of this ceremony is to honor the ancestors or spirits of the ancestors and as a form of gratitude and gratitude to Allah SWT for everything that has been given. The *hajat sasih* ceremony is carried out 6 times a year, namely in the month that is glorified by Islam. The *hajat sasih* ceremony is carried out by all the indigenous people of Kampung Naga, both those who live in Kampung Naga and those who live outside the village area. The ceremony begins with the sounding of a *kentongan* in the mosque. Before doing the pilgrimage, do *beberesih* or *susuci*, namely cleaning the body in the Ciwulan River. After that the ceremony participants or the men walked towards the Kampung Naga Mosque. However, *Kuncen*, *Lebe*, and *Punduh* did not first enter the mosque but entered *Bumi Ageung* to prepare the *lamareun*. After that *Kuncen*, *Lebe*, *Punduh* and the ceremony participants left the mosque and walked with a broomstick to the ancestral grave in the west. The ceremony ended with a *tumpeng* cutting ceremony.

Fig. 1: Hajat Sasih Map

1.2 *Slametan Padi*

The traditional cropping system implemented in Kampung Naga is the *Janli* cropping system, which is

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planting in January and July. In the process of planting to harvesting, various ceremonies or subsets have been carried out from generation to generation. The ceremony is usually carried out by each family. The ceremony process is usually carried out by men. However, in the harvest process after the ceremony, the women can help if there is no housework to be done.

The first activity in the harvest process in Kampung Naga is sowing seeds. After the spread of the seeds is completed, the *rujakan* is carried out where the *rujakan* is carried out, namely placing and storing *rujak*, *deugan* (coconut) and *lamareun* (betel, areca, lime, tobacco) in the first location the rice is planted. It was meant to save and be grateful that we had planted rice at that time. After rice grows and becomes large, at that time rice is considered a craving. And implemented the 2nd *ngarujakan*. Just before harvest time, men carry *nyawen* at 04.00. *Nyawen* is to put *lamareun*, shoots and grain in every corner of the rice field. When the sun has risen, a *mipit* or harvest is carried out accompanied by the women. The next procession, namely *ngariungkeun* / *ngumpulkeun*, is a series of *mipit* / harvesting activities where rice is brought home to be dried. After the rice is dry, do *ngaleseuhan*. *Ngaleseuhan*, namely pounding rice together which is carried out at *Saung Lisung* by women from morning to evening. The results will be stored in a *goah* (rice storage area) in every house in Kampung Naga. On every Tuesday and Friday night, the women put a salad (*ngerujak*) and *lemareun* in the cave.

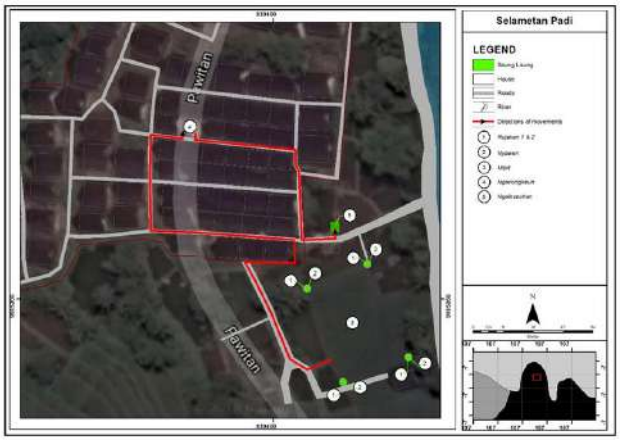

Fig.2: Slametan Padi Map

1.3 *Khitanan*

In Kampung Naga, circumcisions can be performed individually (*karia*) or masse (*ria*). Circumcision is carried out on a mass basis, especially for the people of Kampung Naga who live in Kampung Naga and outside Kampung Naga. Circumcision is carried out simultaneously with *gusaran*, namely circumcision for women.

On the first day, make preparations for parents and children as well as the community to collect the necessary items. After that is *Ngerajah ubrug*. *Ubrug* or soup kitchen is a place for women to carry out large-scale cooking. Besides that, it also prepares *balandongan* (stage) which is made from nature. *Balandongan* is made in mutual cooperation and placed in front of the mosque. On the second day, it started with *beberesih*, where the circumcised and angry participants took a bath in the Ciwulan River accompanied by their parents. After the ritual is complete, the participants return home to change clothes and head to the mosque. This first ritual ends with a meal together. After that, the participants were paraded around the village. After everyone returned, the *sawer* was carried out. The ceremonial process on the third day of circumcision is carried out by *paraji*, *mantri*, and doctors located in front of the bale *patemon* with a *kalangkang* accompanying the circumcision participant in the *jojodog* which is the traditional seat. After that, *wawarian* was carried out. Through the ceremony, garbage and other activity remain in the form of household waste are collected in a shelter and then burned.

Fig. 3: Khitan Map

1.4 *17 Agustus*

17 August is Indonesia's Independence Day. On 17 August, the people of Kampung Naga take part in celebrating Indonesia's Independence Day. The people of Kampung Naga together with the people of Neglasari Village participated in celebrating this Independence Day. On the 14th and 15th or two days before Independence Day, the people of Kampung Naga gathers on the Ciwulan River to catch fish together. Fish that have been caught. On August 17th, the fish that have been caught are then paraded to the *Bale* in Neglasari Village using a *jampang*.

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The traditional art of Kampung Naga is flying since it was played at the time of the procession. After the procession arrived at the *Bale* in Neglasari Village, the fish that had been collected by the village community were given to government officials who were present in 17 activities in Neglasari Village.

1.5 *Gerhana*

Gerhana or *samagaha* is a condition in the sky that darkens at some time during the day. When an eclipse or *samagaha* occurs, the people of Kampung Naga carry out a ritual. The ceremony participants are women who are usually mothers. At this time, the women gathered in the *Saung Lisung*. In *Saung Lisung* itself there is a pounding device called *alu* and *lisung*. The pestle and *lisung* are made of wood. In addition to being used in rice pounding activities, this tool is used as a sign of an eclipse where women play the advantage by hitting *lisung* with a pestle that produces sounds. This is done so that the dark sky becomes brighter again.

1.6 *Lahiran*

The birth of a baby is a welcome thing in Kampung Naga. There are various ceremonies carried out from the pregnancy process to the birth of a baby in Kampung Naga. The ceremony or *selametan* is carried out in the 7th month of pregnancy, and the ceremony at birth. The first is a ceremony or *selametan* which is held in the 7th month of pregnancy. At the ceremony, the family and the invitation will read the verses of the Al-Qur'an at home. After that, prayer is carried out for the safety and goodness of the prospective baby and closes with *ngariung* or eating together. During the birth process, a midwife is assisted and accompanied by *Indung Berang*. The ceremony or *selametan* is carried out by inviting neighboring neighbors to pray for the baby, giving a name to the baby, and ending with *ngariung* or eating together.

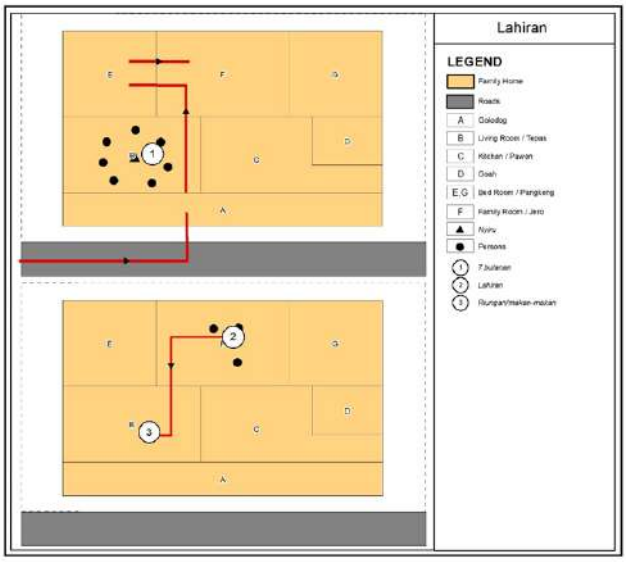

Fig.5: Lahiran Map

1.7 *Pernikahan*

In general, marriages in Kampung Naga is carried out in accordance with Sundanese customs or following the customs of the prospective wife. The wedding ceremony in Kampung Naga is divided into several stages. The first is the *narosan/lamaran*. At this stage, the date of marriage is determined by the male party. After the wedding date has been determined, the next stage is *ngeyeug seureuh* where in this process the men's and women's clothing and their equipment are collected and placed on the *tampah*. Then the *tampah* is lifted / carried by the groom, woman, female guardian, and elders to pray. This is done for the sake of *ngarakeutan*. This activity is carried out at the bride's house, on the night before the marriage contract.

Next is the *Walimahan* (marriage contract) event held at the mosque by inviting officers from the Office of Religious Affairs (KUA). After the *walimahan* was finished, the *saweran buhun* was carried out. The bride and groom are brought to the door of the bride's house. The speaker recites a saying that contains advice. After the *saweran buhun* is finished, the activity continues with the *Nincak Endog* where the groom steps on an egg while the bride cleans it with water that has been taken from the Ciwulan River.

When finished, the bride enters the house while the groom waits at the door to carry out the next step, which is to open the door. Furthermore, *ngariung* is a ceremony performed and attended only by the parents of the bride and groom, *Kuncen*, elders, and close relatives. Where the two brides sit facing each other, then carried out *ngampar*, where the mattress is prayed for by the *Kuncen* and the elders, which is meant to unite the bride and groom and

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not leave the house. Next is the *Munjungan* event, namely the *sungkem* or prostration of the bride and groom to both parents, *Kuncen*, elders, and close relatives. *Munjungan* is meant to ask blessings from parents and elders.

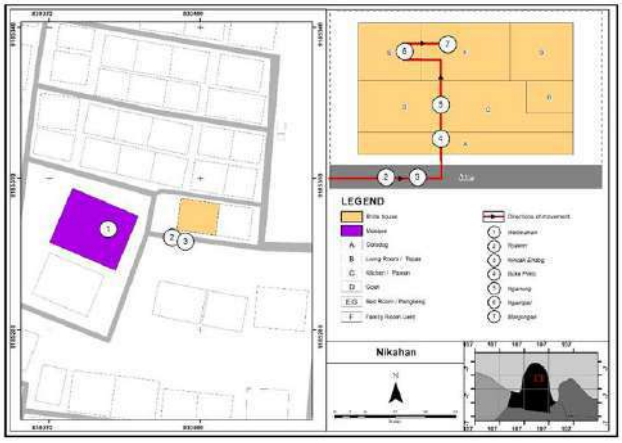

Fig. 6: Pernikahan Map

1.8 *Kematian*

The death ceremony in Kampung Naga is still guided by Islamic religious law. When someone dies, the body is immediately laid down at the funeral home. This ceremony is led by Lebe as a traditional institution that has duties in religious activities. The body was washed in front of the house which had been insulated with cloth by her *muhrim*. After being bathed, the corpse is then used. The funeral prayers are held at the Kampung Naga Mosque. The cemetery used by the people of Kampung Naga is located in the west near the main road and east of the village, which is next to the forest. The land from the cemetery is not traded but *waqaf*.

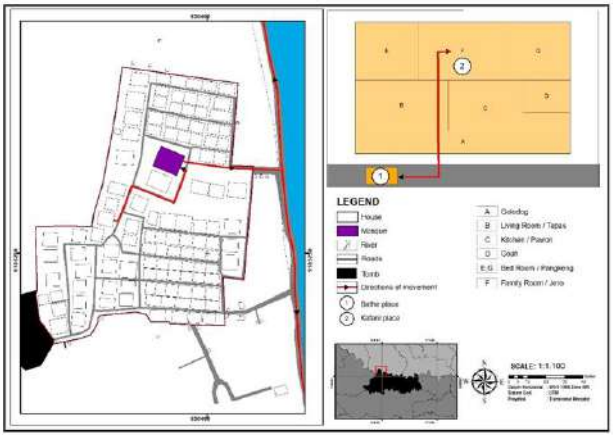

Fig. 7: Kematian Map

1.9 *Bangun Rumah*

In building a house in Kampung Naga, there is no prohibition to build a large or small house, be it beyond the house of *Kuncen* or traditional leaders or the like. However, it cannot be bigger than the size of the mosque in Kampung Naga as a place for worship. Besides that, the size of the house is also influenced by the shape of the land and the existing topography. The ceremony for building a house in Kampung Naga is divided into several stages. The first is *ngibeasan ngadekai*. *Ngadekai* means someone wants to be cut, spliced or cut. Therefore, the wood that has been cut, before going through the process, the house builder performs the ceremony so that it is smooth. After the process is complete, there is a term in the entry of the pillars to the earth, which is that the wood is ready to be attached and built into a house. Before the process was carried out, a canyon was held, namely asking for permission and apologizing to the almighty if there were activities that were not in accordance with their requirements. The experts in building houses pray that later the process will be more blessed and that the houses that are built will be stronger. After the house is built, it will be carried out to celebrate the priest. *Nyalameutkan imah* is a ceremony held before the house is inhabited.

2. Socials Interactions and Use of Space

There are various types of traditional activities that take place in Kampung Naga. These activities can take the form of communal or individual. In every activity, there is a procession with various objectives, times, locations, tools, person. There are social interaction and use of space that occurs in every procession in social activities in the tradition of Kampung Naga. This can be seen in the following table:

Table.2: Social Interactions on Traditional Activities

Procession	**Space**	**Person**	**Social Interactions**
Hajat Sasih			
Kentongan	the front yard of the mosque	Kuncen, Lebe, Punduh, and male participants	No interaction
Bebersih or *susuci*	Ciwulan River	Kuncen, Lebe, Punduh, and male participants	No interaction
Change clothes	At home	Kuncen, Lebe, Punduh, and male participants	No interaction
Preparatio	Bumi	Kuncen, Lebe,	Individuals

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n / taking *parukuyan*	Ageung	Punduh	with ancestors
Get together and pray	Mosque	Kuncen, Lebe, Punduh, and male participants	Individuals with ancestors, Individuals and grup
pilgrimage	Leweung Keramat / Ancestors Grave	Kuncen, Lebe, Punduh, and male participants	Individuals with ancestors
Gathering	Mosque	Kuncen, Lebe, Punduh, and male and female participants	Individuals with ancestors, Individuals and grup, Groups and groups
Selametan Padi			
Prayer and sowing seeds	Rice fields	Male and female	Individuals with ancestors
First *rujakan*	Rice fields	Male	Individuals with ancestors
Second *rujakan*	Rice fields	Male	Individuals with ancestors
Nyawen	Rice fields	Male	Individuals with ancestors
Mipit or harvest	Rice fields	Male and female	Individuals with ancestors
Ngariungkeun/ngumpulkeun	In front of the house or in an empty field	Female	No interaction
Ngaleseuhan	Saung lisung	Female	No interaction
Storaging the rice	Goah	Female	Individuals with ancestors
Khitanan			
N*gerajah ubrug* and *balandongan*	Field and in front of the mosque	The people of Kampung Naga	No interaction
Beberesih	Ciwulan	Customary institutions, Paraji, circumcision participants, families, and the people of Kampung Naga	Groups and groups
	River		
Pray and eat together	Mosque	Customary institutions, Paraji, circumcision participants, families, and the people of Kampung Naga	Groups and groups
paraded around the village	Kampung Naga	Customary institutions, Paraji, circumcision participants, families, and the people of Kampung Naga	No interaction
Saweran	Kampung Naga Square	Customary institutions, Paraji, circumcision participants, families, and the people of Kampung Naga	Individuals and groups, Groups and groups
Khitanan	In front of Bale Patemon	Participants of circumcision, kalangkang paraji / mantri / doctors	No interaction
Wawarian	Kampung Naga	The people of Kampung Naga	No interaction
Gerhana			
Tetunggulan	Saung Lisung	Female	Individuals with ancestors
17 Agustus			
Catching	Ciwulan	The people of	No interaction

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fish	River	Kampung Naga	
Arak-arakan	Jalan	The people of Kampung Naga	No interaction
Penyerahan ikan	Bale Patemon Neglasari	The people of Kampung Naga and the people of Neglasari	Groups and groups
Lahiran			
Ngariung	Living room (*tepas*) / family room (*jero*)	Families with babies, Lebe, and invited guests	Lebe, her family, and invited guests prayed to the God, Individuals and groups
Birth ceremony	Living room (*tepas*) / family room (*jero*)	Families with babies, Lebe, and invited guests	Lebe, her family, and invited guests prayed to the God, Individuals and groups
Pernikahan			
Narosan / lamaran / nanyaan	Living room (*tepas*) / family room (*jero*) (*jero*) of the bride	The two families of the bride and groom	Groups and groups
ngeyeug seureuh	Living room (*tepas*) / family room (*jero*) (*jero*) of the bride	Prospective brides and grooms along with their guardians and elders	Groups and groups
Walimahan (akad nikah)	Mosque	Officers, bride and groom, costumary institutions, family	Individuals and individuals Groups and groups
saweran buhun	In front of the house of the bride	Paraji, bride and groom	Individuals and groups
Nincak Endog	In front of the house of the bride	bride and groom	Individual and individuals
Buka Pintu	At the house of the bride right in front of the door (*golodog*)	bride and groom	Individual and individuals
Ngampar	family room (*jero*) (*jero*) of the bride	Costumary institutions, elderly, bride and groom	Groups and groups
Munjungan	family room (*jero*) (*jero*) of the bride	Costumary institutions, elderly, bride and groom	Groups and groups
Kematian			
Bathe	The front yard of the funeral home	Family or *mahramnya*	No interaction
Mengkafani	Family room	Family or *mahramnya*	No interaction
Disholatkan	Mosque	The people of Kampung Naga	Everyone prays
Buried	Funeral	The people of Kampung Naga	No interaction
Bangun Rumah			
ngibeasan ngadeka.	The land to be built	House builder	Individuals with ancestors
ngarajah	The land to be	House builder	Individuals

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	built		with ancestors
nyalameut kan imah	The land to be built	House builder anf family	Individuals with ancestors

From the table above, it can be seen that there are 4 forms of social interaction, namely interaction between individuals and individuals, interaction between individuals and groups, interaction between groups and groups, and the absence of interaction. However, there is one form of interaction that occurs during the ceremony, namely the interaction of individuals with ancestors or supernatural social groups. In the interaction with the ancestors, the community prays to the ancestors to be given fluency and blessings for each procession, but not only pray to the village ancestors but also pray to God Almighty who is the creator of the universe. In addition, the interactions that occur between individuals and groups occur with actors both from traditional institutions, the village community as a whole, each family who lives in a house and visitors from outside. The interaction was carried out in various spaces, both inside and outside Kampung Naga with various persons, therefore a social interaction scheme was formed. Where there are interactions that occur between humans both individually and in groups, as well as interactions outside of that, namely human interaction with ancestors in the form of prayer.

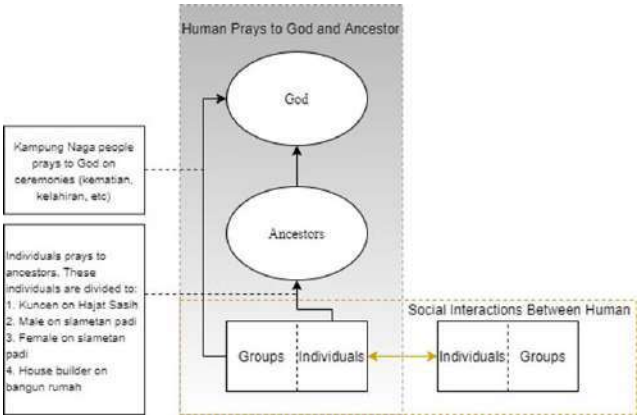

Fig. 8 Social Interactions Scheme

Based on the table above, it can be seen that there are specific rooms used in several activities in Kampung Naga. There is a purpose to the use of those spaces. Space is divided into meso and micro scales; on the meso scale, the spaces used are; *Leweung Keramat* / ancestors grave, *Ciwulan* River, rice fields, roads, village squares, fields, mosques, *Bumi Ageung*, *Saung Lisung*. Whereas at the micro scale, the spaces used in the ceremony are the front yard of the house / *Imah*, *golodog* (house terrace), *tepas* (living room), *jero* (family room), *pangkeng* (bedroom) and *goah* (rice storage area in the house). These spaces can be seen in table. 3 and fig. 9.

Table.2: The Purpose and Use of Space on Traditional Activities

Space	**Purpose / Use of Space**
Hajat Sasih	
Leweung Keramat / Grave	Place of pilgrimage for ancestral graves
Ciwulan River	Place to *bebersih / mensucikan*
Roads	Liaison between ceremony locations
Mosque	The place to gather and pray
Bumi Ageung	Storage place for *parukuyan* and ceremonial tools
Slametan Padi	
Rice fields	The place to pray in various *slametan padi* processions
Roads	Liaison between ceremony locations
Fields	The place for drying rice or *ngariungkeun*
Saung Lisung	Place to pound rice
Goah	The place for storing rice in every house and on Tuesday and Friday evenings is placed the *rujakan* and *lemareun*
Khitan	
Ciwulan River	The place to *bebersih / mensucikan*
Roads	Liaison between ceremony locations
Village Square	The place for the saweran procession and musical entertainment
Fields	The place to *ngerajah ubrug*
Mosque	A place to gather and pray at the beginning of the event and as a place for participants to stay overnight
Gerhana	
Saung Lisung	The place where female play alu and lisung so that the sky will shine again
17 Agustus	

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Ciwulan River	The place to catch fish
Roads	Liaison between ceremony locations
Bale Desa Neglasari	Celebrating 17 August with the people of Neglasari Village
Lahiran	
Tepas	The place to gather and pray for families and invited guests for the 7th month of pregnancy
Jero	The place to carry out childbirth at home
Pernikahan	
Roads	Liaison between ceremony locations
Mosque	The place for the marriage ceremony procession
In front of the house / imah	The place to carry out *saweran* and *nincak endog*
Golodog (house terrace)	The place to carry out *buka pintu*
Tepas (living room)	The place to carry out the *narosan* and *riungan*
Jero (family room)	The place to carry out *munjungan*
Pangkeng (bedroom)	The place to carry out *ngampar*
Kematian	
Roads	Liaison between ceremony locations
Mosque	The place for the prayer of the body
Tepas (living room)	The place to *kafani* as well as a place for families to gather and pray for relatives who have died
Jero (family room)	The place to *kafani* as well as a place for families to gather and pray for relatives who have died
Bangun Rumah	
The land to be built	The place to build a house

Fig. 9 Use of Space Map

IV. CONCLUSION

Based on the research results, the following conclusions can be seen:

1. The tradition in Kampung Naga has its own uniqueness and characteristics that differentiate Kampung Naga from other traditional villages. This tradition also reflects the identity of Kampung Naga as one of the traditional villages in Indonesia

2. In traditional activities/ceremonies, the spaces used in each procession have their own functions and forms of social interaction. this makes these spaces have their own meaning and importance when these traditional activities occur.

There are 9 traditional activities in Kampung Naga where in each activity there is a procession with various objectives, times, locations, tools, actors.

3. Social interaction is divided into no interaction, interaction between humans (individuals and individuals, individuals and groups, groups and groups) and interactions between supernatural groups (humans and ancestors and God). Interaction between humans are carried out when daily activities as well as several ceremonial activities and interactions between humans and supernatural groups occur when processions are carried out on *Bumi Ageung*, *Leweung Keramat*, mosque, rice fields, and goah in the form of prayers to ask for welfare and safety.

4. The spaces used in these activities function to accommodate the traditional activities of Kampung Naga, these spaces are in the form of sacred *Leweung* or graves, Ciwulan River, rice fields, roads, village squares, fields, mosques, *Bumi Ageung*, *Saung Lisung*. Whereas at the micro-scale, the rooms used in the ceremony are the front yard of the house / *Imah*, *golodog* (house terrace), tepas

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(living room), *jero* (family room), *pangkeng* (bedroom) and *goah* (rice storage area in the house)

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Cosmological Value in the Spatial Setting of Kampung Naga

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Abstract— *Kampung Naga has an extraordinary appeal, from the built of the house, the rituals that are still being carried out, as well as the natural scenery, until finally the tourism development is carried out by the government, which is not based on community local customs, thus, resulting in a shift in the function of traditional places. However, the community still has an effort to maintain the inherited traditions of their ancestors. This tradition is manifested in various forms, from norms, rituals, to village arrangements. The spatial setting of Kampung Naga is not only influenced by tradition, but also by cosmological value. Therefore, the researcher wants to look for cosmological values contained in the spatial setting of Kampung Naga. The research method is descriptive-explanatory with the analytical method used is descriptive analysis, behavior mapping analysis, and overlay analysis. Research variables are cosmological beliefs, traditions, ecological elements, and spatial elements. The results of this study note that: 1) orientation is influenced by the order of the universe, the philosophy of tri tangtu dina buana, physical nature, and traditional belief. 2) the layout is influenced by the concept of Sundanese settlements (kaca-kaca and lemah-cai), tri tangtu (structure of the universe). 3) space hierarchy is influenced by the concepts of luhur-handap and tri tangtu (structure of the universe).*

Keywords— ***Cosmological Value, Tradition, Spatial Setting.***

I. INTRODUCTION

Culture is the work of humans obtained from *learned behavior* (Koentjaraningrat, 2009). Culture has a religious system that discusses belief systems and more deeply about the form and characteristics of the world and nature of what is called cosmology. Cosmology is the study of the universe as an organized system. Besides that, there is also a view of natural and social phenomena both in the big universe (macrocosmos) and the small universe (microcosmos) where humans establish a balanced and harmonious relationship with nature (Baedhowi, 2010). Cosmology is a part of belief which is a human perspective on his living space, aiming to create an orderly order achieved through the equilibrium relationship of the elements in the universe, for the creation of a safe life (Titisari et al., 2015). Cosmological belief systems are still widely found in Indonesia in the form of traditional activities, norms and customs, ritual activities, and daily activities, as well as physical elements such as buildings, roads, and settlements (Rosmalia & Prasetya, 2017).

Settlements are the result of the interaction between humans and their environment which is dynamic and always developing, which is formed from five ecistics elements, namely nature, man, society, shells, and network (Doxiadis, 1968). Nature is a natural environment that becomes a place for humans to do activities. Humans as social creatures will eventually form social groups to survive and fulfill their needs. These groups then develop internal norms and relationships and are recognized as societies. From the physical development of the environment, the natural environment is not sufficient to protect human activities. The community then changed part of the natural environment to become a dwelling (shell). The development of *shell* an increasingly complex must then be equipped with elements that support activities that connect dwellings in one environmental system. This connecting network between shells is then known as the network.

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Settlements that still hold customary and cultural values related to religious or religious values are called traditional settlements (Sasongko, 2005). Traditional settlements are scattered throughout Indonesia. Traditional settlements in Java have an attempt to unite humans and nature as a source of life, which is in line with the belief in the power of the macrocosmos (universe) and the microcosmos (settlements, houses, etc.) (Sumardjo, 2002).

In West Java itself, there are still traditional settlements, one of which is Kampung Naga. The traditional settlement of Kampung Naga, located at the foot of Mount Karacak, has special features compared to other traditional settlements. Kampung Naga does have extraordinary appeal, from the shape of the house, the rituals that are still being carried out, and the natural scenery, until it is finally designated as a Cultural Tourism Allocation Area based on the 2012-2032 RTRW of Tasikmalaya Regency. However, this tourism development was responded negatively by the community because the tourism development carried out in Kampung Naga was not based on the customs and norms that apply to the community (Nugraha et al., 2018). The phenomenon of tourism development and the dynamics of local communities has led to a cultural shift (Gadriani et al., 2017) and a shift in function in traditional places (Utami, 2013).

However, the efforts of the local community in protecting Kampung Naga are still far greater, as evidenced by the existence of traditions in the form of customary norms that they still apply, namely *wills*, *mandates*, *consequences*, and *prohibitions* which are norms of behavior and human relations with the universe. These norms are the basis for spatial planning, *zoning*, or building layout and composition (Ismudiyanto, 1987). *Wasiat* as one of the norms held is a tradition of ancestral heritage that must be obeyed and preserved by all residents, which in it discusses the house from the type of material to the arrangement of the direction it faces, as well as the zoning of the area in Kampung Naga so that researchers want to examine how the people of Kampung Naga with their relationship with the universe regulate the spatial layout of Kampung Naga. Spatial elements consist of orientation, layout, hierarchy as well as openness, and spatial size (Ronald, 2005).

This study aims to determine the cosmological beliefs and traditions of the people of Kampung Naga and the elements forming the traditional settlement of Kampung Naga so that in the end they can evaluate the cosmological values contained in the spatial setting of the traditional settlement of Kampung Naga.

II. RESEARCH METHOD

The research method used is the descriptive-explanatory. The descriptive method is a problem-solving procedure by describing or describing the state of the research object based on the facts that appear in the field (Nawawi & Martini, 1996). Explanatory research is carried out to find explanations for why an event or symptom occurs to link different but related patterns. So the descriptive-explanative method is research with problem-solving that is explored to find an explanation of why an event occurs based on the facts that occur in the field.

2.1 Research Variables

Departing from the formulation of the problem in this study, variables are needed to help researchers to answer the existing problem formulations. There are four variables to answer the problem, namely cosmology (Kustedja et al., 2012; Rosmalia & Prasetya, 2017; Titisari et al., 2015), tradition (Peursen, 1988), ecistic elements (Doxiadis, 1968; Rakhmawati et al. al., 2009) and spatial layout (Ronald, 2005).

Table.1: Research Variables

Objective	**Variable**	**Sub Variable**
Knowing the cosmological beliefs and traditions of the people of Kampung Naga	Cosmologi-cal beliefs	Natural elements System of the universe Creation of the universe
	traditions	Customary/ Habits Norms / rules
Knowing the elements forming traditional settlements of Kampung Naga	Ecistic elements	*Nature* *Man* *Society* *Shell* *Network*
Finding cosmological values contained in the spatial layout of the traditional settlement of Kampung Naga.	Cosmology Tradition Spatial elements	

2.2 Data Collection Methods

Data collection methods were primary surveys conducted by through observation, interviews, and

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literature studies. Observations are made by following the daily activities of the community according to the direction of the customary leader. This observation was carried out on the object of research, namely the traditional settlement of Kampung Naga. Interviews were conducted to obtain data about the cosmology of space along with its forms and values that affect the settlement of Kampung Naga. Interviews were conducted with traditional leaders who were used as research subjects related to research variables carried out to obtain data regarding the rules and knowledge of the cosmological beliefs of settlements.

The population in the study of the Cosmological Value in the Spatial Layout of Kampung Naga covers the entire residential buildings of Kampung Naga. The buildings in Kampung Naga consist of 112 buildings, with 109 houses, 1 mosque, 1 Bumi Ageung, and 1 *bale patemon*. Determination of respondents from this study using a non-random sampling technique, namely the purposive sampling technique in which the sample is selected directly based on research objectives. The community respondents are customary elders, *punduh*, and tour guides.

2.3 Analysis Method

2.3.1 Cosmological Beliefs Analysis

Descriptive analysis of cosmological beliefs was carried out to reveal the natural elements that have meaning for the beliefs held by the people of Kampung Naga; the universal system which includes the circulation system, position, level of every natural element which has meaning for the beliefs held by the people of Kampung Naga; the creation of the universe regarding how the universe was formed according to the beliefs of the people of Kampung Naga; Customs/Habits in the form of traditional rituals, folk games, and *selametan* as forms of beliefs held by the people of Kampung Naga; The norms/rules believed by the Kampung Naga community as a regulator and barrier in their behavior and in living daily life

2.3.2 Elements of Settlements Analysis

Analyze descriptively the ecistics elements such as physical nature, religious activities and cultural activities, types and functions of buildings, roles and characteristics of space, as well as road networks and accessibility in shaping the spatial layout of Kampung Naga.

2.3.3 Cosmological Values in the Spatial Setting of Kampung Naga Analysis

Analysis with descriptive analysis methods related to the cosmological values contained in the spatial layout in Kampung Naga which can be seen from the spatial elements which produce patterns formed from ecistic elements seen how the orientation, layout, level/hierarchy, openness, and the amount is based on the cosmological beliefs of the people of Kampung Naga.

2.3.4 Behavior Mapping Analysis

Behavior mapping which was carried out using *place-centered mapping* was used to see the traditions of the people of Kampung Naga. The steps taken are identifying the spaces used by community groups in the spatial setting sketch. The second stage is to observe and record the activities of community groups in the tradition carried out in Kampung Naga and to mark the sketches.

2.3.5 Overlay Map Analysis

Spatial operations that combine different geographic layers to obtain new information. To present information on the spatial cosmology of Kampung Naga, a map was used. The data entered in the map is a combination or pile of spatial data and the cosmological concept of Kampung Naga.

III. RESULTS AND DISCUSSION

3.1 Settlement's Elements/Ecistic's Elements

3.1.1 Physical Elements

Kampung Naga is located in RT 01 / RW 01 of Neglasari Village, Salawu District, Tasikmalaya Regency, West Java Province. Neglasari Village is located on the provincial road that connects Garut Regency and Tasikmalaya Regency and is one of the villages included in the Salawu District. Kampung Naga is located in Naga Village and has an area of 10 hectares consisting of residential land, gardens, rice fields, forest. However, what is included in the customary land is only 1.5 hectares and is limited by a guard cage (*kandang jaga*) around the traditional land of Kampung Naga. The distance from Kampung Naga to Neglasari Village is ± 800 m, the distance to Salawu District is ± 5 km, and the distance to the district capital is ± 16 km. The administrative boundary of Kampung Naga in the west is Bukit Naga, the northern border is Cigalontang Village, the east is bordered by the Ciwulan River and protected forest, and in the south is the Garut-Tasikmalaya highway.

Kampung Naga, which is located on a hillside with an altitude of 600 masl - 670 masl, has an average daily temperature of 21.5-23 ° C with humidity in the range of 69-97%. The airflow created from the location of Kampung Naga in the hills generates an east-west airflow. The valley winds occur during the day, bringing the wind from the valley to the mountains or from the east

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(dwelling) to the west (*Bukit Naga*), while the mountain winds occur at night, blowing from the mountains to the valleys, west to east.

Kampung Naga's water sources come from two sources, namely from the Ciwulan River and from springs. Ciwulan River originates from Mount Cikuray in Garut Regency. The water source from the Ciwulan River is used by the community for bathing, washing, *wudhu* (ablution), and for irrigating rice fields and *balong*. Another source of water is spring water commonly used by the community for drinking and cooking because the water conditions are cleaner.

Land use in Kampung Naga is divided into several types, namely rice fields, forests, and dwellings. The rice fields in Kampung Naga are outside *kandang jaga*, a fence, have an area of ± 3.25 ha. Production forest located in the hills to the west and north of the village has an area of ± 4.63 ha. *Leuweung Kramat* has an area of 0.1 ha which can only be entered when performing a ritual. *Leuweung Larangan* with an area of 1.32 ha, although administratively located outside Kampung Naga, this forest has meaning for the local community. The residential area is an area that is designated for carrying out daily activities for the community within an area of 1.5 ha which includes customary land.

3.1.2 Humans and Society

Kampung Naga community are the original descendants who inhabit the area, while *Sanaga* are all the original descendants of Kampung Naga, both those who live in Kampung Naga and those who live outside the village area.

The origin of the name Kampung Naga, is based on the location where Kampung Naga is located, which is under a cliff. "Cliff" in Sundanese is "*gawir"*, and "at" in Sundanese is "*dina"*. So, they called this village area Kampung (di) Na Gawir, and shortened it again to "Kampung Naga".

No one knows for sure since when Kampung Naga existed. All historical records of the village had been burned down in the burning incident by DI / TII in 1956. Based on the various history of Kampung Naga circulating around, it can be concluded that Kampung Naga has existed since the Galunggung Kingdom was founded (7th century to 12th century), but not it is known exactly when Kampung Naga was founded. Kampung Naga was discovered by *Eyang Singaparna*, as a person who came from Galunggung Kingdom to look for new areas. He came and built the first house in Kampung Naga which is currently known as *Bumi Ageung* or the big or grand house. The people of Kampung Naga lived in peace, but in 1956 DI / TII came and destroyed everything.

The entire community of Kampung Naga adheres to the Islamic religion, so that from their activities and how they interpret everything based on religion and Islamic law. Kampung Naga, which is located at the *Tataran Sunda*, is still influenced by Sundanese customs and culture so that the original Sundanese belief has little influence on people's lives. *Tri Tangtu dina Buana* is a Sundanese philosophy that is still used by the people of Kampung Naga in their daily lives. *Tri Tangtu dina Buana* consists of three interconnected components, namely God or *Hiyang / Hyang*, nature or the structure of the universe, and humans.

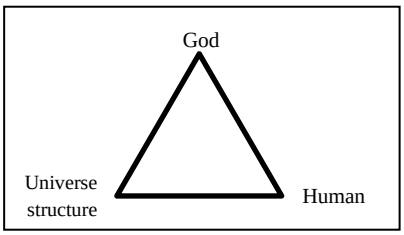

Fig.1: Tritangtu Dina Buana Structure

Rituals are still carried out in Kampung Naga as a form of traditional inheritance and to carry out the will and mandate of the ancestors. Traditional rituals carried out by each family or domestic traditional rituals include ceremonies of birth, *narosan* or marriage, death, and building a house. Meanwhile, the communal traditional rituals are *hajat sasih*, *Agustusan*, harvest celebration ceremonies, and mass circumcision.

Table.2: Traditional Rituals in Kampung Naga

Type of Ceremony	**Purpose**	**Time**	**Location**
	Individual		
Ngarujak	Maintain and respect the rice harvest	Weekly	*Goah*
Birth	Thanksgiving for the birth of a child	*Eventual*	House (*bumi*)
Walimahan	Unite two couples legally according to state law, custom and religion		Mosque, House (*bumi*)
Death	Pray for the death		House (*bumi*)
Building House	Ask for smoothness of the construction of the house		House (*bumi*)

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Type of Ceremony	**Purpose**	**Time**	**Location**
	Communal		
Hajat Sasih / Numpeng	Respect for the ancestors and be grateful for the favors from Allah SWT	Annual	Mosque, the tomb of *karuhun*
Selametan Padi	Begging for rice to grow well and be grateful for the crops		Rice field
Agustusan	Commemorating Indonesia's independence day		*Bale Desa*
Ruwatan Kampung	To ask for safety and to refuse *reinforcements*		Kampung Naga
Khitanan	as a form of Islamizing someone	*Eventual*	Kampung Naga
Samagaha	So that the sun will return to illuminate the earth		*Saung Lisung*

During the implementation of this ritual, there are some elements and spaces that have an important role. There are many uses of elements in each ritual process carried out, but the element that must be present in each ritual is *lemareun*. *Lemareun* is a *sajen* (offerings) that contains betel, areca nut, lime, and tobacco. The existence of *Lemareun* a tradition passed down from *their ancestors* that continues to this day. There are also those who believe that the *lemareun* is a medium of communication between humans and their *karuhun*, so it is important in ritual activities.

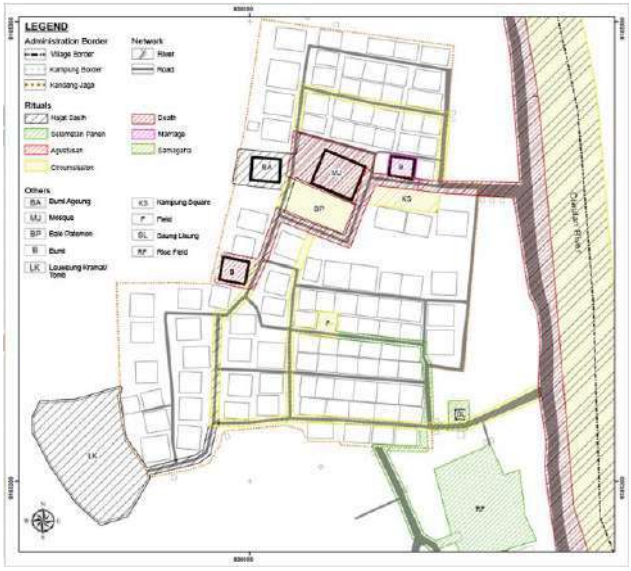

Fig.2: Map of Kampung Naga Traditional Rituals

3.1.3 Buildings

The buildings in Kampung Naga are in the form of stilt houses which are considered suitable for the tropical area. The building construction uses only seven types of materials, namely wood, stone, bamboo, *tepus*, *injuk*, nails, and glass. The buildings in *kandang jaga* are *bumi* or house, mosque (Masjid Jami), *bumi ageung*, *bale patemon*, *rice barn*. The buildings outside *kandang jaga* are *pancuran*, *saung lisung*, and a goat pen.

3.1.4 Circulation Path

Getting to Kampung Naga is quite easy, because of its location which is close to the Garut-Tasikmalaya highway. The entrance to the traditional village has only one route, by descending 439 steps made of stone. When entering the traditional land of Kampung Naga, you can see the boundary between the village and its outer area, by the presence of *kandang jaga*. The main gate to enter Kampung Naga is in a straight line with the mosque, however, several other entrances are smaller, but still passable. Within the village area, all sections can be used as roads, both between houses and other barriers.

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Fig.3: Circulation Path

The roads in the village are also used as spaces for community rituals. Rituals that use roads in their implementation are the rituals of *hajat sasih*, circumcision, and *walimahan*. When performing *hajat sasih*, the road used is the road from the Ciwulan River to the Mosque and *Bumi Ageung*, and the road from the mosque to *Leuweung kramat*. The circumcision ritual uses almost all the roads in the village. The road used for *walimahan* is the front road of the bride's house or the front yard of her house.

3.2 Cosmological Value in the Spatial System

3.2.1 Orientation

The orientation of Kampung Naga's building is one of the rules passed down by the ancestors of Kampung Naga which is still maintained today. This hereditary rule requires buildings facing in one of the two permitted directions, either to the north or south. In the beginning, arrangements regarding the direction of the house were based on calculations from the date of birth. According to the community, the direction of the house to the north or south is not without reason, from a health perspective, the night wind that blows from west to east is a wind that brings disease. Also, with the houses facing north and south, it made it easier for residents to find the Qibla, for praying.

From a geographical point of view, this north-south orientation is also influenced by the high contour in the western part of the village and is getting sloping in the east, making the Ciwulan River water in the west flowing down to the east where the village is located. Because of this flow of water, the construction of houses extends from west to east so that water continues to flow and houses do not block the passage of water.

The orientation is arranged in such a way, taking into account its natural conditions, namely hilly land with the contour in the west is higher than in the east which is quite gentle, where the water flows from high to low (west to east) so that the building is stretched west-east with a door on the north or south. By doing so, water will continue to flow downwards and not be obstructed by buildings. The community is very grateful for the existence of water because it is a source of livelihood that is useful for all their activities, so that its existence is maintained by the community, such as how people protect the forest and nature around the village. From this reason, it can be seen that indeed people believe that they live with nature, so it is obligatory for them to protect nature and not disturb the natural ecosystem (with a form of the orientation of the house so that it does not obstruct the waterways), to achieve the order of the universe.

Fig.4: Orientation Map

3.2.2 Layout

Kampung Naga, whose land belongs to the custom, is bordered by *kandang jaga* made of bamboo. The locations of the buildings are outside and inside of *kandang jaga*. Broadly speaking, the Kampung Naga area is divided into three parts, which are dirty areas, clean areas, and sacred areas. The clean area is inside *kandang jaga* with an area of 1.5 ha, which includes people's houses, houses of traditional leaders, *bale patemon*, *Bumi Ageung*, and mosque. The area outside *kandang jaga* is dirty or polluted area because many activities outside the village area produce waste. Areas that are polluting include *showers*, animal cages, *saung lisung*, *balong*, and rice fields. Sacred areas are spaces that are sacred by the community. The location of the sacred spaces is *leuweung*

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larangan and *leuweung kramat*.

Fig.5: Layout Map

In Kampung Naga, the village layout was also influenced by the Sundanese traditional concept of *kaca-kaca, lemah-cai,* and *buana* zoning. *Kaca-kaca* also means as a barrier of two different areas, manifested in the form of *a kandang jaga*. *Kandang jaga* is a barrier between the clean area (in the village), the dirty area, and the sacred area (west of the village). The existence of *kandang jaga* provides a clear boundary effect in positioning the existence of the village.

Fig.6: Concept of Kaca-Kaca

The concept of *lemah-cai* or land-water shows that in placing a village there must be land or land as a place to live, and *cai* as a source of water which can be a spring or river. *Lemah* is used as a place for living, rice fields, and gardening, while *Cai* which is a source of water used for drinking, Ciwulan River for bathing, *ablution*, rice field irrigation, and *balong*.

Fig.7: Lemah-Cai Concept

The zoning of dirty, clean, and sacred areas also illustrates the cosmological view of Sunda three patterns and also an embodiment of three *buana* (stucture of the universe), which are *buana nyungcung*, *buana panca tengah*, and *buana larang* into the fabric of space good-neutral-bad. Dirty areas that produce polluting waste is a picture of *buana larang* or bad space. Clean areas, as a place for daily activities, is a neutral space, as an illustration of the *buana panca tengah.* Sacred areas as an illustration of *buana nyungcung.*

Fig.8: Buana *Zoning in the village placement*

3.2.3 Hierarchy

In a settlement, based on Rakhmawati (2009), the hierarchy is divided into the level of sacred space. Kampung Naga which is divided into three areas, dirty, clean, and sacred areas has different spatial characteristics. The dirty area has spaces of a profane nature, where daily activities are carried out. In the clean area, there are two different spatial characteristics, namely sacred for *bumi ageung*, mosques, and *bekas pangsolatan*, and profane for the *bumi*, *bale patemon*, and *leuit* with the main function of housing. The entire sacred area of the space is sacred,

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namely *leuweung kramat* and *leweung larangan*.

When traditional rituals are carried out, some spaces change their properties, such as the River Ciwulan during *hajat sasih* and circumcisions rituals, *bumi* during the rituals of death and *walimahan, kampung* square in front of *bale patemon* during the circumcisions ritual, rice field when the ritual of *selametan* rice occur, *saung lisung* when *samagaha* and *selametan panen* take place, as well as the road leading to the tomb during *hajat sasih ritual*.

Based on these two grounds, the nature of space, based on society and based on customary rituals, can identify the hierarchy of space. The hierarchy of space with the highest level is a space that has an existing sacred nature and during ritual activities, the second level is a space with a sacred nature but has no meaning in traditional rituals, the third level is a space with profane characteristics in daily activities and is sacred during rituals, the fourth or last level is a space where only daily activities are carried out in it.

Table.3: Hierarchy of Space

Hierarchy of Space	Space
I	*Leuweung Kramat*, *Bumi Ageung*, and mosque
II	*Bekas pangsolatan*,and *leuweung larangan*
III	Ciwulan river, *bumi* (house), streets, fields and *saung lisung*
IV	Residential, *bale patemon*, *leuit*, *balong*, *pancuran*, animals cage, arable / production forest, rice fields, and roads.

Fig.9: Hierarchy Map

The first level hierarchy of space is located in the west of the village with the highest topographical position - top. The second level is in the east and the lowest position (*leuweung larangan*) - the bottom. The third and fourth levels are somewhere in between which makes it - the middle. The level of sacredness from high to low does not correspond to geographic location, but when viewed from the level of importance, the first level hierarchy of space has the highest level of importance. The second level hierarchy of space has meaning but is less important. And the third and fourth levels are in the middle level of importance. This is related to the Sundanese cosmological concept, the tritangtu which divides the universe into the top - middle - bottom. In addition, the placement of important locations from top to bottom or from higher to lower in Kampung Naga is compatible with the concept of *luhur-handap urang Sunda*.

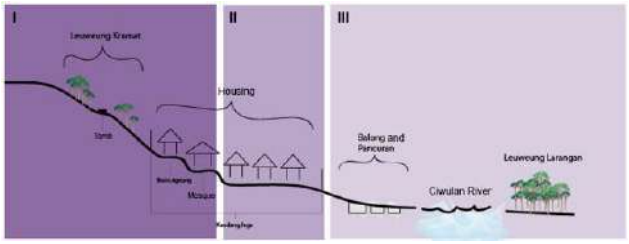

Fig.10: The Hierarchy of the space

The tomb is in the highest position, which when viewed from the concept of *luhur-handap* has the most important function. Its existence is in the forest in the hills so that there are trees that keep the soil strong and so that water is absorbed into the ground and does not immediately flow down. So that this important function is

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more for the forest. The importance of the forest in maintaining the natural balance around the village, however, does not deny that the existence of the graves of the community's ancestors is equally important. Because if there were no ancestors, they wouldn't be alive today. When combined, indeed, the existence of forests and tombs in the west of the village has the most important function for the community. Below the *leuweung kramat* are *bumi ageung*, *bale patemon*, the mosque, and the community dwellings. Underneath, there is a *pancuran* and *balong*, then there is the Ciwulan river which forms a barrier between Kampung Naga and *leuweung larangan* which is in the easternmost part. *leuweung larangan* is not functioned directly by the community but has a role to balance nature with its existence.

3.2.4 Openness and Amount of Space

The openness of space can be seen from the boundary between the buildings in Kampung Naga. Like other traditional villages that do not have a fence, the houses in Kampung Naga are limited to using stones, ditches, and roads. The stones that are installed around the house are the boundaries of the owner's land ownership, and the ditch around the house is for draining rainwater.

The front of the house, which faces the front of the house, has more open space than the back of the house. The lack of separation between the high house, *golodog* mutually equally high vis and give the impression of open, it also supports the community's habit of caring and love to socialize with neighbors. The back of the house is much narrower because there are no activities carried out there, only a small ditch for running water. The side of the house only has a stone boundary and no ditch, the side of the house has a wider openness because it is used as a community road circulation.

At the main entrance gate of Kampung Naga, there is a very wide opening. The buildings are far apart but still, give a friendly and intimate impression. This space is the square that is used by the community for traditional rituals, a place for drying *palupuh*, drying rice, and a place to play for children. The center of the village, where the mosque and the *bale patemon* are located, also has a wide-open space, but not as large as the square.

Fig.11: Open Space

IV. CONCLUSION

Based on the research results, the conclusions can be seen as follow:

1. The belief held by the community is Islam, while still holding the tradition of *karuhun* (ancestor) as a guide for their daily life.
2. Tri tangtu dina Buana is a Sundanese philosophy used by the people of Kampung Naga, this triple pattern depicts the relationship between God, man, and nature.
3. Traditional rituals are categorized as individual and communal rituals. Individual rituals are carried out by each person or family, they are the weekly ritual, *ngarujak*, carried out in the goah, eventual rituals, such as birth in the house, *narosan* in the mosque and house, death ritual in the house, building a house on the land of the house. Communal rituals are rituals performed by the village community both annually and eventually. The annual communal ritual is a celebration of sasih which is carried out in the Ciwulan river, mosque and cemetery, *selametan padi* in the rice fields, *Agustusan* in the village hall, and *ruwatan kampung*. The eventual ritual is circumcision in the Ciwulan river, mosque, and field, and *samagaha* is performed in saung lisung. In each ritual, elements are used to complement the ritual, with the element that must be present in each ritual is a *lemareun* or *sajen*.
4. The orientation of the building faces north and south, extending from west to east which is formed from the contours, water flow, and traditional beliefs contained therein. Thus, the harmonious relationship between humans and nature as evidenced by the reciprocal relationship between nature and the spatial

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orientation of the buildings in the village means that the order of the universe is contained in the spatial orientation of the village.

5. The village is divided into three parts, namely dirty, clean, and sacred areas. Where the dwelling is inside *the kandang jaga.* The mosque, *bale patemon*, and *bumi ageung are* all in the middle of the village, *Bumi Ageung* is placed at the top of the village center, and the *pancuran*, *balong* and rice fields are outside *kandang jaga*. The location of the village as well as the division of this area contains Local Traditions (Concept *of kaca-kaca*, *lemah-cai*, *ritual*) and Traditional Beliefs (*Buana* Structure). Customary traditions and traditional beliefs in managing the area as a manifestation of cosmology horizontally (social relations) as well as vertically (in the division of natural structures up-middle-bottom or good-neutral-bad).
6. The hierarchy within the village shows the highest level of sacredness and importance in the west of the village which is supported by local traditions (the concept of *luhur-handap*) and the structure of the universe. Where the upper part is a sacred space that they highly respect because it is related to the *karuhun* (tomb and *bumi ageung*), the middle part of the residence, and the lower part are the *pancuran*, *balong*, and others.
7. This research serves as an umbrella for limiting and controlling villages or other traditional places when they are opened to the public.

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Chinese sports counter measures under the far-reaching impact of the Novel Coronavirus attacking in 2020

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Abstract— *Facing with the outbreak of the Novel Coronavirus Pneumonia in China, general secretary Xi Jinping deploys and directs the people across the country personally to overcome this unprecedented pandemic blockade. Chinese sports has also taken an active part in the pandemic stagnation battle and has become an important force in fighting the Novel Coronavirus Pneumonia. However, it cannot be ignored that this pandemic has caused negative impacts on Chinese sports at different levels during the key period of Olympic year and the National Fitness Programs. This article takes the development of Chinese sports during the pandemic as the research object, uses literature methods and logic analysis methods, and takes the "COVID-19" as the background to discuss the impact of the pandemic on Chinese sports and how the Chinese sports should act during the "COVID-19". Studies have shown that: Chinese sports must do a good job in combating the "pandemic" and preparing for the Olympics at the same time. and tap the strength of folk sports against "pandemic". Chinese should innovate the immune management model of athletes; change the training preparation model for the Olympics according to special conditions; spread the positive energy of sports; make good use of the leading role of university sports in fighting against the "pandemic "; and exploit civilian anti-pandemic sports forces, etc. It aims to help Chinese sports to do a good job in core sports work, help the people of the whole country win the anti-pandemic war, continue to enhance the international competitiveness of Chinese sports, and provide a theoretical basis for China to continue to promote the construction of a sports power during the Novel Coronavirus Pneumonia.*

Keywords— ***Novel Coronavirus Pneumonia; sports undertaking; sports events; Olympic year; national fitness; overcoming pandemic situation.***

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I. INTRODUCTION

The outbreak of Novel Coronavirus Pneumonia from 2019 to 2020 has become the focus of worldwide attention. The severe cases of the virus are concentrated in the elderly population, and most of the infected people's symptoms are dry cough, myalgia, mouth and nose's abnormal phenomenon, slight fever, reduced leukemia, limb weakness, and abnormal influence of lung CT .Some patients are also accompanied by gastrointestinal upset, which has a huge impact on patients' daily travel and life health. On December 30, 2019, Wuhan Institute of Virology, Chinese Academy of Sciences tested the virus and confirm edit as a new type of coronavirus[1]. On January 9, 2020, the National Biosafety Laboratory of Wuhan obtained the genome sequence of the virus, confirmed that the pathogen as a new type B corona virus

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and adopted Class A management. The World Health Organization officially named this virus 2019 NovelCoronavirus（2019-nCoV）on

January 13, 2020, and identified the pneumonia outbreak caused by this virus as an international public health emergency on January 31, 2020. It marks that the Novel Coronavirus Pneumonia has become a major global health event [2].

On February 11, the WHO definitely named this virus as SARS-CoV2, listed it as a sister virus of SARS coronavirus, and renamed the disease caused by the virus to COVID-19 (corona virus disease 2019).

The effect of the “COVID-19” has been alleviated in a nationwide by the lead of General Secretary Xi Jinping who calls all the people to fight against the Novel Coronavirus Pneumonia. At present, the source and intermediate host of the virus are not clear and no special medicine or vaccine has been developed to meet the promotion conditions .The Novel Coronavirus Pneumonia not only threatens the lives of people in China and other countries around the world, but also impacts the normal operation of all walks of life. The Chinese sports has also been strongly shaken by the pandemic, and has affected to varying degrees in sports events, athlete’s health, school sports, and national fitness and other aspects. The pandemic situation is like a double-edged sword. When it brings China's sports crisis, it also encourages China's sports undertakings to adopt new strategies under the severe challenges, so as to make preparations for the "pandemic" and help to fight the “COVID-19” resistance well, and continue to promote the construction of China's sports power.

1 The situation of Chinese sports under the attacking of Novel Coronavirus

1.1 Various sports events are forced to be postponed

In the early stage of the pandemic, due to the instability of the pandemic situation and the uncertainty of information, the domestic and foreign sports circles have not yet attached great importance to it, and all competitions are still going on normally. As the situation is getting more and more serious into the high-risk period of the “COVID-19”, open large-scale sports competitions such as football, basketball, tennis and other events not only gather the players and the whole sports team, but also gather thousands of spectators outside the field in a fixed place, which undoubtedly increases the transmission risk of the “COVID-19”. In response to the call of pandemic stagnation, many international sports events scheduled to be held in China have been postponed. The Lingshui International Badminton Masters planned to be held on February 25, 2020 will be postponed . The FIBA Basketball Asian Cup originally planned to be heldin Changsha in May was adjusted to September. In terms of domestic sports leagues, many leagues with a large audience capacity, such as CBA tournaments, have been suspended at least until July due to the impact of the pandemic ; the Chinese Football Association has also announced that all kinds of football matches at all levels in 2020 will be postponed; in addition, in consideration of protecting the health of athletes and referees, the State General Administration of Sport has also cancelled the Winter Olympics test match that will be held in Beijing in February [3].

As the pandemic gradually spreads around the world, many well-known foreign sports events has also been affected by the pandemic and are planning to put off competitions. Undoubtedly, the impact of the pandemic on the holding of the Tokyo Olympic Games is of most concern. Affected by the Novel Coronavirus Pneumonia, the 2020 Tokyo Olympics will be forced to be postponed to 2021, the specific time is from July 23 to August 8, 2021, and the Tokyo Olympics Paralympics will also be postponed In addition, due to the impact of the Novel Coronavirus Pneumonia, many international events have been directly affected and made corresponding adjustments .For example, the ITTF stated that it would postpone the South Korean Busan 2020 World Table Tennis Team Championship which started on March 22 to June 21; Worldwide known sports leagues such as the American Professional Basketball League and the five major European football leagues, Serie A, La Liga, Bundesliga, Ligue 1 and the Premier League have also been forced to stop by the “COVID-19”. The 2020 European Cup and the America's Cup have also been postponed to 2021, so that UEFA President Cheferin said the virus is the biggest crisis in football history. Major international sports events such as ATP tennis and F1 also announced suspension due to the Novel Coronavirus Pneumonia. Regardless of whether it is a domestic or international event, only after the pandemic situation is initially stable or even after the pandemic situation is over, can the competition get a chance to resume normally. If the pandemic situation is not further controlled, not only many events cannot be restarted, but also the competitive status of Chinese athletes and the preparation of the Olympic period will be pinned down.

1.2 The life and health of athletes preparing for the Olympic Games and the state of competitive training are threatened

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The virus spread regardless the object. Compared with the general public, although the athletes have better overall body functions and stronger immunity to the virus, the virus is too aggressive to be prevented.. The pandemic will increase the impact on athletes for the following reasons .Firstly, athletes' self-confidence in their physical functions will make them neglect the prevention of the pandemic .Secondly, the frequency of athletes' competition location changes is high .Thirdly, the mobility of athletes' competition venue personnel is strong, the close-up game with competitors in the competition and the interaction between athletes and spectators after the competition increase the risk of infection of the Novel Coronavirus Pneumonia. In addition, according to the "window theory" -the J-curve effect of sports and immunity, which is well-known in the sports science community, after the athletes having a fierce confrontation during the game, the immune function of the body will normally be at the button of human immunity. Meanwhile, the immune window that is forced to open during the period allows the virus to invade the athlete's body. That's why British football star Wayne Rooney says athletes may be less resistant to the virus than ordinary people. The above-mentioned crisis elements become apparent after the pandemic entering a high-incidence stage, which affects the normal competition of athletes. In the field of basketball, the two-time best defender of NBA which plays for Jazz team, and Mitchell, a member of the American Dream Team, have been detected with Novel Coronavirus Pneumonia. Brooklyn Nets star Kevin Durant and Pistons forward Wood have also been confirmed to be infected with Novel Coronavirus Pneumonia. In the field of football, At least 12 in Serie A and 35% of members of Spanish League Valencia have been diagnosed with Novel Coronavirus Pneumonia. Chelsea forward Odoi, Juventus defender Rugani and others have been diagnosed with Novel Coronavirus Pneumonia, and even international football megastar Ronaldo has something to do with the pandemic. Not only are many athletes infected, but many sports management personnels have also been attacked by Novel Coronavirus Pneumonia. For example, the president of the Japan Football Association, the vice chairman of the Japanese Olympic Committee, Koshima Tajima, and Arsenal head coach Arteta were diagnosed with Novel Coronavirus Pneumonia.

With the increasing number of cases of Novel Coronavirus Pneumonia in athletes, the virus has even directly threatened the lives of athletes. In China , a 72-year-old Wuhan bodybuilder ,Qiu Jun died on February 8 due to the Novel Coronavirus Pneumonia; In Iran , on February 28, Sheikh, a member of the Iranian women's futsal national team, was only 23 years old and died for the same virus .Sumo wrestler Mo Qingxiao died in the early hours of May 13 in local time, which is the first professional athlete who died of the Novel Coronavirus Pneumonia in Japan, reminding athletes of the severity of the Novel Coronavirus Pneumonia once more. Under the guidance of the General Administration of Sports of China, various sports teams began to conduct closed isolation for athletes, effectively controlling the spread of the pandemic among athletes. As a result of the isolation, it is difficult for the national teams of China to conduct comprehensive system training in the isolated space to maintain a high level of competition. On the contrary, foreign sports teams are becoming more competitive, making the situation even more severe. At the 2020 Japan Track and Field Championships held in Japan, Japanese track and field athletes set a number of Japanese national records, demonstrating a strong competitive edge to the world. However, due to the impact of the pandemic in China, it is hard to provide a platform for the national track and field team to exercise. If the pandemic situation continues, it will not only affect the performance of Chinese track and field teams participating in international events, but also interfere with the implementation of the preparation cycle plan for the Olympic Games, and pose new problems for the construction of Chinese sports power.

1.3 National fitness and school sports are encountering major crisis and severe test

On June 15, 2016, the Chinese State Council issued the document "National Fitness Plan (2016-2020)" for promoting the efficient development of the national fitness planning, accelerating the pace of building a leading sports nation, and ensuing the smooth development of the national fitness during the"13th Five-YearPlan" period [4] .However, there are indications from various aspects shown that the outbreak of the Novel Coronavirus Pneumonia poses new challenges to the efficient development of the national fitness program. In a key year for the implementation of the National Fitness Program (2016-2020), people across the country are home quarantine, unable to go out to enjoy public sports facilities for physical exercise, and institutions and clubs which dedicated to serving the mass fitness industry have suffered shocks. Various government sponsored national fitness theme activities were also be cancelled, including the Jiangshan Village Games in Zhejiang Province, which has been held for 15 consecutive years .

School sports have also been affected by the pandemic. It is an indispensable part of building a leading

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sports nation that providing students online and offline sports classes to discover and cultivating sports talents for our country. Affected by the pandemic, all kinds of schools at all levels in China will postpone the entrance examination of physical education , and even the entrance examination of high-level sports teams in universities . For example, Zhejiang University has decisively postponed the admission test of high-level sports teams. In terms of competitive games, school leagues of all levels in China, including the most representative league: CUBA, will also be postponed. As a result , the start date of all schools across the country has been postponed .The physical education classroom was cancelled due to the inability to implement on-site intuitive teaching, and the systematic and well-planned physical education curriculum was temporarily suspended, resulting in the lack of an important sports platform for students, which not only increases the risk of myopia among primary and secondary school students, affects the scientific enhancement of the physical quality of students of all ages in China ,but also greatly tests the scientific nature of the redesign of the school sports curriculum system and program after the pandemic has stabilized. Further more , increase the uncertain factors on the process of promoting the goal of achieving leading sports nation.

2 Win the pandemic war：Chinese sports has made great contributions to the construction of a leading sports nation

When a country's government or an industry area is faced with an unexpected new event, whether its response strategy is firm and proper is a touchstone to test the real strength of the government or industry. The outbreak of the Novel Coronavirus Pneumonia has triggered a series of situations that have never occurred in world history. For example, novel coronavirus pneumonia broke out on the top of the world's luxury cruise ship, Japan's Diamond Princess, and was forced to stop in Yokohama, Japan in February 5, 2020. This is the first cruise port incident in history due to a pandemic. If the Japanese government does not take the initiative to provide proper isolation for reception, the domestic and foreign credibility of the government will be seriously damaged, and it will also directly affects the Japanese government’s reputation and weathervane for the Tokyo Olympics.

The Chinese people will be more united in the face of the current predicament, and the Chinese nation will be stronger in the face of the virus. The Novel Coronavirus Pneumonia pandemic is the first outbreak in history in China during the Olympic year. It is a new challenge for Chinese sports in the Olympic preparation cycle and the construction of a leading sports nation. Only when Chinese Sports actively contributes and adopts effective measures to cope with the pandemic can it help win the pandemic stagnation battle and prepare for the Olympic Games.

2.1 Innovate immune management system for athletes

The prerequisite of fighting for a country’s honor is the health body of athletes. On February 27, 2020, the General Administration of Sport of the people's Republic of China held a video conference on the system of prevention and control of the national sports pandemic system and the key sports work in 2020 to study and overall plan the pandemic prevention and control and the whole year's sports work. After the outbreak, the State General Administration of Sport took preventive and control measures with quickly act. In view of the fact that the sports team had disinfected the apartments and buses of the team members before the outbreak , it immediately set up a procurement team to ensure the supply of necessary facilities for the prevention and control of the sports team, strictly supervises the entry and exit personnel and increase publicity of the pandemic prevention and control. For service support personnel, the daily report system is implemented, and closed management is implemented for staff who have direct contact with athletes from February 1. The crisis of the pandemic is still quite serious. Therefore, it is necessary to innovate the public health emergency system of sports teams, establish a "community of fate for preventing the pandemic of Olympic teams" with Chinese characteristics, and carry out targeted prevention and control of Chinese athletes.

At the organizational level, it is necessary to clarify the vertical emergency organization model of the order “National Sports Bureau, National Team and Local Sports Teams”, coordinate the prevention and control functions of various sports teams and emergency resources, and athletes should be the main roles to build a three-dimensional, comprehensive, flexible and mobile Sports team pandemic prevention system with Chinese characteristic [5]. At the level of laws and regulations, from the bottom to the top, initiated by athletes and cadres, the general administration of sport of China makes decisions and formulates relevant laws and regulations on pandemic prevention and preparation in the Olympic year to clarify the boundaries of pandemic prevention functions of sports teams at all levels, so as to provide legal guarantee for pandemic prevention of sports teams at all levels in the Olympic preparation cycle. In terms of drug diet reserves, Chinese sports should cooperate with the Chinese Medical Doctors Association and the Chinese Nutrition Association, based on scientific diet formulas, combined with traditional Chinese medicine antiviral treatment

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formulas that have made outstanding contributions in the anti-epidemic medical field, and jointly develop athlete-specific pandemic prevention health. The dietary system is used to protect the athletes 'diet and nutrition while taking into account the anti-pandemic effect, and to ensure the health and safety of athletes in all aspects. At the level of grass-root spost planning, we should consider learning from the PLA's support to the Hubei medical team for several days to achieve a "zero infection" experience, the Communist Party members of the sports team should be given full play as pioneers and model leaders, increase publicity, and encourage athletes to actively do their own prevention and control work. Distribute to the athletes the "Psychological Guidance Manual for Active Athletes" prepared by experts organized by the Human Resources Development Center of the General Administration of Sports of the People's Republic of China, to guide athletes to complete the national team's pandemic prevention and control tasks. The National Archery Team's Party Branch immediately established a prevention and control leading group, which played the role of a fortress against the " pandemic " and set up four "Party Pioneer Posts" to establish party member prevention and control models and encourage party members in the team to take the lead in charge of training Team′s prevention and control. The national archery team has done a good job of disinfection and hygiene, publicized prevention and control education, combined ideological work with practical actions, and ensured a healthy level of the team's athletes, coaches, scientific researchers and staff during the pandemic..

2.2 Adopt specific training plans according to local conditions, practicing in an enclosed place and training abroad simultaneously.

Due to the severe impact of the pandemic, many domestic and foreign competitions have been cancelled. However,2021 is the Olympic year and national sports teams should take the interests of the whole into account. While implementing the anti- pandemic work of Chinese athletes, Chinese sports should focus on the overall situation, explore superior training resources by dialectical thinking, maximize the effectiveness of closed training modes, adopt targeted training programs, and prepare for the Olympics scientifically. In order to ensure the health, safety and training status of the members of the national snowboarding training team during the pandemic, the training team focuses on trampoline technology and physical training, and adopts closed training to ensure that pandemic prevention and training go hand in h and [6] .On January 22,the national badminton team shifted its focus at the current stage to " pandemic prevention and preparedness," not only to strictly prevent the pandemic, but also to overcome the weak links of team members' physical fitness and technology. The National Gymnastics Team also decided to adopt a fully closed training mode for all members to grasp physical fitness and make up for shortcomings, and implement the last systematic winter training before the Tokyo Olympics. For Chinese sports, in addition to closed training, training or competitions that go abroad to those countries with relatively stable pandemic should also be included in the preparation plan for sports teams. During the outbreak, National trampoline team chose to train in Baku, Azerbaijan for the Olympics. The National Throwing Team arranged most of its players to Germany for intensive training, and participated in multiple international competitions, before the end of the foreign training time in early June, to test the effects of the Olympic preparations. When training abroad, if the pandemic gradually begins to affect the local area, the sports team can also consider adopting a closed training mode abroad. In order to deal with the pandemic and continue to prepare for the Tokyo Asian Games qualifying round, the Chinese wrestling team went to Serbia for training. At present, the team adopts the same closed model as the training situation in domestic , and does a good job of "polyphonic" training, which will carry out closed training and overseas training at the sometime.

2.3 SpreadthepositiveenergyofChinesesportsagainstth e"pandemic"andhelp

Chinese people overcome the threat of the "COVID-19"

As a typical representative of the national public figures, the athletes in China are highly admired by people from all walks of life in China and enjoy high popularity among the Chinese people. Numerous nurses who contributed to the anti-**pandemic** in Thunder Mountain and the volunteers who went to the front line have written the names of athletes' idols behind their protective clothing, which deeply proves that the status of Chinese athletes is in Chinese people′s heart. Chinese sports should therefore take advantage of the outstanding public image of Chinese athletes, spread the positive energy of sports and the behaviors of pandemic combat, win the pandemic fight with all sectors of society, and set an excellent example for continuing to promote the development of a leading sports nation.

Firstly, the superb skill performance and tenacious fighting style on the field by athletes, the inspiring words during the game, and the good news after winning the glory for the country can all help Chinese sports to spread positive energy for the pandemic resistance. The Chinese women's basketball team defeated the third-ranked Spain

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team by the indomitable will of the whole team, got the Olympic tickets, and gave the Chinese people a satisfactory answer with excellent results. And the inspiring words of their coach said before the first game made an exciting mobilization of the national anti-pandemic at a higher level. He said: "When a person stands out, it is called bravery; when a team comes forward, it is called responsibility; when a country is in adversity and calls for a spirit, it is a mission! Just faith! Just go forward!" These words have now been incorporated into the cognition of the people throughout China, and have inspired the Chinese people's determination to fight the virus resolutely. In addition, the Chinese ice and snow sports team also brought good news to Chinese people through record competition results and the feat of winning gold medals. After the game, they collectively cheered for the "anti- pandemic " fighters in Wuhan and the whole country.

Secondly, disasters have no emotion, but people do. By donating to the front line to fight the pandemic, and participating in public welfare performances, Chinese sports can also pass on positive energy to the society. National football coach Li Tie, female football player Wang Shuang and other sports stars and sports companies have donated nearly 10 million yuan to fight the pandemic. In addition to personal donations, basketball player Yi Jianlian also donated 11,250 protective clothing to Wuhan to send greetings and warmth to the nation's anti-pandemic fighters in a timely manner. The Chinese table tennis team, who is training in Macau, sang a song "I Love You China" at the end of the voluntary performance of the "Believe in the Future" online charity

show, expressing the national table tennis soldier′s resolution to fight the pandemic.

Thirdly, Chinese sports should convene members of the sports team to cheer on the people of the country, combine the heroic posture of athletes through video editing, present it to the audience through the Internet and television, and show the image of athletes on the field, spread the positive energy of sports, and let more people feel the firm determination of Chinese sports athletes to fight the "pandemic". The Winter Sports Management Center, affiliated to the General Administration of Sport of China, organized members of the national team of ice and snow sports including skating, hockey and other projects to conduct anti- pandemic publicity activities during the pandemic, and posted the cheering support from snow and ice athletes along with the stadium's heroic behavior on the Internet through video clips which passed them ajestic positive energy of sports to against the pandemic.

Finally, we ought to call on Chinese sports people to voluntarily participate in the front line of fighting the pandemic and actively sign up for volunteers to help fighting the pandemic. Beijing, Hubei Provincial Swimming Association, Jiangsu National Swimming Referee Xu Jie, and Chengdu University of Sport swimming teaching and research teacher Xiao Lina have all witnessed their actions on the frontline of the pandemic, and exerted their anti- pandemic energy among the Chinese people. Tianjin women's volleyball players and coaches rushed to the front line of the grassroots, demonstrating the courage and determination of Chinese sportsmen who can not only play games but can also "go to the anti-pandemic battle field"!

2.4 Take advantage of the exemplary role of university sports in fighting the "pandemic" and innovate the teaching mode of sports education

The role played by sports colleges (departments) of various colleges and universities at all levels in China has a clear demonstration during the Novel Coronavirus Pneumonia pandemic. Affected severely by the pandemic, sports education classes in schools at all levels in China cannot be conducted normally due to student home quarantine. As the bridge between competitive sports and public sports, the university sports departments in China need to meet the needs of teachers and students, ordinary Chinese people, and other student groups in the severely affected areas of the pandemic at the same time. Therefore, university sports in China should take the initiative to play a good role as a bridgehub.

In face of the teachers and students in the severely affected areas of the pandemic, Chinese university sports should learn from the spiritual of the speech by general secretary Xi Jinping while he greeted the anti-pandemic soldiers in frontline, use online video to pass on the motivational energy of university sports, and cooperate with well-known sports figures to spread the "anti-pandemic" energy. On February 29, 13 Beijing Sports University graduate champion class students including Yang Yilin, the Beijing Olympics women ′s gymnastics team champion, sounded the horn of the "new heartwarming network connection" action of college sports during the outbreak. They made a video connection with 49 representatives of teachers and students from Hubei to sent them their sincere greetings. Zhang Hao, a teacher of Beijing Sports University and a world figure skating star, together with 58 Olympic champions and world champions, recorded a Wuhan refueling video sponsored by the Beijing 2022 Winter Olympics Organizing Committee, adding some university characteristics to the "pandemic" battle.

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In face of the social masses, the teachers and students in Chinese university sports education should make full use of their sports professional knowledge, use WeChat public accounts and online self-media to share the scientific experience of physical pandemic prevention and home fitness methods, which is applicable to people at all levels of society. During the pandemic, students from Beijing Sport University used the Beijing Sport University Power WeChat public account platform to deliver home scientific fitness guides to platform audiences through domestic and foreign scientific fitness videos, sports science articles, and other forms. There are also post-graduate students posting live news on the Beijing Sport University Power WeChat public account, and combined with the Tik Tok platform to open a fitness live course which is suitable for home exercise.

In face of students across the country, in addition to scientifically planning live video fitness, regimen, and aerobic training classes during the pandemic, Chinese university sports should also exert the appeal of high-level university sports teams among the majority of youth groups. Chinese university sports should encourage outstanding university high-level athletes to make an Internet broadcast of exercising at home, so that student athletes can play an exemplary role to call on the majority of student groups to take the initiative to exercise at home so that enhance their fitness, and work together to continue contributing to the building of a leading sports nation during the outbreak. Members of CUBA (Chinese University Basketball Association) teams such as Peking University and Tsinghua University carried on live training activities on the network platform. By sharing the video of fitness at home, students are encouraged to learn fitness during the pandemic, which enriches the school's online physical education classroom teaching methods.

2.5 Reach the grassroots people and explore the anti-pandemic force of folk sports

It is a key year that efficiently develops the national fitness program in 2020. How to keep the people in a good state of exercise during the pandemic is a major problem for Chinese government and it remains to be solved at present. Therefore, the Chinese government should be integrated with the people, use big data networks, cloud computing, and new information platforms to initiate online national fitness activities, organize online home fitness competitions, diversify the competition evaluation standards, and make people of all ages full with enthusiasm when they exercise at home to promote the national fitness program from bottom to top. [8] For making the people's fitness methods more diverse and colorful, the Social Sports Center of the General Administration of Sports of China organized a home network fitness video contest with the theme of "National Anti-pandemic. Health You and Me." among the “COVID-19” outbreak, and stipulated that the competition will be divided according to routine and free competition evaluation criteria with different awards setting. The recent “Longdu Sportsmen” National Anti-pandemic Fitness Competition organized by Puyang, Henan China has provided a new platform for local people to display home exercise activities. The competition not only set off an upsurge of fitness for the whole people, but also strengthened the mass foundation for winning the war of resistance against pandemic.

The Beijing Winter Olympics will be held in 2022. At present, the majority of the people in China are relatively unfamiliar with snow and ice sports. because the requirements for practicing basic skills of ice and snow sports are relatively simple. It provides a chance for people who stay at home with a long time that to learn the culture of ice and snow sports. As an old Chinese saying goes “The master is in the folk”. The Chinese government should seize the opportunity to tap the talents of snow and ice sports among the Chinese people, and encourage them to use the Internet platform to promote the popularization of ice and snow sports culture, so as to improve the quality of the Chinese people's ice and snow sports. During the outbreak, Zhao Zhixin, a well-known coach of Beijing Sports University, shared a set of ice and snow aerobics that integrates six activities of speed skating, figure skating, short track skating, ski jumping, cross-country skiing and snowboarding. It not only enriched the home exercise model for the masses, contributed to the Chinese people's pandemic resistance activities, but also promoted the accumulation of mass snow and ice sports literacy, which will help develop the mass deposits of the Chinese ice and snow sports and the 2022 Beijing Winter Olympics.

II. CONCLUSION

This Novel Coronavirus Pneumonia pandemic made a surprise attack on Chinese sports, which is at a critical period of national fitness and in the Olympic year, and gave new challenges to the construction of a leading sports nation in China. As an important force in fighting the pandemic, Chinese sports have played a huge role in promoting the preparation for the Olympic Games and speeding up the establishment of a leading sports nation. From the perspective of the mission of the times, Chinese sports must remain true to the original aspiration and keep the mission firmly in mind. During the pandemic period and national fitness and Olympic years, Chinese sports

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should be the model leader in both anti-pandemic campaign and preparations for competition. From the perspective of development law, it is necessary for Chinese sports to follow the development law of sports undertakings during the pandemic, to make steady progress and mobilize all the positive factors conducive to the development of a leading sports nation in China. From the perspective of the way of interaction with the outside world, Chinese sports should play a good role in connecting with the government and the people. From the perspective of coping strategies, starting from the actual situation of its own development during the pandemic, Chinese sports should open up a road that combine with anti-pandemic battle and preparation of contest with Chinese characteristics. Chinese sports should increase their weight in fighting the pandemic, ensure the implementation of the key tasks of the National Fitness Program and the preparation of Olympic, promote the building of a leading sports nation in China ,and share the successful experience of Chinese sports in fighting the pandemic, and provide an excellent model for the development of world sports during the pandemic. Chinese sports should encourage the world sports to fight the pandemic together, contribute Chinese sports power to the world, and then enhance the competitiveness and influence of World sports in all walks of globalize industry. .

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Comparative Study and Sensitivity Analysis in Simulation of Non-Darcy Flow in Shale Gas Reservoirs

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Abstract *— In this work, we perform a comparative study of flow models and a sensitivity analysis concerning some parameters, considering the effects of slipping and gas adsorption in shale gas reservoirs, using numerical simulation. We use the Finite Difference Method, a linearization based on the Picard method, and the Conjugate Gradient method to obtain the reservoir and production well pressures. The results obtained demonstrate the importance of the effects of slipping and adsorption in the variation of pressure in a single-phase isothermal gas flow. Mainly because some parameters in the flow models, depending on their values, can act favoring (or disfavoring) the pressure drop.*

Keywords *— **Adsorption. Finite Difference Method. Natural gas. Reservoir simulation. Slipping flow.***

I. INTRODUCTION

For decades, the oil industry has followed a standard strategy in the context of hydrocarbon exploration/exploitation: the search for rock formations of interest, the location of the reservoir rocks, the identification of the mechanisms of imprisonment, and well drilling. These procedures had been used by geologists, geophysicists, and engineers, aiming mainly at the production of hydrocarbons via vertical wells in reservoirs formed, for example, by sandstones or carbonates.

However, in the past two decades, new concepts of exploitation have emerged. Rock formations that were previously less important, to the point of not being considered economically viable, are currently seen as potential reservoirs. Among unconventional sources, shale gas reservoirs are gaining more and more relevance on the world stage [8].

1.1. Natural gas

Natural gas is a homogeneous fluid with low viscosity and density. In a reservoir, natural gas can be classified as dry (it does not contain molecules heavy enough to form a liquid hydrocarbon under surface conditions), for example, when composed essentially of methane. Generally, natural gas (depending on the reservoir and its characteristics) contains methane, ethane, propane, butane, pentane, and hexane, but we can also find other heavier components in it. The non-hydrocarbon parcels, considered as impurities, include carbon dioxide, hydrogen sulfide, and nitrogen. The primary component is always methane, which may represent 70 to 98% of the total, followed by ethane (which may reach 10%).

Natural gas is the cleanest and richest source of hydrogen among hydrocarbons and has high efficiency in energy conversion. The current trend is for natural gas to become one of the most important fuels in the global economy [12] due to economic and environmental reasons [29, 31]. See Fig. 1 for the breakdown of the internal energy supply in Brazil for the year 2019 [13].

In terms of its use, natural gas can provide heating, generate electricity, and we can use it as fuel for motor vehicles or in the production of hydrogen [12]. According to Economides and Wood [12], the world reserves of natural gas have been increasing at an annual rate of about 5% since the seventies. The number of countries with known natural gas reserves has grown from 40, in 1960, to 85 in 2005.

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1.2. Shale gas

Non-conventional reservoirs differ from conventional ones, for example, in that they have a very low permeability. Among the non-conventional reservoirs, we can mention the tight-gas sands (low permeability reservoirs), the coal bed methane (in which there is gas adhered to coal veins), and the shale gas (gas in shale-like rocks). The latter, the focus of this work, typically have extremely low permeabilities, in the range of 10^{-6} to 10^{-9} Darcy, low porosity, gas adsorbed on the solid, and the gas slips on the pore surfaces of the reservoir. Its formations are composed of sedimentary rocks, consisting of clay minerals such as illite, smectite, and kaolinite [8].

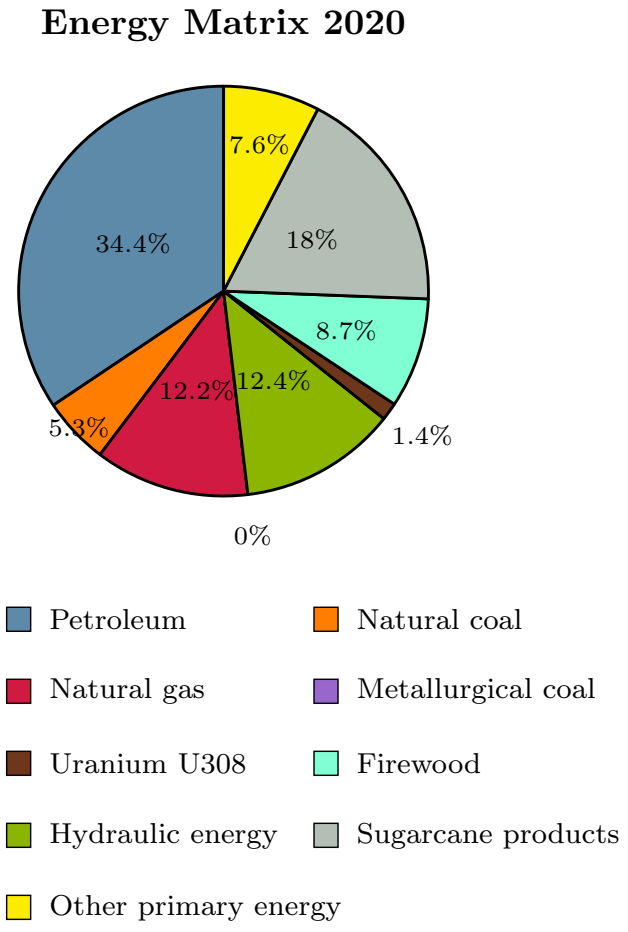

Fig. 1: *Supply by energy source in Brazil in 2019.*

In them, the gas is present as a free phase in the pores, dissolved in liquids, or adsorbed on solids. We find the gas adsorbed on carbon-rich compounds, such as kerogen. According to Ali [1], Wang [27] and Berawala [3], gas in an adsorbed state represents a fraction ranging from 20 to 80 % of the total gas reserves in shales. As the pressure decreases, as a result of continuous production, the gas adsorbed detaches from the solid and becomes part of the free phase, contributing to flow and production. Therefore, by neglecting the effects of adsorption, we can underestimate the potential of a shale reservoir [30].

About two decades ago, we considered gas recovery in shale reservoirs as economically and technically nonviable. However, with the emergence of new technologies, especially the drilling of horizontal wells and hydraulic fracturing, their exploitation has become possible and economically viable. In 2015, about three-quarters of natural gas production in the United States originated from these reservoirs, with the expectation of continued growth over the next two decades [28]. The great success in North America has led to unconventional sources gaining more attention on the world stage, including the countries of South America, such as Argentina and Brazil.

II. NATURAL GAS FLOW IN POROUS MEDIA

Typically, the classical Darcy law [7] is used in engineering to describe low-speed flows in porous media. For non-Darcy flows, it is modified and expressed in the form:

$$\mathbf{v} = -\frac{\mathbf{k}_a}{\mu}\left(\nabla p - \rho g \nabla D\right), \tag{1}$$

where $\mathbf{v}$ is the surface velocity of the fluid, $\mathbf{k}_a$ is the apparent permeability tensor, μ is the viscosity, p is the pressure, ρ is the density, g is the magnitude of the acceleration due to gravity, and D is the depth. Among the non-Darcy effects, which we can incorporate into the apparent permeability, we have:

- the inertial and turbulent effects,
- the non-Newtonian flow,
- the slipping and adsorption of the gas on the pore surface,

in addition to others that also cause non-linearity [2].

2.1. The gas slippage phenomenon

Florence et al. [15] reported that the phenomenon of gas slipping occurs when the mean free path of the fluid molecules is of the order of the characteristic hydraulic radius of the pores. We know that gas flows

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in the porous medium differently from a liquid for two reasons: its high compressibility and the Klinkenberg effect [2]. We use Klinkenberg's correction to take into account the effects of gas slippage, which can be verified when carrying out permeability measurements on rock samples [14]

$$\mathbf{k_a} = \left(1 + \frac{b}{p}\right)\mathbf{k} \tag{2}$$

where b is the Klinkenberg parameter and $\mathbf{k}$ the absolute permeability tensor [19]. For example, gas slippage can occur in shale gas and tight gas sand reservoirs.

As an alternative to Klinkenberg's correction, we can also account for this effect through a more general expression for the determination of apparent permeability, which we can calculate as a function of Knudsen number [18],

$$\mathbf{k}_a = f(Kn)\mathbf{k} = (1 + \alpha_k Kn)\left(1 + \frac{4Kn}{1 + Kn}\right)\mathbf{k}, \tag{3}$$

where $\mathbf{k}$ is the absolute permeability tensor, and α_k is the rarefaction parameter [18], whereas for the slip regime, $\alpha_k = 0$. The Knudsen number, Kn, is defined by

$$Kn = \frac{\lambda}{R_h}, \tag{4}$$

where λ is the average free path of the molecules and R_h the characteristic hydraulic radius [15]

$$R_h = 2\sqrt{2\tau}\sqrt{\frac{k}{\phi}} \tag{5}$$

and

$$\lambda = \frac{\mu}{p}\sqrt{\frac{\pi Z R T}{2M}}, \tag{6}$$

where τ is the tortuosity of the porous medium, k is the geometric mean representing the absolute permeability of the porous medium, ϕ the effective porosity of the porous medium, Z is the compressibility factor, T is the temperature, R is the universal constant for gases, M is the molecular mass of the gas, and $\gamma = M/M_{air}$ is the relative density of the gas and M_{air} the molecular mass of air [8]. The slip regime exists for the $10^{-3} < Kn < 0.1$ range [4].

2.2. The adsorption phenomenon

Adsorption occurs when the gas molecules attach to the solid surface of the pores, and the volume of gas adsorbed depends on the pressure of the gas phase. Here, we consider the Langmuir isotherm model:

$$V_{ads} = \frac{pV_L}{p + p_L}, \tag{7}$$

where V_{ads} is the volume of adsorbed gas, V_L is the maximum volume adsorbed (Langmuir volume), and p_L is the pressure corresponding to half of the maximum adsorption capacity (Langmuir pressure). According to Jiang and Younis [18], we can also incorporate the effects of adsorption into the calculation of apparent permeability

$$\mathbf{k'_a} = \left[1 - \frac{d_m}{R_h}\left(\frac{\frac{p}{p_L}}{1 + \frac{p}{p_L}}\right)\right]^4 \mathbf{k} \tag{8}$$

where d_m is the diameter of the gas molecule adhered to the surface. Therefore, we can combine the contributions due to gas slippage and adsorption in determining the apparent permeability in the form:

$$\mathbf{k}_a = f(Kn')\mathbf{k'}_a \tag{9}$$

where

$$f(Kn') = (1 + \alpha_k Kn')\left(\frac{1 + 4Kn'}{1 + Kn'}\right) \tag{10}$$

and the modified Knudsen number is set to

$$Kn' = \frac{\lambda}{R_{eff}}, \tag{11}$$

where

$$R_{eff} = R_h - d_m\left(\frac{\frac{p}{p_L}}{1 + \frac{p}{p_L}}\right) \tag{12}$$

is the effective hydraulic radius.

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2.3. Governing equation

According to Li et al. [21], the mass conservation equation, incorporating the effects of adsorption, is given by

$$\frac{\partial}{\partial t}\left(\frac{\rho_{sc}\phi}{B}\right)+\frac{\partial}{\partial t}\left(\frac{\rho_s\rho_{sc}V_{ads}}{B}\right)+\nabla\cdot\left(\frac{\rho_{sc}\mathbf{v}}{B}\right)$$

$$-\frac{q_{sc}\rho_{sc}}{V_b}=0, \tag{13}$$

where q_{sc} is a source term, ρ_s is the density of the rock, $B=\rho_{sc}/\rho$ is the volume formation factor, V_b is the total volume of the volume control (rock plus pores), and the subscript sc indicates the standard conditions,

$$\phi=\phi^0\left[1+c_\phi\left(p-p^0\right)\right], \tag{14}$$

where the superscript 0 indicates the reference conditions, and c_ϕ is the compressibility coefficient of the rock. We consider here small and constant rock compressibility.

Substituting Eq. (1) in Eq. (13) and considering that: ρ_{sc} and ρ_s are constant, we neglect the gravitational effects, the flow is two-dimensional, and the apparent permeability tensor is diagonal,

$$\frac{\partial}{\partial x}\left(\frac{k_{ax}}{\mu B}\frac{\partial p}{\partial x}\right)+\frac{\partial}{\partial y}\left(\frac{k_{ay}}{\mu B}\frac{\partial p}{\partial y}\right)-\frac{J_w}{V_b}\left(p-p_{wf}\right)$$

$$=\left(\Gamma'_p+\Gamma'_s\right)\frac{\partial p}{\partial t} \tag{15}$$

where for a non-isothermal flow and considering the previous expressions of V_{ads} and B

$$\Gamma'_p=\frac{c_\phi\phi^0}{B}+\phi\frac{d}{dp}\left(\frac{1}{B}\right) \tag{16}$$

and

$$\Gamma'_s=\rho_s\left[\frac{1}{B}\frac{dV_{ads}}{dp}+V_{ads}\frac{d}{dp}\left(\frac{1}{B}\right)\right], \tag{17}$$

being that we used the term source to represent the well flow through an internal boundary condition for the well-reservoir coupling:

$$q_{sc}=-J_w\left(p-p_{wf}\right), \tag{18}$$

where J_w is the productivity index, and p_{wf} is the pressure in the well [14]. In this work, we employ a prescribed production flow condition.

We know that Eq. (15) is a partial nonlinear parabolic differential equation that we use to determine the gas pressure. As an initial condition, we consider

$$p(x,y,t=0)=p_{ini}(x,y), \tag{19}$$

where p_{ini} is the initial pressure before the reservoir is disturbed by production/injection.

On the other hand, the external boundary conditions are those of null flow at the borders

$$\left(\frac{\partial p}{\partial x}\right)_{x=0,L_x}=\left(\frac{\partial p}{\partial y}\right)_{y=0,L_y}=0, \tag{20}$$

where L_x and L_y are the respective lengths of the reservoir in the x- and y- directions.

III. NUMERICAL METHODOLOGY

In this work, we use the Finite Difference Method (FDM) and a computational mesh of centered blocks [2, 14], together with a well-reservoir coupling technique [10], to determine the pressures in the reservoir and the producing well.

3.1. Discretization of the governing equation

We provide a schematic representation of a discretized two-dimensional domain is provided considering a single cell in the direction of the z-axis (highlighted in Fig. 2). We obtain the numerical solution at the nodes of the computational mesh, located in the centers of the cells. n_x and n_y represent the number of cells in the x- and y- directions, respectively. The integer indexes i and j represent the numbering of the cell nodes in the respective x- and y- directions, and the fractional indexes $i\pm1/2$ and $j\pm1/2$ their interfaces.

Therefore, by writing the governing equation as being evaluated in cell node i,j, and at time level $n+1$:

$$\left[\frac{\partial}{\partial x}\left(\mathbb{T}'_x\frac{\partial p}{\partial x}\right)dx+\frac{\partial}{\partial y}\left(\mathbb{T}'_y\frac{\partial p}{\partial y}\right)dy\right]_{i,j}^{n+1}$$

$$=\left[\left(\Gamma_p+\Gamma_s\right)\frac{\partial p}{\partial t}+q_{sc}\right]_{i,j}^{n+1}, \tag{21}$$

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where, as $V_b = dxdyL_z$, we used

$$(V_b)_{i,j} = (\Delta x \Delta y)_{i,j} L_z \tag{22}$$

and we introduced the variables

$$\mathbb{T}'_x \equiv \frac{A_x k_{a,x}}{\mu B} \tag{23}$$

and

$$\mathbb{T}'_y \equiv \frac{A_y k_{a,y}}{\mu B}, \tag{24}$$

with $A_x = \Delta y L_z$ and $A_y = \Delta x L_z$. $\Delta x_{i,j}$ and $\Delta y_{i,j}$ are, respectively, the mesh spacing in the x- and y-directions in the cell (i,j), and L_z the length of the rock formation in the z-direction.

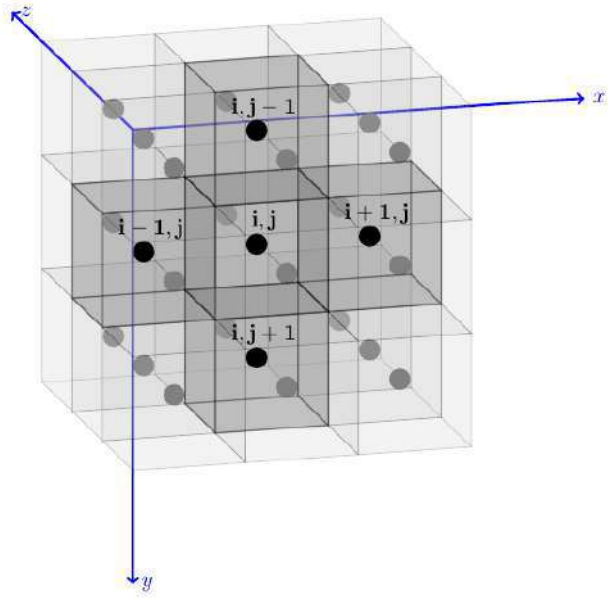

Fig. 2: *Example of some cells of the discretized domain.*

Then, we employ a centered difference type scheme to approximate the spatial derivative in the x-direction [2, 14],

$$\frac{\partial}{\partial x}\left(\mathbb{T}'_x \frac{\partial p}{\partial x}\right)^{n+1}_{i,j} \cong \frac{1}{\Delta x_{i,j}}\left[\left(\mathbb{T}'_x \frac{\partial p}{\partial x}\right)_{i+\frac{1}{2},j}\right]^{n+1} - \frac{1}{\Delta x_{i,j}}\left[\left(\mathbb{T}'_x \frac{\partial p}{\partial x}\right)_{i-\frac{1}{2},j}\right]^{n+1}. \tag{25}$$

Spatial derivatives, evaluated on the faces of cells, are also discretized by centered differences,

$$\left(\frac{\partial p}{\partial x}\right)^{n+1}_{i+\frac{1}{2},j} \cong \frac{p^{n+1}_{i+1,j} - p^{n+1}_{i,j}}{\Delta x_{i+\frac{1}{2},j}} \tag{26}$$

and

$$\left(\frac{\partial p}{\partial x}\right)^{n+1}_{i-\frac{1}{2},j} \cong \frac{p^{n+1}_{i,j} - p^{n+1}_{i-1,j}}{\Delta x_{i-\frac{1}{2},j}} \tag{27}$$

where $\Delta x_{i\pm 1/2,j}$ is the distance between the centers of cells (i,j) and $(i \pm 1, j)$. We can obtain the approximations for derivatives in the y-direction in an analogous way.

We also introduced transmissibilities in the x- and y- directions:

$$\mathbb{T}^{n+1}_{x,i\pm\frac{1}{2},j} = \left(\frac{A_x k_{a,x}}{\mu B \Delta x}\right)^{n+1}_{i\pm\frac{1}{2},j} \tag{28}$$

and

$$\mathbb{T}^{n+1}_{y,i,j\pm\frac{1}{2}} = \left(\frac{A_y k_{a,y}}{\mu B \Delta y}\right)^{n+1}_{i,j\pm\frac{1}{2}} \tag{29}$$

where a harmonic mean is used to determine the values of areas and permeabilities in positions $(i \pm 1/2, j)$ and $(i, j \pm 1/2)$, from the values known in neighboring nodes. With regard to the properties of the fluid, we applied an arithmetic mean [14].

Thus, using an Euler approximation for the time derivative and a fully implicit formulation in time, it is possible to obtain the final discretized form of Eq. (21),

$$\mathbb{T}_x\Big|^{n+1}_{i+1/2,j}\left(p^{n+1}_{i+1,j} - p^{n+1}_{i,j}\right) - \mathbb{T}_x\Big|^{n+1}_{i-1/2,j}\left(p^{n+1}_{i,j} - p^{n+1}_{i-1,j}\right)$$

$$+\mathbb{T}_y\Big|^{n+1}_{i,j+1/2}\left(p^{n+1}_{i,j+1} - p^{n+1}_{i,j}\right) - \mathbb{T}_y\Big|^{n+1}_{i,j-1/2}\left(p^{n+1}_{i,j} - p^{n+1}_{i,j-1}\right)$$

$$= \left(\frac{\Gamma_p + \Gamma_s}{\Delta t}\right)^{n+1}_{i,j}\left(p^{n+1}_{i,j} - p^{n}_{i,j}\right) + (q_{sc})^{n+1}_{i,j} \tag{30}$$

where n indicates the time level at which we know the pressure, and we used a conservative expansion for the accumulation term [14]:

$$\Gamma^{n+1}_p = V_{bi,j}\left[\frac{c_\phi \phi^0}{B^n} + \phi^{n+1}\frac{d}{dp}\left(\frac{1}{B}\right)\right]_{i,j} \tag{31}$$

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and

$$\Gamma_s^{n+1} = V_{bi,j}\left[\rho_s V_{ads}^n \frac{d}{dp}\left(\frac{1}{B}\right) + \frac{\rho_s}{B^{n+1}}\frac{dV_{ads}}{dp}\right]_{i,j}. \quad (32)$$

3.2. Well-reservoir coupling

We proceed with the process of discretization and the source term $(q_{sc})_{i,j}^{n+1}$ takes the discrete form

$$(q_{sc})_{i,j}^{n+1} = -(J_w)_{i,j}^{n+1}\left[p_{i,j}^{n+1} - (p_{wf})_{i,j}^{n+1}\right], \quad (33)$$

and the productivity index is expressed by [24]

$$(J_w)_{i,j}^{n+1} = \left[\frac{2\pi L_z\sqrt{k_{a,x}k_{a,y}}}{B\mu\,\ln\left(\frac{r_{eq}}{r_w}\right)}\right]_{i,j}^{n+1} \quad (34)$$

where r_w is the radius of the well and the equivalent radius, r_{eq}, is given by [24]

$$r_{eq_{i,j}} = \frac{0,28\left(\sqrt{\sqrt{\frac{k_{a,y}}{k_{a,x}}}\Delta x^2 + \sqrt{\frac{k_{a,x}}{k_{a,y}}}\Delta y^2}\right)_{i,j}}{\left(\sqrt[4]{\frac{k_{a,y}}{k_{a,x}}} + \sqrt[4]{\frac{k_{a,x}}{k_{a,y}}}\right)_{i,j}} \quad (35)$$

and we already rewrote the equivalent radius for its use with the apparent permeability.

3.3. Linearization

Equation (30) forms a system of nonlinear algebraic equations [17]. From Eq. (33), for the particular case of the two-dimensional problem, we can isolate the pressure of the vertical well once we know the flow and the pressure of the reservoir at the end of each time step.

To achieve the linearization of Eq. (30), we adopted the well-known method of Picard [22]. Therefore, after its linearization, we get the following equation

$$\mathbb{T}_y\Big|_{i,j-1/2}^{v,n+1} p_{i,j-1}^{v+1,n+1} + \mathbb{T}_x\Big|_{i-1/2,j}^{v,n+1} p_{i-1,j}^{v+1,n+1}$$

$$+\mathbb{T}_x\Big|_{i+1/2,j}^{v,n+1} p_{i+1,j}^{v+1,n+1} + \mathbb{T}_y\Big|_{i,j+1/2}^{v,n+1} p_{i,j+1}^{v+1,n+1}$$

$$-\left[\mathbb{T}_y\Big|_{i,j-1/2}^{v,n+1} + \mathbb{T}_x\Big|_{i-1/2,j}^{v,n+1} + \left(\frac{\Gamma_p+\Gamma_s}{\Delta t}\right)_{i,j}^{v,n+1}\right] p_{i,j}^{v+1,n+1}$$

$$-\left[\mathbb{T}_x\Big|_{i+1/2,j}^{v,n+1} + \mathbb{T}_y\Big|_{i,j+1/2}^{v,n+1}\right] p_{i,j}^{v+1,n+1}$$

$$= (q_{sc})_{i,j}^{v,n+1} - \left(\frac{\Gamma_p+\Gamma_s}{\Delta t}\right)_{i,j}^{v,n+1} p_{i,j}^{n} \quad (36)$$

and transmissibilities, Γ_p, Γ_s, and q_{sc} are evaluated at the iterative level v.

Then, we utilize the values determined at the iterative level v to calculate the pressure at $v+1, n+1$. Therefore, we obtain the pressure from two internal and external iterative processes for a given time step [8].

We choose the method of the Conjugate Gradient (CG) to solve the algebraic system of Eq. (36) [16, 25].

We can find in Fig. 3 the flowchart of the numerical scheme of the resolution algorithm for a single time step calculation. To verify whether we achieve the convergence of the internal and external iterations, we use tolerance values equal to tol_1 and tol_2, respectively.

IV. RESULTS

In this section, we present our numerical results. Initially, we introduce the standard case and some information about the data used in the simulations, including rock and fluid properties, simulation parameters, and geometric data.

Next, we do a numerical verification study, including the refinement of the computational mesh. Finally, we carry out a sensitivity study of parameters and compare the different models employed. Here, the standard model is that incorporating the effects of gas slippage and adsorption in the modified Darcy's law, as discussed in Jiang and Younis [18].

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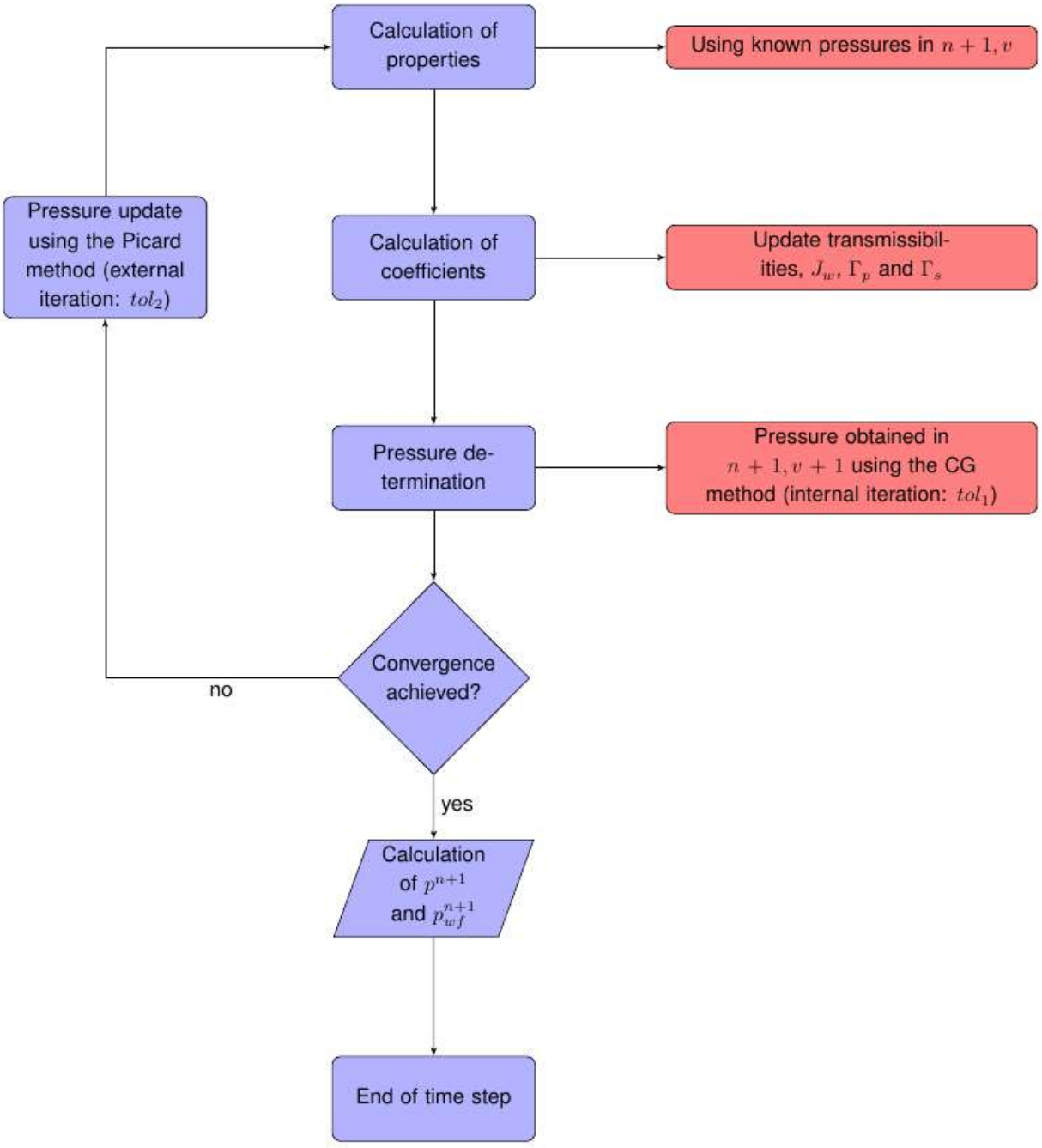

Fig. 3: *Flowchart for a single time step.*

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We show the results using specialized plots, commonly employed in the area of well pressure test analysis [5].

We consider six models according to how we calculate the apparent permeability values ($\mathbf{k}_a$) in Eq. (1) and the Γ_s coefficient in Eq. (15):

- Model 1 [14], which represents the classic case of Darcy's law, without the effects of slippage and adsorption;
- Model 2 [15], the apparent permeability is calculated as a function of the Knudsen number (slippage effect);
- Model 3 [3], without slippage effect and with an accumulation term for the inclusion of adsorption;
- Model 4 [21], apparent permeability corrected as a function of the Knudsen number (slippage effect) and insertion of adsorption through the source term in Eq. (15);
- Model 5, we modify the apparent permeability taking into account adsorption and, also, we introduce its effects via the accumulation term in Eq. (15);
- Model 6 [18], we change the value of $\mathbf{k}_a$ to take into account the combined effects of slippage and adsorption, and we also include the term $\Gamma_s \neq 0$ in Eq. (15).

We modify the initial time step (Δt_{ini}) according to the growth rate ($\delta_{\Delta t}$) to obtain the next time step. This procedure is interrupted when we reach the specified final time step (Δt_{max}). We employ this strategy to achieve greater accuracy in the initial stages of production.

We can find the default values used in the simulations in Table 1. They are defined based on the works of [21], [18] and [9]. We adopt the same tolerance value for the internal (tol_1) and external (tol_2) iterative procedures.

Table 1: *Parameters for the default case.*

Parameter	Value	Unit
c_ϕ	1.0×10^{-6}	psi^{-1}
d_m	2.3×10^{-10}	ft
$k_x = k_y$	5.0×10^{-6}	Darcy
$L_x = L_y$	4,000	ft
L_z	40.0	ft
L_{wf}	40.0	ft
$n_x = n_y$	321	–
p_{sc}	14.65	psi
p_L	1,100	psi
$p_{ini} = p^0$	6,000	psi
Q_{sc}	-5.0×10^4	scf/day
r_w	0.25	ft
R	10.73	ft^3psi/R lbm-mol
t_{max}	365	day
$tol_1 = tol_2$	1.0×10^{-4}	psi
T	609.67	R
T_{sc}	519.67	R
V_L	0.0005	ft^3/lbm
γ	0.6	psi
$\delta_{\Delta t}$	1.05	–
Δt_{ini}	0.01	day
Δt_{max}	10.0	day
ρ_s	200.0	lbm/ft^3
τ	1.41	–
$\phi_{ini} = \phi^0$	0.12	–

We use the relative density of the gas, together with the pressure and temperature values, to determine the other properties of the gas [8, 20, 26].

4.1. Mesh refinement

Table 2 shows the numbers of cells used in the generation of the different computational meshes applied in the study of refinement of the computational mesh.

As the production time increases, we can see (Fig. 4) that the pressure curves of the well approach each other. However, for the initial instants of time, there is no overlap of values due to the increased effect of the well known numeric artifact [10, 11].

The numerical artifact appears as a consequence of the well-reservoir coupling technique, that assumes a steady-state flow regime near the well [23, 24]. Nevertheless, its effects do not compromise the results for the advanced time instants. So, having verified

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the numerical convergence, Mesh 5 was chosen as the standard, given the significant reduction of the numerical artifact for times higher than one day of production.

Table 2: *Meshes.*

Mesh	n_x	n_y
1	21	21
2	41	41
3	81	81
4	161	161
5	321	321
6	641	641

We emphasize that de Souza [9] validated the simulator used in the present work by comparing its results with those of the commercial simulator IMEX [6] for Model 1.

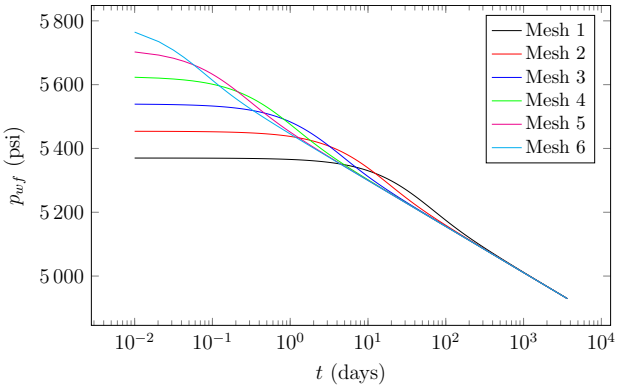

Fig. 4: *Results for mesh refinement.*

4.2. Sensitivity analysis and model comparison

After conducting the mesh refinement study, we performed a sensitivity analysis considering the different models for the single-phase flow of natural gas, incorporating (or not) the slippage and gas adsorption phenomena. We must remark that for all the studied cases, the Kn remained within the validity range of the slip flow regime [4].

Initially, we compare the results obtained with Models 1 (Fig. 5) and 6 (Fig. 6) in simulations by varying the absolute permeability. We can see in Fig. 5 that for the highest values of absolute permeability, there are the smallest pressure variations in the well. In the graphs, the sloping lines are characteristic of the transient regime in a porous medium. In Fig. 6, again, for the highest permeabilities, there is the smallest pressure variation in the well. We also observed the occurrence of the transient regime. However, compared with Fig. 5, it appears that the results for Model 6 show a lower pressure drop than those for Model 1, for the same absolute permeability, as a result of higher apparent permeability. It also leads to a shorter duration and magnitude of the numerical artifact. Besides that, we should note that a lower absolute permeability leads to a higher Kn [8], thus leading to a lower pressure drop, in contrast to the effect of the absolute permeability in the modified Darcy's law.

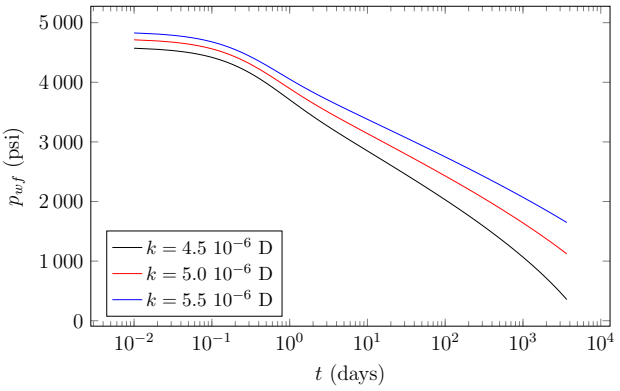

Fig. 5: *Permeability variation for Model 1.*

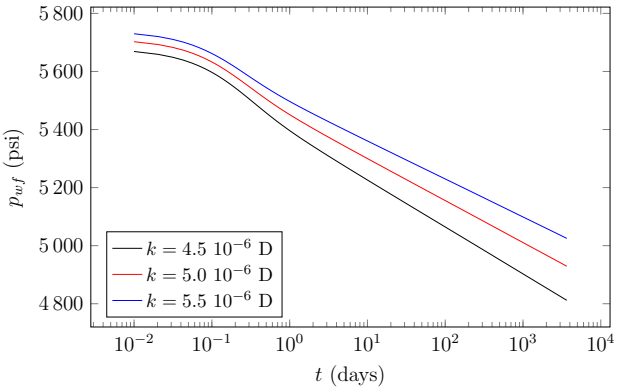

Fig. 6: *Permeability variation for Model 6.*

About temperature variation for Model 6, see Fig. 7, its increase leads to an augmentation in the Knudsen number (via λ) and, consequently, to a growth in the permeability apparent (facilitating the flow), which contributes to a lower pressure drop. However, the viscosity of the gas rises with temperature too. Thus, it also causes an increase in pressure drop due to the higher resistance to flow. Therefore,

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there is a contraposition of effects that leads to different trends about pressure variation, with growth in pressure drop for increasing temperature being prevalent in the tested cases.

We can see in Fig. 8 the influence that V_L has on the term source (due to adsorption) and the apparent permeability. We noticed that the curves are close in the initial moments and that at a later time, there is a gap between them. For the higher volume of Langmuir, there is a higher amount of adsorbed gas that can be released, favoring the maintenance of production (less pressure drop). We know that the increase of V_L causes a reduction in the apparent permeability. However, with the release of the adsorbed gas, the effect of V_L on $\mathbf{k'}_a$ decreases.

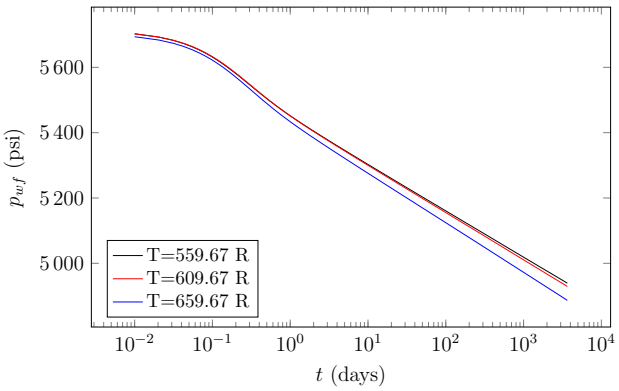

Fig. 7: *Temperature variation for Model 6.*

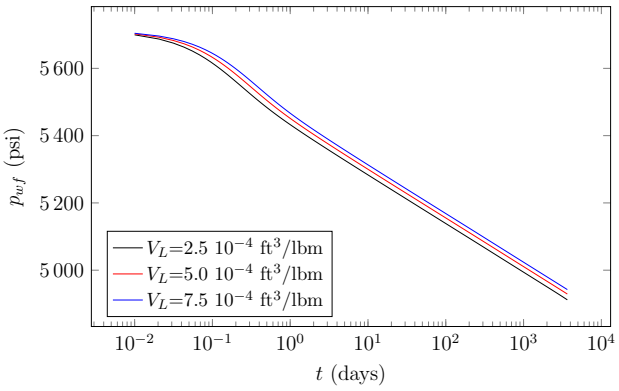

Fig. 8: *Variation of V_L for Model 6.*

In the last case studied, we compare the six flow models, and we show the results in Fig. 9. Indeed, we should point out that we have not found Model 5, $\mathbf{k}_a = \mathbf{k'}_a$ and $\Gamma_s \neq 0$, in the literature. Nevertheless, it could be used, for example, in reservoir simulations where the effects of adsorption are considerable, although we can neglect those of slippage.

When comparing Models 1 and 2, we observe that the incorporation of the slippage effect leads to a lower pressure drop due to the higher values of apparent permeability. The curves start from different points and have different slopes, in the region of the transient flow, due to the difference in apparent permeabilities. In the specific case of Models 1 and 3, the curves begin close with each other, as the apparent permeabilities are the same (the absolute). Further, we observe that the slopes are similar in the region of the transient regime (except for the effects of non-linearities) due to the properties of the fluid, with a lower pressure drop for the case where adsorption supplements production.

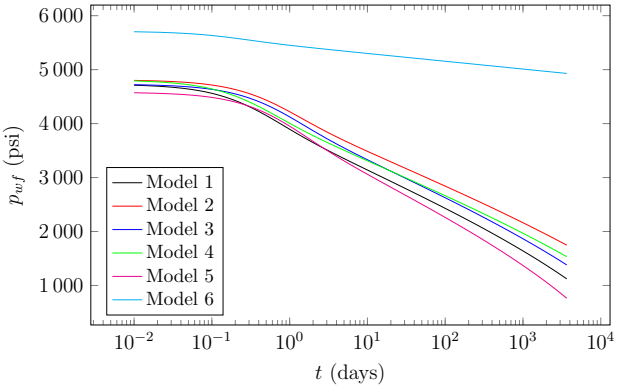

Fig. 9: *Comparison between different models.*

For Models 1 and 4, we perceive that adsorption and slippage effects favor the maintenance of pressure. Because of the slippage effect, we must correct the permeability apparent. As a consequence, the slope of these curves is not similar to those of Models 1 and 3. Indeed, they are closer to that of Model 2. However, the overlapping effects of slippage and adsorption did not lead to values of pressure higher than those obtained in Model 2. We can explain this behavior by the fact that Kn depends on pressure so that for higher pressure values, there is a decrease in Kn and a higher resistance to flow. In the case of Model 3, the overlapping effects lead to higher pressure values after about 20 days of production.

As the apparent permeability in Model 5 is lower than the absolute permeability, at least at the beginning of production, the numerical artifact appears more strongly. In the beginning, the production poten-

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tial is lower, but over time the increase in Langmuir volume results in a higher amount of adsorbed gas that can be released, favoring the maintenance of production (less pressure drop). Even so, this situation is transient, and Model 1 has a lower pressure drop over long periods. A possible explanation is associated with the pressure variation in the reservoir since it has a limited direct impact on $\mathbf{k}_a$ and because the model only considers its correction based on V_L. Therefore, the predominant effect becomes that of the accumulation term, and lower pressure drops than those of Model 1 would only be possible for even higher values of V_L.

Finally, for Model 6, the difference in pressure drop is highlighted when slippage and adsorption phenomena are not neglected, as in the case of Model 1. Although the effects are opposite concerning the variation in apparent permeability (predominant in the cases studied here), adsorption contributes to sustaining production through the accumulation term.

V. CONCLUSION

As expected, we showed the positive influence of adsorption once we have more gas available for production as a consequence of this phenomenon, despite its negative impact on the calculation of the apparent permeability. On the other hand, we also remarked the benefits of the slippage effect on increasing the apparent permeability, facilitating flow through the reservoir. Besides, we were able to capture the influence of non-Darcy models in the well-reservoir coupling by analyzing the pressure variation of the producing well during production.

Therefore, it was clear, given the results obtained, that for single-phase gas flow in shale-type reservoirs, failure to consider both phenomena of slippage and gas adsorption may result in incorrect values for pressures in the well and the gas reservoir. Such a fact may lead to mistaken decision making. For example, we can invest resources in the production of a deposit that will present less pressure on the producing well than expected or failing to invest in a reservoir that would have favorable production conditions. As we have seen, this can happen if we do not consider these two effects. Further, we could perform simulations resulting in production flows closer to real conditions if we take into account both slippage and adsorption phenomena.

In the case of shale gas reservoirs, due to their characteristics, we must not forget that their feasibility is possible through the use of horizontal producing wells and hydraulic fracturing.

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Comparative Study and Sensitivity Analysis in Simulation of Non-Darcy Flow in Shale Gas Reservoirs

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Abstract *— In this work, we perform a comparative study of flow models and a sensitivity analysis concerning some parameters, considering the effects of slipping and gas adsorption in shale gas reservoirs, using numerical simulation. We use the Finite Difference Method, a linearization based on the Picard method, and the Conjugate Gradient method to obtain the reservoir and production well pressures. The results obtained demonstrate the importance of the effects of slipping and adsorption in the variation of pressure in a single-phase isothermal gas flow. Mainly because some parameters in the flow models, depending on their values, can act favoring (or disfavoring) the pressure drop.*

Keywords *— **Adsorption. Finite Difference Method. Natural gas. Reservoir simulation. Slipping flow.***

I. INTRODUCTION

For decades, the oil industry has followed a standard strategy in the context of hydrocarbon exploration/exploitation: the search for rock formations of interest, the location of the reservoir rocks, the identification of the mechanisms of imprisonment, and well drilling. These procedures had been used by geologists, geophysicists, and engineers, aiming mainly at the production of hydrocarbons via vertical wells in reservoirs formed, for example, by sandstones or carbonates.

However, in the past two decades, new concepts of exploitation have emerged. Rock formations that were previously less important, to the point of not being considered economically viable, are currently seen as potential reservoirs. Among unconventional sources, shale gas reservoirs are gaining more and more relevance on the world stage [8].

1.1. Natural gas

Natural gas is a homogeneous fluid with low viscosity and density. In a reservoir, natural gas can be classified as dry (it does not contain molecules heavy enough to form a liquid hydrocarbon under surface conditions), for example, when composed essentially of methane. Generally, natural gas (depending on the reservoir and its characteristics) contains methane, ethane, propane, butane, pentane, and hexane, but we can also find other heavier components in it. The non-hydrocarbon parcels, considered as impurities, include carbon dioxide, hydrogen sulfide, and nitrogen. The primary component is always methane, which may represent 70 to 98% of the total, followed by ethane (which may reach 10%).

Natural gas is the cleanest and richest source of hydrogen among hydrocarbons and has high efficiency in energy conversion. The current trend is for natural gas to become one of the most important fuels in the global economy [12] due to economic and environmental reasons [29, 31]. See Fig. 1 for the breakdown of the internal energy supply in Brazil for the year 2019 [13].

In terms of its use, natural gas can provide heating, generate electricity, and we can use it as fuel for motor vehicles or in the production of hydrogen [12]. According to Economides and Wood [12], the world reserves of natural gas have been increasing at an an-

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nual rate of about 5% since the seventies. The number of countries with known natural gas reserves has grown from 40, in 1960, to 85 in 2005.

1.2. Shale gas

Non-conventional reservoirs differ from conventional ones, for example, in that they have a very low permeability. Among the non-conventional reservoirs, we can mention the tight-gas sands (low permeability reservoirs), the coal bed methane (in which there is gas adhered to coal veins), and the shale gas (gas in shale-like rocks). The latter, the focus of this work, typically have extremely low permeabilities, in the range of 10^{-6} to 10^{-9} Darcy, low porosity, gas adsorbed on the solid, and the gas slips on the pore surfaces of the reservoir. Its formations are composed of sedimentary rocks, consisting of clay minerals such as illite, smectite, and kaolinite [8].

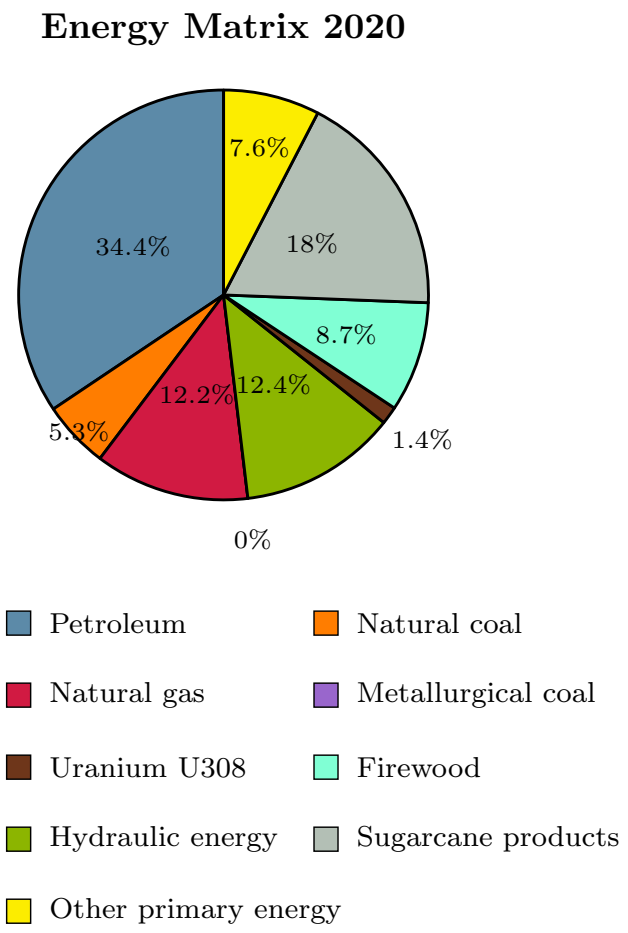

Fig. 1: *Supply by energy source in Brazil in 2019.*

In them, the gas is present as a free phase in the pores, dissolved in liquids, or adsorbed on solids. We find the gas adsorbed on carbon-rich compounds, such as kerogen. According to Ali [1], Wang [27] and Berawala [3], gas in an adsorbed state represents a fraction ranging from 20 to 80 % of the total gas reserves in shales. As the pressure decreases, as a result of continuous production, the gas adsorbed detaches from the solid and becomes part of the free phase, contributing to flow and production. Therefore, by neglecting the effects of adsorption, we can underestimate the potential of a shale reservoir [30].

About two decades ago, we considered gas recovery in shale reservoirs as economically and technically nonviable. However, with the emergence of new technologies, especially the drilling of horizontal wells and hydraulic fracturing, their exploitation has become possible and economically viable. In 2015, about three-quarters of natural gas production in the United States originated from these reservoirs, with the expectation of continued growth over the next two decades [28]. The great success in North America has led to unconventional sources gaining more attention on the world stage, including the countries of South America, such as Argentina and Brazil.

II. NATURAL GAS FLOW IN POROUS MEDIA

Typically, the classical Darcy law [7] is used in engineering to describe low-speed flows in porous media. For non-Darcy flows, it is modified and expressed in the form:

$$\mathbf{v} = -\frac{\mathbf{k}_a}{\mu}\left(\nabla p - \rho g \nabla D\right), \tag{1}$$

where $\mathbf{v}$ is the surface velocity of the fluid, $\mathbf{k}_a$ is the apparent permeability tensor, μ is the viscosity, p is the pressure, ρ is the density, g is the magnitude of the acceleration due to gravity, and D is the depth. Among the non-Darcy effects, which we can incorporate into the apparent permeability, we have:

- the inertial and turbulent effects,
- the non-Newtonian flow,
- the slipping and adsorption of the gas on the pore surface,

in addition to others that also cause non-linearity [2].

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2.1. The gas slippage phenomenon

Florence et al. [15] reported that the phenomenon of gas slipping occurs when the mean free path of the fluid molecules is of the order of the characteristic hydraulic radius of the pores. We know that gas flows in the porous medium differently from a liquid for two reasons: its high compressibility and the Klinkenberg effect [2]. We use Klinkenberg's correction to take into account the effects of gas slippage, which can be verified when carrying out permeability measurements on rock samples [14]

$$\mathbf{k_a} = \left(1 + \frac{b}{p}\right)\mathbf{k} \tag{2}$$

where b is the Klinkenberg parameter and $\mathbf{k}$ the absolute permeability tensor [19]. For example, gas slippage can occur in shale gas and tight gas sand reservoirs.

As an alternative to Klinkenberg's correction, we can also account for this effect through a more general expression for the determination of apparent permeability, which we can calculate as a function of Knudsen number [18],

$$\mathbf{k}_a = f(Kn)\mathbf{k} = (1 + \alpha_k Kn)\left(1 + \frac{4Kn}{1+Kn}\right)\mathbf{k}, \tag{3}$$

where $\mathbf{k}$ is the absolute permeability tensor, and α_k is the rarefaction parameter [18], whereas for the slip regime, $\alpha_k = 0$. The Knudsen number, Kn, is defined by

$$Kn = \frac{\lambda}{R_h}, \tag{4}$$

where λ is the average free path of the molecules and R_h the characteristic hydraulic radius [15]

$$R_h = 2\sqrt{2\tau}\sqrt{\frac{k}{\phi}} \tag{5}$$

and

$$\lambda = \frac{\mu}{p}\sqrt{\frac{\pi Z R T}{2M}}, \tag{6}$$

where τ is the tortuosity of the porous medium, k is the geometric mean representing the absolute permeability of the porous medium, ϕ the effective porosity of the porous medium, Z is the compressibility factor, T is the temperature, R is the universal constant for gases, M is the molecular mass of the gas, and $\gamma = M/M_{air}$ is the relative density of the gas and M_{air} the molecular mass of air [8]. The slip regime exists for the $10^{-3} < Kn < 0.1$ range [4].

2.2. The adsorption phenomenon

Adsorption occurs when the gas molecules attach to the solid surface of the pores, and the volume of gas adsorbed depends on the pressure of the gas phase. Here, we consider the Langmuir isotherm model:

$$V_{ads} = \frac{pV_L}{p + p_L}, \tag{7}$$

where V_{ads} is the volume of adsorbed gas, V_L is the maximum volume adsorbed (Langmuir volume), and p_L is the pressure corresponding to half of the maximum adsorption capacity (Langmuir pressure). According to Jiang and Younis [18], we can also incorporate the effects of adsorption into the calculation of apparent permeability

$$\mathbf{k'_a} = \left[1 - \frac{d_m}{R_h}\left(\frac{\frac{p}{p_L}}{1 + \frac{p}{p_L}}\right)\right]^4 \mathbf{k} \tag{8}$$

where d_m is the diameter of the gas molecule adhered to the surface. Therefore, we can combine the contributions due to gas slippage and adsorption in determining the apparent permeability in the form:

$$\mathbf{k}_a = f(Kn')\mathbf{k'}_a \tag{9}$$

where

$$f(Kn') = (1 + \alpha_k Kn')\left(\frac{1 + 4Kn'}{1 + Kn'}\right) \tag{10}$$

and the modified Knudsen number is set to

$$Kn' = \frac{\lambda}{R_{eff}}, \tag{11}$$

where

$$R_{eff} = R_h - d_m\left(\frac{\frac{p}{p_L}}{1 + \frac{p}{p_L}}\right) \tag{12}$$

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is the effective hydraulic radius.

2.3. Governing equation

According to Li et al. [21], the mass conservation equation, incorporating the effects of adsorption, is given by

$$\frac{\partial}{\partial t}\left(\frac{\rho_{sc}\phi}{B}\right)+\frac{\partial}{\partial t}\left(\frac{\rho_s\rho_{sc}V_{ads}}{B}\right)+\nabla\cdot\left(\frac{\rho_{sc}\mathbf{v}}{B}\right)$$

$$-\frac{q_{sc}\rho_{sc}}{V_b}=0, \tag{13}$$

where q_{sc} is a source term, ρ_s is the density of the rock, $B=\rho_{sc}/\rho$ is the volume formation factor, V_b is the total volume of the volume control (rock plus pores), and the subscript sc indicates the standard conditions,

$$\phi=\phi^0\left[1+c_\phi\left(p-p^0\right)\right], \tag{14}$$

where the superscript 0 indicates the reference conditions, and c_ϕ is the compressibility coefficient of the rock. We consider here small and constant rock compressibility.

Substituting Eq. (1) in Eq. (13) and considering that: ρ_{sc} and ρ_s are constant, we neglect the gravitational effects, the flow is two-dimensional, and the apparent permeability tensor is diagonal,

$$\frac{\partial}{\partial x}\left(\frac{k_{ax}}{\mu B}\frac{\partial p}{\partial x}\right)+\frac{\partial}{\partial y}\left(\frac{k_{ay}}{\mu B}\frac{\partial p}{\partial y}\right)-\frac{J_w}{V_b}\left(p-p_{wf}\right)$$

$$=\left(\Gamma'_p+\Gamma'_s\right)\frac{\partial p}{\partial t} \tag{15}$$

where for a non-isothermal flow and considering the previous expressions of V_{ads} and B

$$\Gamma'_p=\frac{c_\phi\phi^0}{B}+\phi\frac{d}{dp}\left(\frac{1}{B}\right) \tag{16}$$

and

$$\Gamma'_s=\rho_s\left[\frac{1}{B}\frac{dV_{ads}}{dp}+V_{ads}\frac{d}{dp}\left(\frac{1}{B}\right)\right], \tag{17}$$

being that we used the term source to represent the well flow through an internal boundary condition for the well-reservoir coupling:

$$q_{sc}=-J_w\left(p-p_{wf}\right), \tag{18}$$

where J_w is the productivity index, and p_{wf} is the pressure in the well [14]. In this work, we employ a prescribed production flow condition.

We know that Eq. (15) is a partial nonlinear parabolic differential equation that we use to determine the gas pressure. As an initial condition, we consider

$$p(x,y,t=0)=p_{ini}(x,y), \tag{19}$$

where p_{ini} is the initial pressure before the reservoir is disturbed by production/injection.

On the other hand, the external boundary conditions are those of null flow at the borders

$$\left(\frac{\partial p}{\partial x}\right)_{x=0,L_x}=\left(\frac{\partial p}{\partial y}\right)_{y=0,L_y}=0, \tag{20}$$

where L_x and L_y are the respective lengths of the reservoir in the x- and y- directions.

III. NUMERICAL METHODOLOGY

In this work, we use the Finite Difference Method (FDM) and a computational mesh of centered blocks [2, 14], together with a well-reservoir coupling technique [10], to determine the pressures in the reservoir and the producing well.

3.1. Discretization of the governing equation

We provide a schematic representation of a discretized two-dimensional domain is provided considering a single cell in the direction of the z-axis (highlighted in Fig. 2). We obtain the numerical solution at the nodes of the computational mesh, located in the centers of the cells. n_x and n_y represent the number of cells in the x- and y- directions, respectively. The integer indexes i and j represent the numbering of the cell nodes in the respective x- and y- directions, and the fractional indexes $i\pm1/2$ and $j\pm1/2$ their interfaces.

Therefore, by writing the governing equation as being evaluated in cell node i,j, and at time level $n+1$:

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$$\left[\frac{\partial}{\partial x}\left(\mathbb{T}'_x\frac{\partial p}{\partial x}\right)dx+\frac{\partial}{\partial y}\left(\mathbb{T}'_y\frac{\partial p}{\partial y}\right)dy\right]_{i,j}^{n+1}$$

$$=\left[\left(\Gamma_p+\Gamma_s\right)\frac{\partial p}{\partial t}+q_{sc}\right]_{i,j}^{n+1}, \tag{21}$$

where, as $V_b = dxdyL_z$, we used

$$\left(V_b\right)_{i,j}=\left(\Delta x\Delta y\right)_{i,j}L_z \tag{22}$$

and we introduced the variables

$$\mathbb{T}'_x\equiv\frac{A_x k_{a,x}}{\mu B} \tag{23}$$

and

$$\mathbb{T}'_y\equiv\frac{A_y k_{a,y}}{\mu B}, \tag{24}$$

with $A_x = \Delta y L_z$ and $A_y = \Delta x L_z$. $\Delta x_{i,j}$ and $\Delta y_{i,j}$ are, respectively, the mesh spacing in the x- and y-directions in the cell (i, j), and L_z the length of the rock formation in the z-direction.

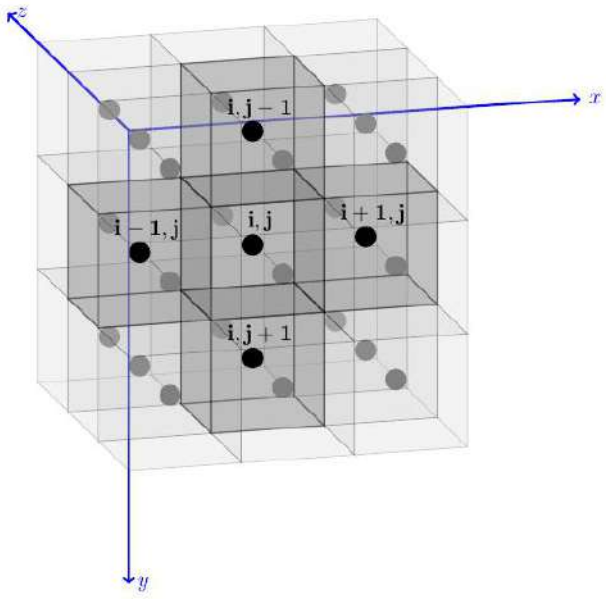

Fig. 2: *Example of some cells of the discretized domain.*

Then, we employ a centered difference type scheme to approximate the spatial derivative in the x-direction [2, 14],

$$\frac{\partial}{\partial x}\left(\mathbb{T}'_x\frac{\partial p}{\partial x}\right)_{i,j}^{n+1}\cong\frac{1}{\Delta x_{i,j}}\left[\left(\mathbb{T}'_x\frac{\partial p}{\partial x}\right)_{i+\frac{1}{2},j}\right]^{n+1}$$

$$-\frac{1}{\Delta x_{i,j}}\left[\left(\mathbb{T}'_x\frac{\partial p}{\partial x}\right)_{i-\frac{1}{2},j}\right]^{n+1}. \tag{25}$$

Spatial derivatives, evaluated on the faces of cells, are also discretized by centered differences,

$$\left(\frac{\partial p}{\partial x}\right)_{i+\frac{1}{2},j}^{n+1}\cong\frac{p_{i+1,j}^{n+1}-p_{i,j}^{n+1}}{\Delta x_{i+\frac{1}{2},j}} \tag{26}$$

and

$$\left(\frac{\partial p}{\partial x}\right)_{i-\frac{1}{2},j}^{n+1}\cong\frac{p_{i,j}^{n+1}-p_{i-1,j}^{n+1}}{\Delta x_{i-\frac{1}{2},j}} \tag{27}$$

where $\Delta x_{i\pm1/2,j}$ is the distance between the centers of cells (i, j) and $(i \pm 1, j)$. We can obtain the approximations for derivatives in the y-direction in an analogous way.

We also introduced transmissibilities in the x- and y- directions:

$$\mathbb{T}_{x,i\pm\frac{1}{2},j}^{n+1}=\left(\frac{A_x k_{a,x}}{\mu B\Delta x}\right)_{i\pm\frac{1}{2},j}^{n+1} \tag{28}$$

and

$$\mathbb{T}_{y,i,j\pm\frac{1}{2}}^{n+1}=\left(\frac{A_y k_{a,y}}{\mu B\Delta y}\right)_{i,j\pm\frac{1}{2}}^{n+1} \tag{29}$$

where a harmonic mean is used to determine the values of areas and permeabilities in positions $(i\pm1/2, j)$ and $(i, j \pm 1/2)$, from the values known in neighboring nodes. With regard to the properties of the fluid, we applied an arithmetic mean [14].

Thus, using an Euler approximation for the time derivative and a fully implicit formulation in time, it is possible to obtain the final discretized form of Eq. (21),

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$$\mathbb{T}_x\Big|_{i+1/2,j}^{n+1}\left(p_{i+1,j}^{n+1}-p_{i,j}^{n+1}\right)-\mathbb{T}_x\Big|_{i-1/2,j}^{n+1}\left(p_{i,j}^{n+1}-p_{i-1,j}^{n+1}\right)$$

$$+\mathbb{T}_y\Big|_{i,j+1/2}^{n+1}\left(p_{i,j+1}^{n+1}-p_{i,j}^{n+1}\right)-\mathbb{T}_y\Big|_{i,j-1/2}^{n+1}\left(p_{i,j}^{n+1}-p_{i,j-1}^{n+1}\right)$$

$$=\left(\frac{\Gamma_p+\Gamma_s}{\Delta t}\right)_{i,j}^{n+1}\left(p_{i,j}^{n+1}-p_{i,j}^{n}\right)+\left(q_{sc}\right)_{i,j}^{n+1} \tag{30}$$

where n indicates the time level at which we know the pressure, and we used a conservative expansion for the accumulation term [14]:

$$\Gamma_p^{n+1}=V_{bi,j}\left[\frac{c_\phi\phi^0}{B^n}+\phi^{n+1}\frac{d}{dp}\left(\frac{1}{B}\right)\right]_{i,j} \tag{31}$$

and

$$\Gamma_s^{n+1}=V_{bi,j}\left[\rho_s V_{ads}^n\frac{d}{dp}\left(\frac{1}{B}\right)+\frac{\rho_s}{B^{n+1}}\frac{dV_{ads}}{dp}\right]_{i,j}. \tag{32}$$

3.2. Well-reservoir coupling

We proceed with the process of discretization and the source term $(q_{sc})_{i,j}^{n+1}$ takes the discrete form

$$\left(q_{sc}\right)_{i,j}^{n+1}=-\left(J_w\right)_{i,j}^{n+1}\left[p_{i,j}^{n+1}-\left(p_{wf}\right)_{i,j}^{n+1}\right], \tag{33}$$

and the productivity index is expressed by [24]

$$\left(J_w\right)_{i,j}^{n+1}=\left[\frac{2\pi L_z\sqrt{k_{a,x}k_{a,y}}}{B\mu\,\ln\left(\frac{r_{eq}}{r_w}\right)}\right]_{i,j}^{n+1} \tag{34}$$

where r_w is the radius of the well and the equivalent radius, r_{eq}, is given by [24]

$$r_{eq_{i,j}}=\frac{0,28\left(\sqrt{\sqrt{\frac{k_{a,y}}{k_{a,x}}}\Delta x^2+\sqrt{\frac{k_{a,x}}{k_{a,y}}}\Delta y^2}\right)_{i,j}}{\left(\sqrt[4]{\frac{k_{a,y}}{k_{a,x}}}+\sqrt[4]{\frac{k_{a,x}}{k_{a,y}}}\right)_{i,j}} \tag{35}$$

and we already rewrote the equivalent radius for its use with the apparent permeability.

3.3. Linearization

Equation (30) forms a system of nonlinear algebraic equations [17]. From Eq. (33), for the particular case of the two-dimensional problem, we can isolate the pressure of the vertical well once we know the flow and the pressure of the reservoir at the end of each time step.

To achieve the linearization of Eq. (30), we adopted the well-known method of Picard [22]. Therefore, after its linearization, we get the following equation

$$\mathbb{T}_y\Big|_{i,j-1/2}^{v,n+1}p_{i,j-1}^{v+1,n+1}+\mathbb{T}_x\Big|_{i-1/2,j}^{v,n+1}p_{i-1,j}^{v+1,n+1}$$

$$+\mathbb{T}_x\Big|_{i+1/2,j}^{v,n+1}p_{i+1,j}^{v+1,n+1}+\mathbb{T}_y\Big|_{i,j+1/2}^{v,n+1}p_{i,j+1}^{v+1,n+1}$$

$$-\left[\mathbb{T}_y\Big|_{i,j-1/2}^{v,n+1}+\mathbb{T}_x\Big|_{i-1/2,j}^{v,n+1}+\left(\frac{\Gamma_p+\Gamma_s}{\Delta t}\right)_{i,j}^{v,n+1}\right]p_{i,j}^{v+1,n+1}$$

$$-\left[\mathbb{T}_x\Big|_{i+1/2,j}^{v,n+1}+\mathbb{T}_y\Big|_{i,j+1/2}^{v,n+1}\right]p_{i,j}^{v+1,n+1}$$

$$=\left(q_{sc}\right)_{i,j}^{v,n+1}-\left(\frac{\Gamma_p+\Gamma_s}{\Delta t}\right)_{i,j}^{v,n+1}p_{i,j}^{n} \tag{36}$$

and transmissibilities, Γ_p, Γ_s, and q_{sc} are evaluated at the iterative level v.

Then, we utilize the values determined at the iterative level v to calculate the pressure at $v+1, n+1$. Therefore, we obtain the pressure from two internal and external iterative processes for a given time step [8].

We choose the method of the Conjugate Gradient (CG) to solve the algebraic system of Eq. (36) [16, 25].

We can find in Fig. 3 the flowchart of the numerical scheme of the resolution algorithm for a single time step calculation. To verify whether we achieve the convergence of the internal and external iterations, we use tolerance values equal to tol_1 and tol_2, respectively.

IV. RESULTS

In this section, we present our numerical results. Initially, we introduce the standard case and some information about the data used in the simulations, in-

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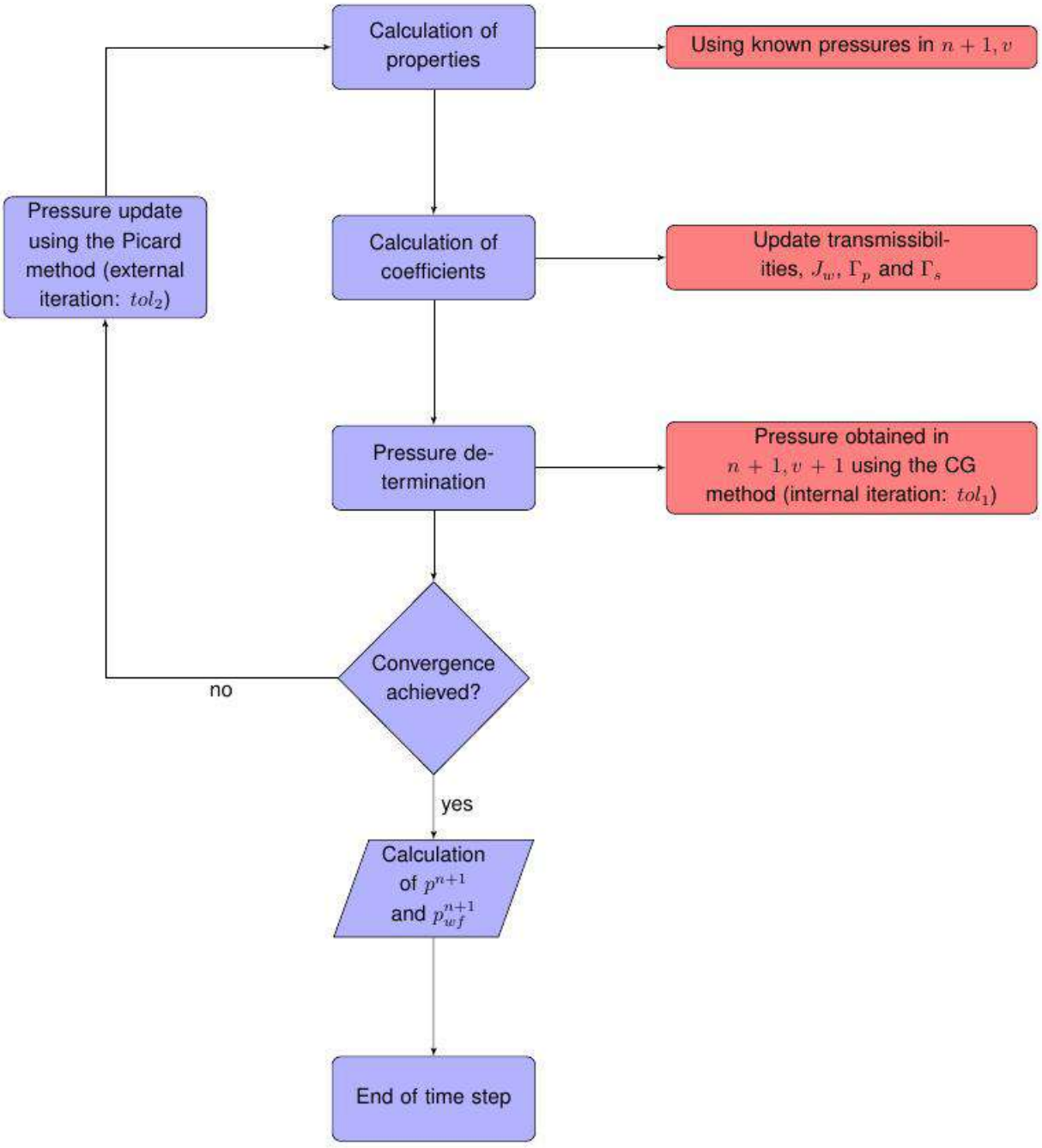

Fig. 3: *Flowchart for a single time step.*

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cluding rock and fluid properties, simulation parameters, and geometric data.

Next, we do a numerical verification study, including the refinement of the computational mesh. Finally, we carry out a sensitivity study of parameters and compare the different models employed. Here, the standard model is that incorporating the effects of gas slippage and adsorption in the modified Darcy's law, as discussed in Jiang and Younis [18].

We show the results using specialized plots, commonly employed in the area of well pressure test analysis [5].

We consider six models according to how we calculate the apparent permeability values ($\mathbf{k}_a$) in Eq. (1) and the Γ_s coefficient in Eq. (15):

- Model 1 [14], which represents the classic case of Darcy's law, without the effects of slippage and adsorption;
- Model 2 [15], the apparent permeability is calculated as a function of the Knudsen number (slippage effect);
- Model 3 [3], without slippage effect and with an accumulation term for the inclusion of adsorption;
- Model 4 [21], apparent permeability corrected as a function of the Knudsen number (slippage effect) and insertion of adsorption through the source term in Eq. (15);
- Model 5, we modify the apparent permeability taking into account adsorption and, also, we introduce its effects via the accumulation term in Eq. (15);
- Model 6 [18], we change the value of $\mathbf{k}_a$ to take into account the combined effects of slippage and adsorption, and we also include the term $\Gamma_s \neq 0$ in Eq. (15).

We modify the initial time step (Δt_{ini}) according to the growth rate ($\delta_{\Delta t}$) to obtain the next time step. This procedure is interrupted when we reach the specified final time step (Δt_{max}). We employ this strategy to achieve greater accuracy in the initial stages of production.

We can find the default values used in the simulations in Table 1. They are defined based on the works of [21], [18] and [9]. We adopt the same tolerance value for the internal (tol_1) and external (tol_2) iterative procedures.

Table 1: *Parameters for the default case.*

Parameter	Value	Unit
c_ϕ	1.0×10^{-6}	psi^{-1}
d_m	2.3×10^{-10}	ft
$k_x = k_y$	5.0×10^{-6}	Darcy
$L_x = L_y$	4,000	ft
L_z	40.0	ft
L_{wf}	40.0	ft
$n_x = n_y$	321	–
p_{sc}	14.65	psi
p_L	1,100	psi
$p_{ini} = p^0$	6,000	psi
Q_{sc}	-5.0×10^4	scf/day
r_w	0.25	ft
R	10.73	ft^{3}psi/R lbm-mol
t_{max}	365	day
$tol_1 = tol_2$	1.0×10^{-4}	psi
T	609.67	R
T_{sc}	519.67	R
V_L	0.0005	ft^3/lbm
γ	0.6	psi
$\delta_{\Delta t}$	1.05	–
Δt_{ini}	0.01	day
Δt_{max}	10.0	day
ρ_s	200.0	lbm/ft^3
τ	1.41	–
$\phi_{ini} = \phi^0$	0.12	–

We use the relative density of the gas, together with the pressure and temperature values, to determine the other properties of the gas [8, 20, 26].

4.1. Mesh refinement

Table 2 shows the numbers of cells used in the generation of the different computational meshes applied in the study of refinement of the computational mesh.

As the production time increases, we can see (Fig. 4) that the pressure curves of the well approach each other. However, for the initial instants of time, there is no overlap of values due to the increased effect of the well known numeric artifact [10, 11].

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The numerical artifact appears as a consequence of the well-reservoir coupling technique, that assumes a steady-state flow regime near the well [23, 24]. Nevertheless, its effects do not compromise the results for the advanced time instants. So, having verified the numerical convergence, Mesh 5 was chosen as the standard, given the significant reduction of the numerical artifact for times higher than one day of production.

Table 2: *Meshes.*

Mesh	n_x	n_y
1	21	21
2	41	41
3	81	81
4	161	161
5	321	321
6	641	641

We emphasize that de Souza [9] validated the simulator used in the present work by comparing its results with those of the commercial simulator IMEX [6] for Model 1.

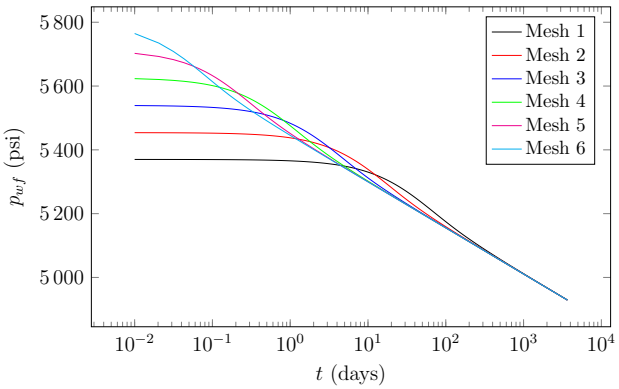

Fig. 4: *Results for mesh refinement.*

4.2. Sensitivity analysis and model comparison

After conducting the mesh refinement study, we performed a sensitivity analysis considering the different models for the single-phase flow of natural gas, incorporating (or not) the slippage and gas adsorption phenomena. We must remark that for all the studied cases, the Kn remained within the validity range of the slip flow regime [4].

Initially, we compare the results obtained with Models 1 (Fig. 5) and 6 (Fig. 6) in simulations by varying the absolute permeability. We can see in Fig. 5 that for the highest values of absolute permeability, there are the smallest pressure variations in the well. In the graphs, the sloping lines are characteristic of the transient regime in a porous medium. In Fig. 6, again, for the highest permeabilities, there is the smallest pressure variation in the well. We also observed the occurrence of the transient regime. However, compared with Fig. 5, it appears that the results for Model 6 show a lower pressure drop than those for Model 1, for the same absolute permeability, as a result of higher apparent permeability. It also leads to a shorter duration and magnitude of the numerical artifact. Besides that, we should note that a lower absolute permeability leads to a higher Kn [8], thus leading to a lower pressure drop, in contrast to the effect of the absolute permeability in the modified Darcy's law.

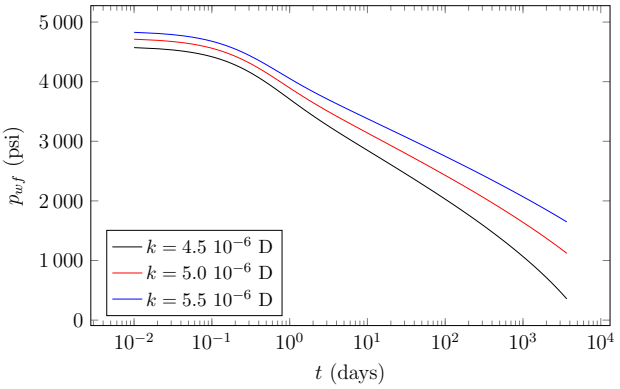

Fig. 5: *Permeability variation for Model 1.*

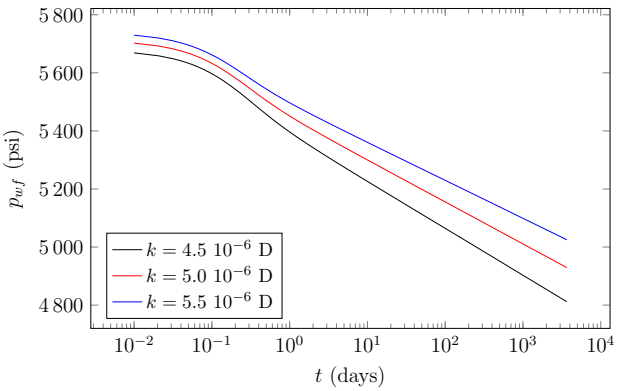

Fig. 6: *Permeability variation for Model 6.*

About temperature variation for Model 6, see Fig. 7, its increase leads to an augmentation in the Knudsen number (via λ) and, consequently, to a

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growth in the permeability apparent (facilitating the flow), which contributes to a lower pressure drop. However, the viscosity of the gas rises with temperature too. Thus, it also causes an increase in pressure drop due to the higher resistance to flow. Therefore, there is a contraposition of effects that leads to different trends about pressure variation, with growth in pressure drop for increasing temperature being prevalent in the tested cases.

We can see in Fig. 8 the influence that V_L has on the term source (due to adsorption) and the apparent permeability. We noticed that the curves are close in the initial moments and that at a later time, there is a gap between them. For the higher volume of Langmuir, there is a higher amount of adsorbed gas that can be released, favoring the maintenance of production (less pressure drop). We know that the increase of V_L causes a reduction in the apparent permeability. However, with the release of the adsorbed gas, the effect of V_L on $\mathbf{k'}_a$ decreases.

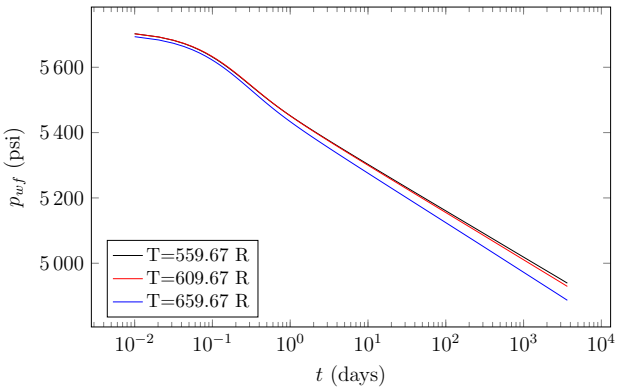

Fig. 7: *Temperature variation for Model 6.*

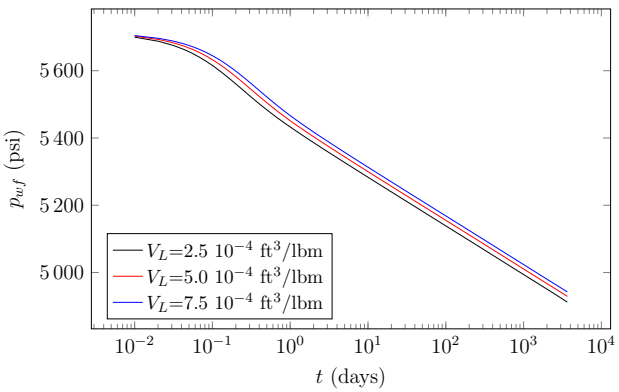

Fig. 8: *Variation of V_L for Model 6.*

In the last case studied, we compare the six flow models, and we show the results in Fig. 9. Indeed, we should point out that we have not found Model 5, $\mathbf{k}_a = \mathbf{k'}_a$ and $\Gamma_s \neq 0$, in the literature. Nevertheless, it could be used, for example, in reservoir simulations where the effects of adsorption are considerable, although we can neglect those of slippage.

When comparing Models 1 and 2, we observe that the incorporation of the slippage effect leads to a lower pressure drop due to the higher values of apparent permeability. The curves start from different points and have different slopes, in the region of the transient flow, due to the difference in apparent permeabilities. In the specific case of Models 1 and 3, the curves begin close with each other, as the apparent permeabilities are the same (the absolute). Further, we observe that the slopes are similar in the region of the transient regime (except for the effects of non-linearities) due to the properties of the fluid, with a lower pressure drop for the case where adsorption supplements production.

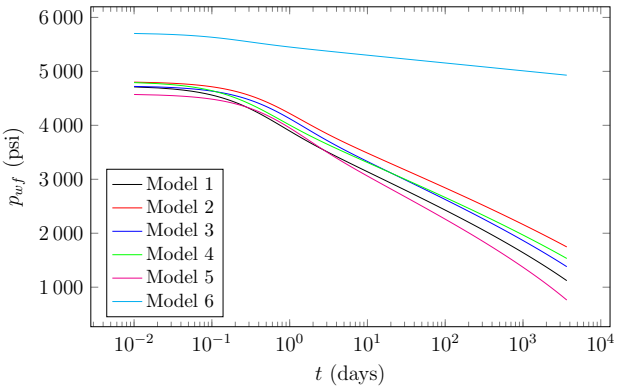

Fig. 9: *Comparison between different models.*

For Models 1 and 4, we perceive that adsorption and slippage effects favor the maintenance of pressure. Because of the slippage effect, we must correct the permeability apparent. As a consequence, the slope of these curves is not similar to those of Models 1 and 3. Indeed, they are closer to that of Model 2. However, the overlapping effects of slippage and adsorption did not lead to values of pressure higher than those obtained in Model 2. We can explain this behavior by the fact that Kn depends on pressure so that for higher pressure values, there is a decrease in Kn and a higher resistance to flow. In the case of Model 3, the overlapping effects lead to higher pres-

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sure values after about 20 days of production.

As the apparent permeability in Model 5 is lower than the absolute permeability, at least at the beginning of production, the numerical artifact appears more strongly. In the beginning, the production potential is lower, but over time the increase in Langmuir volume results in a higher amount of adsorbed gas that can be released, favoring the maintenance of production (less pressure drop). Even so, this situation is transient, and Model 1 has a lower pressure drop over long periods. A possible explanation is associated with the pressure variation in the reservoir since it has a limited direct impact on $\mathbf{k}_a$ and because the model only considers its correction based on V_L. Therefore, the predominant effect becomes that of the accumulation term, and lower pressure drops than those of Model 1 would only be possible for even higher values of V_L.

Finally, for Model 6, the difference in pressure drop is highlighted when slippage and adsorption phenomena are not neglected, as in the case of Model 1. Although the effects are opposite concerning the variation in apparent permeability (predominant in the cases studied here), adsorption contributes to sustaining production through the accumulation term.

V. CONCLUSION

As expected, we showed the positive influence of adsorption once we have more gas available for production as a consequence of this phenomenon, despite its negative impact on the calculation of the apparent permeability. On the other hand, we also remarked the benefits of the slippage effect on increasing the apparent permeability, facilitating flow through the reservoir. Besides, we were able to capture the influence of non-Darcy models in the well-reservoir coupling by analyzing the pressure variation of the producing well during production.

Therefore, it was clear, given the results obtained, that for single-phase gas flow in shale-type reservoirs, failure to consider both phenomena of slippage and gas adsorption may result in incorrect values for pressures in the well and the gas reservoir. Such a fact may lead to mistaken decision making. For example, we can invest resources in the production of a deposit that will present less pressure on the producing well than expected or failing to invest in a reservoir that would have favorable production conditions. As we have seen, this can happen if we do not consider these two effects. Further, we could perform simulations resulting in production flows closer to real conditions if we take into account both slippage and adsorption phenomena.

In the case of shale gas reservoirs, due to their characteristics, we must not forget that their feasibility is possible through the use of horizontal producing wells and hydraulic fracturing.

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Bazillian ornamental rock imports and exports: A study of the impact of Covid-19 in the market

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Abstract *— The present study will present a brief historical context, methods and proceedings of the brazilian ornamental rock export market. The impacts and crysis generated by the global Covid-19 pademic was characterized, and expressive reduction was verified. The analyzed period was the first semester (january through june) 2020, epoch in wich ocurred the beginning of the pandemic. We presented numbers and details of the sector trough an comparative analysis to the same period of 2019 and 2018. We present a brief context of what can happen in the next moments in this sector, in an idication of extension of the crisis generated by the Covid-19 impacts. We present methods that adress the ornamental rock market in Brazil and its relationship with its most important export and import countries in the world with data from official sources, separated by rock types to better understand the impacts on the market. We present in this study what the market can go throught with the global pandemic.*

***Keywords*— Pandemic, COVID-19, Ornamental, Rock, Exports.**

I. INTRODUCTION

Over mankind's history, mierals had a fundamental role in the advancement of the industry and tecnology (KLEIN et al, 2012). Mierals are crystalline, solid substances formed throught natural processes (KLEIN et al, 2012). The ones with economic value are called ores, resources that we use in our every day life and impact directly in our economy (KLEIN et al, 2012).

Rocks are cystalline aggregates of many minerals in a solid structure, and rocks, as with minerals, may have economic value, also becoming ores. Ornamental rocks are defined as natural rock material, subjected to diferent types and degrees of manufacturing (brute, sliced, sculpted, or polished), that are used in an aestethic way (ABNT). Ornamental rocks are classified according to the export market in two main groups: marbles and granites (COSTA, 2001). These names are consolidated in the market and used worldwide to designate these objects, that are extracted in blocks and sliced, in wich the production chain involves four main steps: deposit prospecting, extraction, manufacturing and commercialization.

Ornamental rocks are used as construction material since anciecnt Egypt, with relevance as a ornamental material in Italy I B.C. Roman people used travertine marble, and even with the ever-growing scarcity of this material, it is still explored in the region of Carrara, Italy.

The ornamental rock market has a gread global demand, in wich developed countries are the main importers, and the coutries in development, as Brazil, are the main exporters (SINDIROCHAS 2019).

The year of 2020 was marked by the emergence of a new global disease, and China was the first country to be affected by the Coronavirus COVID-19 (McKibbitn et al, 2020). the first case, in Wuhan, ocuured around december 2019 (Khan et al, 2020). Governments of affected countries took various measures to stop the spread of the disease, that included airport lockdown, port

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lockdown, rail and highway closure, and ever curfew and cities lockdown, that caused great impacton global economy, that resulted in different number of confirmed cases (Graphic 1).

The present study aims to analyze the impacts of the pandemic in the ornamental rocks sector through an analysis of exterior commerce data from the Economy Ministry of Brazil, along with official pandemic data from John Hopkings Universisy, in Baltimore - EUA

II. METHODOLOGY

The methodology consisted in collecting data from the ComexStat platform (http://comexstat.mdic.gov.br), from the Ministry of Economy of Brazil. This platform reports monthly the official import and export data of Brazil, divided into ,amy categories, by country and type of product, using the worldwide known SH system, notadely the Class (SH4), Subposition (SH6) and the Mercosul Common Nomenclature (NCM). With data in hand, tables and graphics were made to better visualize the numbers.

The Covid-19 data used was obtained from the Data Repository by the Center for Systems Science and Engineering (CSSE), Johns Hopkins University, obtained trought GitHUB platform. GitHUB is an online database host that allows multiple users to have access to databases of various open source projects throughout the world. To make the graphics we utilizes Microsoft PowerBI Desktop (https://powerbi.microsoft.com).

The analysed periods was the first semester (janiary to june) 2018, 2019 and 2020. These periods will be referred as 1S18, 1S19 ans 1S20, respectively. Values of medium price and its variations were also calculated for the periods investigated, ans separated by country, to identify the major contributors to the results.

To compose the ornamental rock database, we divided this sector in five categories: 1. Brute Carbonatic Rocks; 2. Brute Silicate Rocks; 3. Manufactured Carbonatic Rocks; 4. Manufactured Silicate Rocks; and 5. Slates and other rocks. To classify the export products in these categories, we used the same criteria as the SINDIROCHAS entity (www.sindirochas.com) in its monthly exports report, dividing the NCMs that are considered ornamental rocks in the 5 categories, as summarized in the table below.

Table.1 – Groups of Ornamental Rocks by NCM. Adapted by: SINDIROCHAS, relatório mensal de exportações junho de 2020, pág. 15

Groups	NCM Code	NCM Description
Brute Carbonate Rocks	25151100	Marbles and Travertine, brute
	25151210	Sliced Marbles, in rectangular boards or blocks.
	25151220	Sliced Travertines in rectangular boards or blocks.
	25152000	Granites and other cornerstone or calcareous construction stones, alabastres
Brute Silicate Rocks	25062000	Quartzites, cut in saw or brute, or in rectangular boards or blocks
	25161100	Brute Granite
	25161200	Sliced Granites, in rectangular boards or blocks.
	25169000	Other construction Rocks
	25162000	Sandstone, cut in blocks, boards, or rectangular blocks
Manufactured Carbonatic Rocks	68022100	Marbles, travertine and alabaster, cut in saw with flat surface
	68029100	Marbles, travertine and alabaster, polished
	68029200	Other Calcareous rocks, polished
Manufactured Silicate Rocks	68021000	Tiles, cubes, tablets and similars, even in a shape other than rectangular, whose largest face can be inserted in a square with 7cm sides. Granules, fragments and powders, even if artificially coloured
	68022300	Granite, simply cut in saw, with flat and polished surface

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	68022900	Other construction Rocks, cut in saw, with flat and polished surface
	68029990	Other construction Rocks manufactured in other ways
	68029390	Granites manufactured in other ways
Slates and Other Rocks	25140000	Slates, chopped or cut in saw, in blocks or boards in rectangular shape
	25261000	Natural Soapstone, chopped or cut in saw, in blocks or boards in a rectangular shape
	68010000	Paving stones, slabs for paving, of natural stones (except slates)
	68030000	Natural Slates and its works and its aggregates

The table above shows us the uses and classifications of rock groups, according to Brazilian and South American (Mercosul) standards agreed on NCM.

Before starting analyzing the numbers, however, extensive bibliographic research was realised. To do so, articles, books, dissertations and cientific magazines, and publications in general were scrutinized. The main goal of this step was to provide a background for the activities being developed.

In Brazil, the ornamental rock production chain is structured trough the Local Productive Arrangements (APLs) (Suzigan 2006). These local arrangements are the union of small extractors that work nearby, and sharing common useful structures to minimize the operational costs, such as transport, equipment maintenance, machinery, etc. (Suzigan 2006). According to Slack et al (2002), the APL by process has as its main objectives, to minimize production costs that are associated with the extraction and transportation of the product, from the source to the consumer. There is research pointing to the advantages of business in agglomerations, thats is growing in its concept and being driven toward better efficiency and competitiveness of business, regions and countries. (LASTRES; CASSIOLATO 2005)

In Brazil, the APLs grants competitiveness, in an environment that lacks adequate logistic infrastructure. An expressive sum of the extractors work this way.

In developed countries, ornamental rocks, brute or manufactured, are mainly transported through railways. In Brazil, the main transportation pathway is through highways, which elevates a lot the freight costs, reducing competitiveness (SUZIGAN 2006). Transportation was very affected by the pandemic, when countries implemented their lockdowns.

In relation to the COVID-19 pandemic, we had lockdowns in Brazil, that included highway blocks, blocked access to ports, and locked access to the shared APL infrastructure, which caused a lot of delays and impacts on the sector. Beside, port access was also blocked throughout the world, causing even more difficulties and delays, because is the main pathway by which Brazil imports and exports ornamental rocks. There was also an expressive fall in demand, caused by the COVID-19 pandemic.

III. RESULTS AND DISCUSSION

3.1 Imports

We begin analyzing the import market in its whole, by weight (tons), in the periods of study:

Table.1.1— Total ornamental rock imports in 1S18, 1S19 and 1S20, in US$ and Tons. Source: comexstat.mdic.gov.br.

PERIOD	US$	Tons (t)
1S18 (jan-jun)	15.280.947	26.046
1S19 (jan-jun)	11.201.086	21.386
1S20 (jan-jun)	8.737.007	17.125
Variation 1S18-1S19 (%)	-26,70%	-17,89%
Variation 1S19-1S20 (%)	-22,00%	-19,92%

We can note that imports had a negative variation, Brazil importing 20% less in 1S20 compared to 1S19 in weight.

To analyse wich kind of rocks we exported the least, we classified by type as seen below:

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Table 2 - Ornamental Rock imports in 1S18, 1S19 and 1S20, in FOB value, by type. Source: comexstat.mdic.gov.br.

Groups	2018 - Value FOB (US$)	2019 - Value FOB (US$)	2020 - Value FOB (US$)	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Slates and other rocks	575.681	295.548	293.955	-48,66%	-0,54%
Manufactured Silicate Rocks	2.156.579	1.132.605	1.402.238	-47,48%	23,81%
Brute Carbonatic Rocks	3.900.913	2.856.230	2.624.350	-26,78%	-8,12%
Manufactured Carbonatic Rocks	8.109.643	6.634.604	4.244.029	-18,19%	-36,03%
Brute Silicatic Rocks	538.131	282.099	172.435	-47,58%	-38,87%
Total	15.280.947	11.201.086	8.737.007	-26,70%	-22,00%

In this way it is possible to note that brute carbonatic rocks were along the most affected, along with manufactured carbonatic rocks, both having almost 40% less imports in 1S20 than in 1S19, but in contrast we noted an 23% increase in manufactured silicatic rocks, being this type the only one that has increased in the period, showing that the market is demanding more of this type of product. We will look at price variations to better understand this results, as seen below:

Table 3 - Average price of the main brazillian ornamental rock imports. In blue: positive variations. in red: negative variations. Source: comexstat.mdic.gov.br.

Groups	2018 - Average Price	2019 - Average Price	2020 - Average Price	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Slates and other rocks	734,29	631,51	701,56	-14,00%	11,09%
Manufactured Silicate Rocks	743,90	727,43	516,67	-2,21%	-28,97%
Brute Carbonatic Rocks	501,15	419,29	426,93	-16,33%	1,82%
Manufactured Carbonatic Rocks	606,78	566,48	570,28	-6,64%	0,67%
Brute Silicatic Rocks	442,91	337,04	426,82	-23,90%	26,64%
Total	586,67	523,76	510,16	-10,72%	-2,60%

A slight variation was observed between 2019 and 2020, but we should note that in relation to 2018 we had a 13% negative variation, denoting an expressive reduction in the analysed period.

The main natural ornamental rock exporters to brazil were Italy, Turkey, Indonesia and Spain, respectively, and the main artificial ornamental rock exporters to brazil were China, Spain and Greece, respectively. China has growing in its artificial rock export (ABIROCHAS 2020).

3.2 Exports

The export market in bulk numbers also show a considerable reduction when 1S19 and 1S20 are analyzed, as shown in the table below:

Table 4 - Total brazillian ornamental rock exports in 1S18, 1S19 and 1S20. Source: comexstat.mdic.gov.br.

PERIOD	Value US$	Weight (tons)
1S18 (jan-jun)	457.148.853	999.851
1S19 (jan-jun)	489.579.456	989.887
1S20 (jan-jun)	398.046.003	928.034
Variation 1S18-1S19 (%)	7,09%	-1,00%
Variation 1S19-1S20 (%)	-18,70%	-6,25%

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It is possible to note in table 04 a reduction in demand in the last 3 years, both in weight and price, and we can see that in 2020 the reduction was a lot more significant.

In the table below we describe these total values in FOB US$, specifying the rock type:

Table 5 - Ornamental Rocks exports in 1S18, 1S19 and 1S20, in FOB US$, by rock type. Source: comexstat.mdic.gov.br.

Groups	2018 - Value (US$)	2019 - Value (US$)	2020 - Value (US$)	1S18 - 1S19 Variation (%)	1S19 - 1S20 Variation (%)
Manufactured Silicate Rocks	312.822.592	344.757.930	261.098.137	10,21%	-24,27%
Slates and other rocks	24.256.654	25.717.633	20.229.314	6,02%	-21,34%
Brute Carbonatic Rocks	4.368.166	5.809.048	7.037.697	32,99%	21,15%
Manufactured Carbonatic Rocks	21.016.773	28.855.793	25.501.355	37,30%	-11,62%
Brute Silicate Rocks	94.684.668	84.439.052	84.179.500	-10,82%	-0,31%
Total	457.148.853	489.579.456	398.046.003	7,09%	-18,70%

We can note in table 05 that manufactured silicate rocks and slates had a smaller variation than the other rock types, that presented signifficant reduction.

It is evident from tables 04 and 05 the good moment experienced by the sector in 2018 through 2019. There was signifficant grow in export weight and value to the main importers. This scenario changes dramatticaly when we analyse the 2019-2020 period. In these period, we can observe a signifficant reduction in almost all export categories, in exception to brute carbonatic rocks, that increased 21%, against the trend. The totals were grealy affected, with prices falling 18%, almost 3x the reduction in weight (-6,25%) (Table 1)

In the table below we describe the avreage price by rock type, to better apreciate the details of exports:

Table 6 - Variations in average export prices between 1S18, 1S19 and 1S20, in percentage. Average price in US$ per ton. Source: comexstat.mdic.gov.br.

Groups	2018 - Average Price (US$/t)	2019 -Average Price (US$/t)	2020 - Average Price (US$/t)	1S18 - 1S19 Variation (%)	1S19 - 1S20 Variation (%)
Manufactured Silicate Rocks	709,36	716,91	674,63	1,07%	-5,90%
Slates and other rocks	385,59	368,28	346,47	-4,49%	-5,92%
Brute Carbonatic Rocks	387,39	350,81	419,13	-9,44%	19,48%
Manufactured Carbonatic Rocks	1007,53	1006,48	908,49	-0,10%	-9,74%
Brute Silicate Rocks	204,14	214,35	192,30	5,00%	-10,29%
Total	457,22	494,58	428,91	8,17%	-13,28%

We can note in table 6 that brute silicate rocks had a smaller reduction than the other rock types. We follow analyzing weight and rock type in the period of study:

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Table.7- Variations in weight of ornamental rock exports in the periods analysed, in percentage. Source: comexstat.mdic.gov.br.

Groups	2018 – weight(T)	2019 – weight(T)	2020 – weight(T)	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Slates and other rocks	784	468	419	-40,31%	-10,47%
Manufactured Silicate Rocks	2.899	1.557	2.714	-46,29%	74,31%
Brute Carbonatic Rocks	7.784	6.812	6.147	-12,49%	-9,76%
Manufactured Carbonatic Rocks	13.365	11.712	7.442	-12,37%	-36,46%
Brute Silicatic Rocks	1.215	837	404	-31,11%	-51,73%
Total	26.047	21.386	17.126	-17,89%	-19,92%

We can observe a very great reduction in weight exports, in tons, showing that we exported a gradattively smaller amount in 2020 than in the previous years, but brute carbonate rocks were agains the trend, with an whoppig 75% increase in 1S20 compared to 1S19.

In the table below we present weght variations in the periods analysed according to rock type:

Table 8 - Onrmantal Rock Exports in 1S19 and 1S20, in weight (tons), by rock type. Source: comexstat.mdic.gov.br.

Grupos	2018 - Peso (t)	2019 - Peso (t)	2020 - Peso (t)	(%) Variação 1S18 - 1S19	(%) Variação 1S19 - 1S20
Manufactured Silicate Rocks	440.995	480.891	387.026	9,05%	-19,52%
Slates and other rocks	62.908	69.832	58.387	11,01%	-16,39%
Brute Carbonatic Rocks	11.276	16.559	16.791	46,86%	1,40%
Manufactured Carbonatic Rocks	20.860	28.670	28.070	37,44%	-2,09%
Brute Silicate Rocks	463.812	393.935	437.759	-15,07%	11,12%
Total	999.851	989.887	928.033	-1,00%	-6,25%

Slates and manufactured silicate rocks were amongst the ones that had signifficant reduction in the period.

Looking to the marbles data we can note that even with a small weight in exports, it has registered positive variation in weight, value and average price. and granite and quartzite exports had a increase driven by quartzites but even though had a 1.7% reduction in FOB US$ value and 2.2% reduction in weight, with a 0.6% increase in average price.

The most affected rock types were the manufactured ones, with a significant 13.2% reduction in FOB US$ price, 8.8% reduction in weight and 4.8% redution in average price, being the most important factor that contributed to the bad performance of the brazillian ornamental rock exports.

The artifical rocks exports also had a small weight, being United States our biggest importer, but this rock type had increased demand in the period analysed, summing US$14,6 millions and 25,2 Mt, varying positively by 11 and 24,3% respectively. The most important consumers were China, Spain and Greece with remarks to China's demands.

In table 09 below we describe the main countries to wich Brazil exports:

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Table 9 - Avegage price of the main brazilian ornamental rock importers. In blue: positive values. In red: negative values. Source: comexstat.mdic.gov.br.

Country	jun/18	jun/19	jun/20	**(%) Average Price Variation 1S18 - 1S19**	**(%) Average Price Variation 1S19 - 1S20**
	Average Price (US$/t)	Average Price (US$/t)	Average Price (US$/t)		
China	168,05	202,47	142,20	20,48%	-29,76%
United States	711,28	711,07	615,05	-0,03%	-13,50%
Italy	573,88	449,71	491,07	-21,64%	9,20%
Taiwan	270,31	135,17	193,96	-49,99%	43,49%
United Kingdom	383,21	370,80	345,97	-3,24%	-6,69%
México	671,22	541,71	475,38	-19,29%	-12,25%
Hong Kong	224,54	229,40	64,60	2,17%	-71,84%
Germany	556,24	446,00	456,84	-19,82%	2,43%
Spain	826,43	625,59	869,21	-24,30%	38,94%
Paraguay	247,81	217,34	214,96	-12,30%	-1,10%
Vietnam	476,91	1048,74	935,45	119,90%	-10,80%
Colombia	469,29	415,69	358,54	-11,42%	-13,75%
Poland	422,82	325,91	516,57	-22,92%	58,50%
Canada	1018,54	1089,02	1345,73	6,92%	23,57%
Costa Rica	480,37	430,89	325,04	-10,30%	-24,57%

According to table 09 is possible to note that most countries had negative variations when 1S19 is compared ro 1S20.

The table below configures the mains destinys of brazillian ornamental rock exports, showing reduction in 2020.

Table 10 – Brazilian exports in weight (tons) to the main importer countries. In blue: positive values. In red: negative values. Source: comexstat.mdic.gov.br.

Country	**2018 - Weight (t)**	**2019 -Weight (t)**	**2020 - Weight (t)**	**(%) Variation 1S18 - 1S19**	**(%) Variation 1S19 - 1S20**
China	361.289	294.897	358.568	-18,38%	21,59%
United Stated	388.224	424.279	346.515	9,29%	-18,33%
Italy	63.803	62.899	58.155	-1,42%	-7,54%
United Kingdom	20.353	25.036	27.699	23,01%	10,64%
México	20.903	24.870	23.698	18,98%	-4,71%
Hong Kong	9.448	5.824	5.206	-38,35%	-10,62%
Germany	8.528	9.000	8.465	5,54%	-5,94%
Spain	5.999	8.023	6.556	33,74%	-18,28%
Paraguay	1.356	2.834	2.877	108,98%	1,51%

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Vietnam	1.815	3.338	4.421	83,98%	32,42%
Colombia	7.475	7.404	6.105	-0,94%	-17,56%
Poland	2.598	5.256	3.207	102,32%	-38,98%
Canada	7.886	8.136	5.265	3,18%	-35,29%
Costa Rica	1.432	1.436	1.625	0,23%	13,22%

Table 11 - Brazilian ornamental rock exports in 1S28, 1S19 and 1S20, by country. In blue: positive values. In red: negative values. Source: comexstat.mdic.gov.br.

Country	2018 - Value (US$)	2019 - Value (US$)	2020 - Value (US$)	1S18 - 1S19 Variation (%)	1S19 - 1S20 Variation (%)
China	64.184.039	52.321.666	52.918.726	-18,48%	1,14%
united States	275.235.857	305.940.584	236.411.948	11,16%	-22,73%
Italy	31.509.271	30.988.203	31.101.286	-1,65%	0,36%
United Kingdom	7.808.392	9.015.176	9.216.661	15,45%	2,23%
Mexico	12.603.359	14.331.322	12.893.136	13,71%	-10,04%
Hong Kong	2.420.682	1.464.188	1.025.001	-39,51%	-30,00%
Germany	4.183.966	4.860.720	3.894.331	16,17%	-19,88%
Spain	4.515.748	5.438.958	4.685.362	20,44%	-13,86%
Paraguay	367.528	440.188	615.139	19,77%	39,74%
Vietnam	1.700.658	2.979.824	3.193.097	75,22%	7,16%
Colombia	3.424.409	3.341.949	2.475.109	-2,41%	-25,94%
Poland	1.212.841	2.393.859	1.913.501	97,38%	-20,07%
Canada	7.635.474	8.503.516	5.655.426	11,37%	-33,49%
Costa Rica	672.961	693.159	653.582	3,00%	-5,71%

Following this global analysis, in the table below we see the variation in the average price of the main importer countries:

Table 12 - Average price of the main ornamental rock importers of Brazil. in blue: positive values. In red: negative values. Source: comexstat.mdic.gov.br.

Country	2018 - Average Price FOB US$ per ton	2019 - Average Price FOB US$ per ton	2020 - Average Price FOB US$ per ton	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Turquia	433,56	402,39	395,17	-7,19%	-1,79%
Itália	710,58	586,70	626,46	-17,43%	6,78%
Espanha	477,15	435,29	493,54	-8,77%	13,38%
Indonésia	600,34	537,45	548,31	-10,48%	2,02%
China	766,48	774,72	556,74	1,07%	-28,14%
México	514,58	462,64	439,02	-10,09%	-5,11%
Portugal	487,42	470,21	468,46	-3,53%	-0,37%

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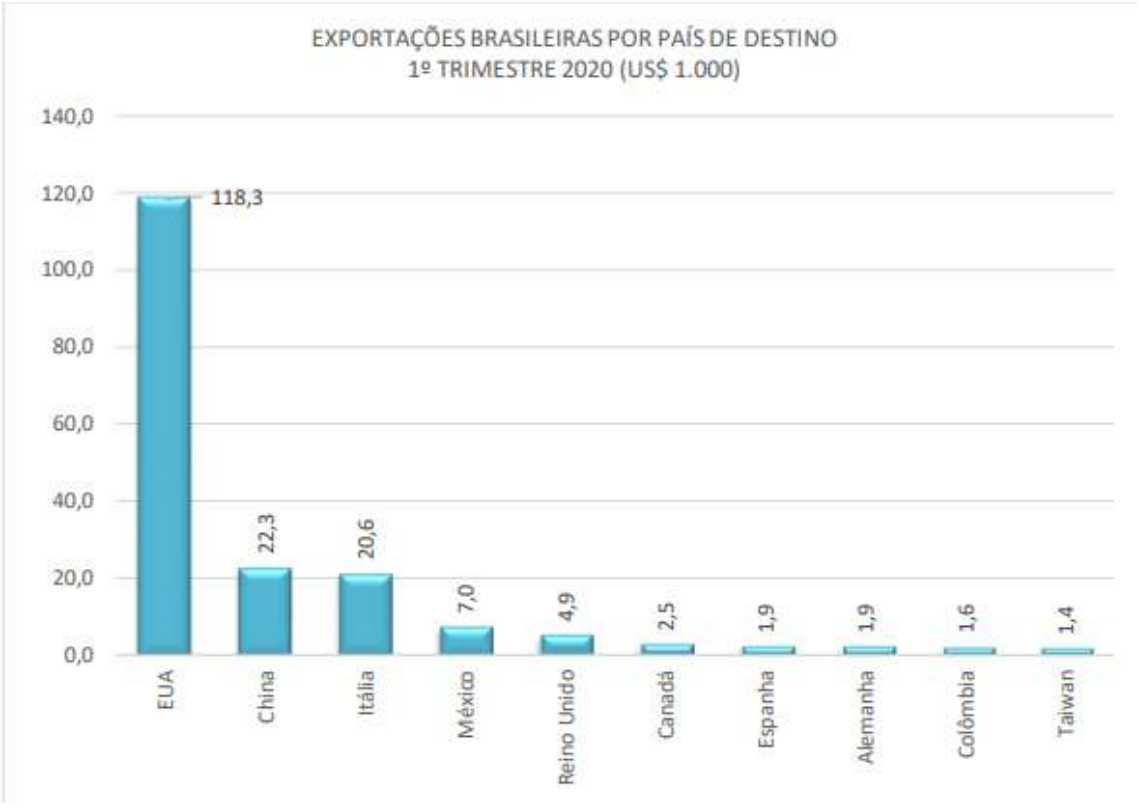
Grécia	566,42	755,93	669,67	33,46%	-11,41%
Egito	330,45	283,99	291,71	-14,06%	2,72%
Namíbia	0,00	282,80	404,81	0,00%	43,15%
Total	582,46	523,92	509,20	-10,05%	-2,81%

We can note that China, one of the main global importers had a signifficant reduction in average price in the period analysed. In the chart below we detail the main brazillian importers by country:



Source: Associação Brasileira da Indústria de Rochas Ornamentais (2020)

United States are still brazillian's biggest ornamental rock importer, but we can note the ever-growing participation of China in this market.

We exported a total of US$ 118,3 million, composig a total of 59,1% of all brazillian exports. China and Italy come close and consolidate as our best ornamental rock trading parthners, as buyers, china having only 11,1% of the exports share.

In the internal market we can note that few has changed, being Espirito Santo, Minas Gerais and Ceará, the biggest ornamental rock producers, respectively

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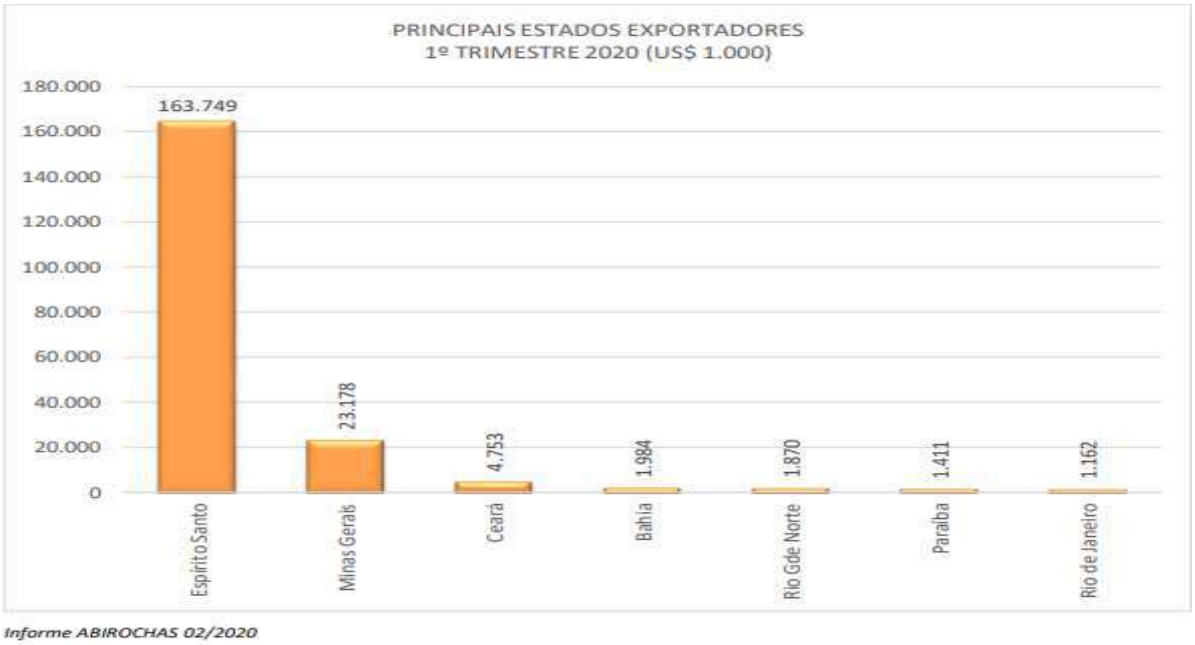
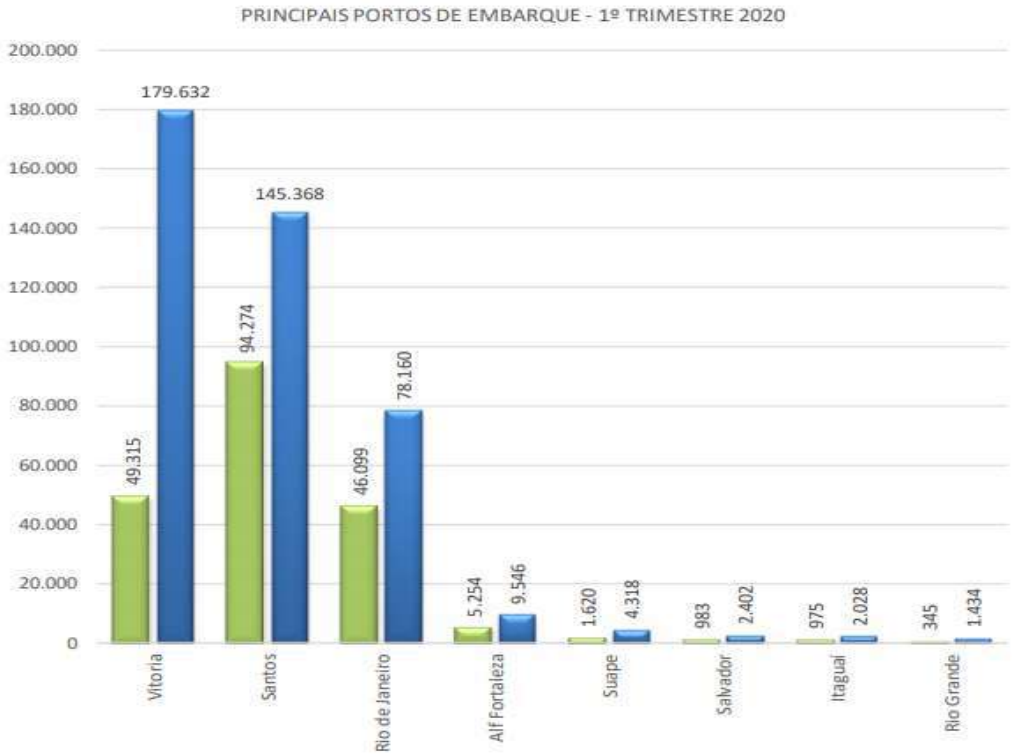


Source: Associação Brasileira da Indústria de Rochas Ornamentais (2020)

The main export routes are through marine ports, with no big changes, being Vitoria port, Santos port and Rio de Janeiro ports, the main pathways that Brazil exports its rocks.



Source: Associação Brasileira da Indústria de Rochas Ornamentais (2020)

We can note a larger concentration of exports in the southern states of Brazil. Its important to analyse the number of cases of COVID-19 in the world, to better understan the moments of most severity of the pandemic in each country, and its economic closures and reopenings, as illustrated in the chart below:

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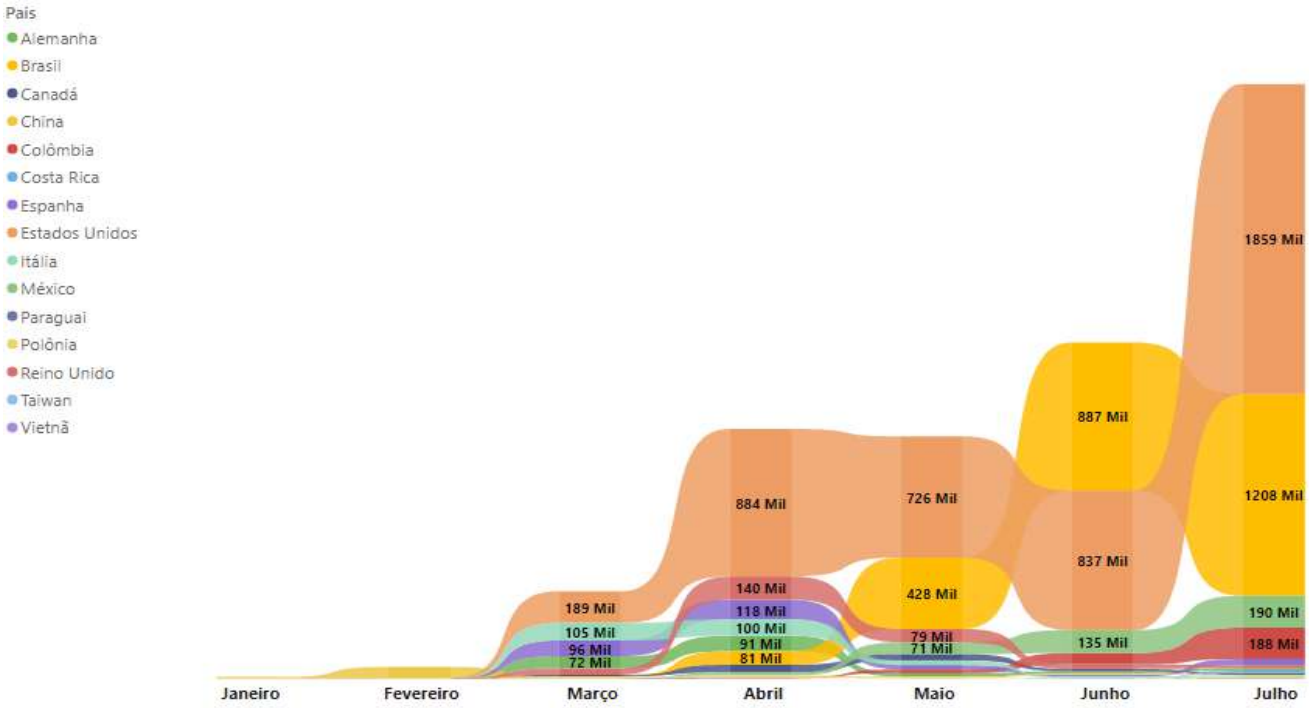

Chart 1 - Tota by month and country of study. Data from John Hopkins University (julho de 2020). China e Hong Kong (Tabela 5) are represented in this chart only as China

We can analyse by this perspective and see it more clearly in the chart below:

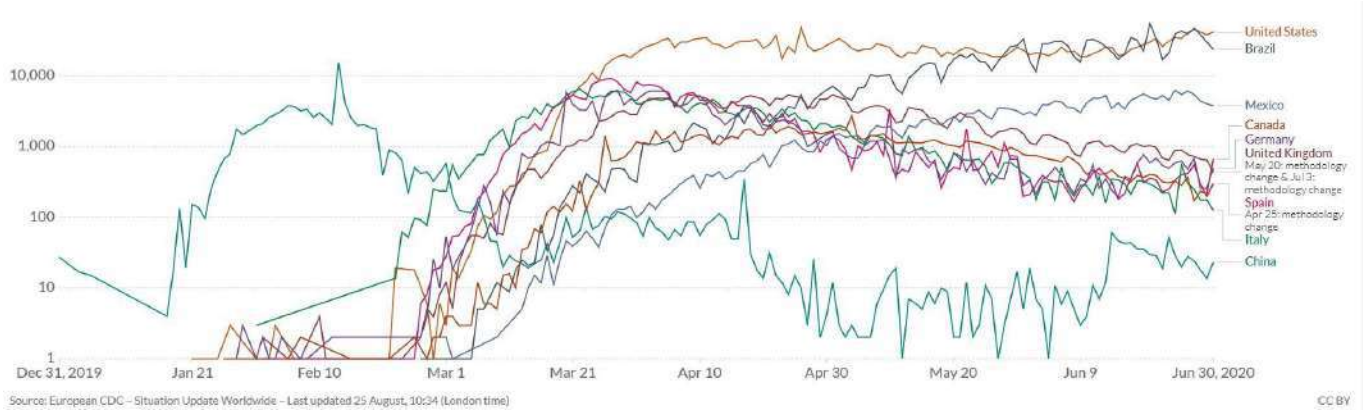

Chart 02 – New cases of COVID-19 by day and country of study Source: (Roser, Ortiz-Ospina, Hesell, 2020). China e Hong Kong (Tabela 5) are represented in this chart only by China

Through the chart 02 we can note that china was leading the number of new cases in the beginning of the pandemic, with european coutries following in a second moment, with Brazil and United States following the leadership in a late moment.

Various factors must be observed to analyse these results. Firstly, it is obvious the coincidence between the most severe moments of the pandemic (january through june 2020), as expressed in Chart 1, and the bad performance of the ornamental rock exports of Brazil. We also need to observe that changes in supply and demand seem to show a tendency toward bigger exports of brute products and smaller exports of manufactured products during the pandemic. This can be explained by the adaptation of the consumers to the new moment, more financially restricted, in wich the consumers shifted toward products with cheaper average prices, buying brute to manufacture later.

We can also observe that a significant reduction in the average price of exported products (Table12). With

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excessio of brute carbonatic rocks, that had a 19,48% increase in 1S20, all other rock types presented a reduction in value per ton. This confirms the impacts od the oandemic in the brazilian export market of ornamento rocks, and agrees with the interpretation that the demand shifted towards brute products relative to the manufactured ones in the period investigated.

With relation to the exported weight, we observe a little different tendency: in the 1S18 - 1S19 period, there was no signifficant changes in the total exported weight, but there was reduction in the total brute rocks exported in relation to the manufactured ones, that experienced pronounced increase. Since the brasilian export profile is composed of mainly silicatic brute rocks, its 15,07% reduction balanced the totals, denoting a moment of stability in the market, that agrees to the 1S18 - 1S19 increase in average prices. That picture changes if we look at the 1S19-1S20 interval, that showed a reduction in both total value and weight. This depicts the impacts of the pandemic in the brazilian ornamental rock market.

IV. CONCLUSION

The impacts of the pandemic on the brazilian rock market in notorious. The sedctor was very affected, and is going trought difficulties because of it. The generalized reduction in average prices per ton, and the reduction exports in the market, can drive a lot or productor out of business.

It is important to mention that this data is reflecting only the initial period of the pandemic in Brazil, and there is more impacts that will appear in the forthcoming months, or even years.

There is also a shift in the market toward artifficial products, mainly driven by China. The reduction in the imports of natural rock material supports this observation.

In relation to the natural materials, there was an increase in the exported volume os manufactured silicatic rocks, products as granites and polished slabs are the most demanded, with increase in average price.

The reductions in export;s were expressive, but the brute carbonatic rocks showed a increase, against the general tendency

The United States, Italy and China are still our most important commercial parthners in the ornamental rock market.

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ICT Use and Importance in a Higher Education Institution in the city of Belém do Pará by Coordinators, Teachers and Students

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Abstract**—** *The aim of this study is to analyze the educational community, the CESUPA (IES) and the students, education professionals, teachers and coordinators, as the insertion of information and communication technologies (ICT) can influence in the learning and teaching process. The study focused on the perceptions about the limits and possibilities of teachers' performance in the face-to-face higher education modality offered by an HEI and seeks to identify aspects that can determine the teacher's performance associated with the use and exploitation of digital media in higher education and as these can contribute to the formation of an Educational Methodology for face-to-face higher education. For this purpose, a field survey was conducted in four physical units of the CESUPA academic community. The elements that form the sample are related to the characteristics established in the objective of the study, taking non-probabilistic samples of the intentional type or rational selection. The research chose to use the questionnaire with the education professionals (teachers and coordinators) of the academic community of CESUPA (IES). It is raised in this context as a requirement that the school intends to develop in its students an active and critical thinking. This leads to a cooperation between teacher and students so that an intellectual growth of this relationship can be triggered, with the teacher taking into account the difficulties of each student. In addition, the use of electronic games as a pedagogical tool in several disciplines in the HEIs is identified because they are fun, entertaining, yet educational experiences with the potential to reduce the gap between the theoretical and practical knowledge of the trainees and help the insertion of more professionals prepared for the labor market. The study also made it possible to verify that ICT is already part of CESUPA's routine, whether through electronic games, online questionnaires, TV, research, among other strategies, with professors affirming their constant search for inclusion in the teaching and learning process of digital media. However, it was evidenced the need for continuous training for teachers, who still do not feel prepared to deepen the use of ICT in order to promote meaningful learning, a factor also perceived by managers and students. This study contribution is the proposal of a an approach to take advantage of ICT in higher education, involving professors, students and management in order to produce incremental improvements in the teaching and learning processes.*

Keywords**— *Information and Communication Technologies, Higher Education Institutions, higher education, face-to-face teaching, CESUPA.***

I. INTRODUCTION

This is the civilization of knowledge and information, where the mode of production becomes that of knowledge, no longer that of goods, and the labor force passes from the arms to the head. If organizations are not aware of this paradigm shift now, there will be no future for them, they will all be fatally doomed to failure (ARAÚJO; GOUVEIA, 2018).

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Education in general also suffers the effects of these paradigmatic changes (KUHN, 1975). This research aims to understand the impact of the use of Information and Communication Technologies in face-to-face higher education, enabling diagnosis in a Higher Education Institution (HEI). This assessment is carried out through the perception of the actors involved, namely coordinators, teachers and students, in the context of higher education and the use of information and communication technologies to support the teaching and learning process. It is believed that it is a precondition for the use and exploration of information and communication technologies (ICT) in teaching and learning activities, the perception that its actors have about them (ARAÚJO; GOUVEIA, 2018b).

II. INFORMATION AND COMMUNICATION TECHNOLOGIES APPLIED TO TEACHING

The study assumes that we are under the strong influence of an information and knowledge society (SIC), in which the role of technology is central, as a mediator of value interactions in our society and also in the acquisition of knowledge (ARAÚJO; GOUVEIA, 2018c). It was thus argued that in this society, the fact that the subject is able to acquire and process information is valued, giving it a new meaning so that it can be transformed into information and knowledge and for society to achieve this true CIS status - placing the individual's ability to deal information, digital and ICT, at the center of the action (ARAÚJO; GOUVEIA, 2018c).

In addition, it is exposed that the human being started to expand his channels of expression, from rudimentary language to cybernetic language. While this whole process would serve to explain that political systems would not be born out of nowhere, since they would need a means of preparation so that they could promote themselves in an ideological, physical and social way (ARAÚJO; GOUVEIA, 2018). In this context of SIC, this concept of culture has also been attributed a new meaning, adapted precisely to this technological environment. This digital culture can be understood, not as a simple technology, but as a whole system of values, symbols, practices and attitudes that involve the technological universe (ARAÚJO; GOUVEIA, 2018c).

The historical path of SIC followed the evolution of technologies at the same time. This provided individuals with a perception that the more access to information there was, the more they believed they had knowledge about all things. However, it is important to mention that the study positions itself stating that it was not technologies that shaped and transformed society, this is because society is the one who shapes technology according to its own needs, priority values and the interest of individuals who use technologies. Thus, what the proposed approach seeks to bring is the use of technologies by society as a way of accessing information and, consequently, developing knowledge to operate at SIC (ARAÚJO; GOUVEIA, 2017).

The study also includes the position that access to information that was previously restricted to the adult universe, now also reaches children and adolescents. In this context, childhood is faced with a new reality, distinct from films and children's characters. The formation of identity and the building of knowledge of this generation are consolidated regardless of the will and administration of parents and institutions, such as the school. Children informed and encouraged by what they do especially on the Internet, which gives them greater autonomy. As a result, they face the digital world in a natural way that causes the astonishment and administration of the elderly (BENTO; GARCIA; GRAÇA, 2010).

The young person may not be “owner” of his own life, of his own room, but he considers himself sovereign in his virtual spaces and activities. This feeling may have some kind of relationship with a new form of self-education that challenges the school and, consequently, the entire field of education, knowledge production and teacher training (DEMO, 2008). In this way, information becomes the core and the medium for production and consumption goods in the global market and generates interpersonal and knowledge relationships quite different from the traditional forms established and expected in the school context.

In this sense, education becomes a fundamental element for the formation and acquisition of these skills prioritized by this society. This is because the subjects who are devoid of them, are not valued in the SIC and run the risk of being excluded. Therefore, education must pay attention to new spaces and technologies aimed at teaching and learning, enabling the production of knowledge through these information and communication technologies, in disruption with the traditional stages as defined by Piaget (1986).

III. ON-SITE HIGHER EDUCATION IN BRAZIL AND THE STATE OF PARÁ

Taking into account higher education in Brazil and Pará, its evolution and considering public policies for evaluation and financing, it appears that the panorama in

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the State of Pará indicates that higher education needs more attention (ARAÚJO; GOUVEIA, 2018c).

Considering that Higher Education comprises teaching, research and its demanding extension of applied work, it makes the issue addressed here and associated with the use and importance of ICT for the teaching and learning process, just one of the components to take into account in the higher education context. For example, in medical schools and dental schools, the complementarity between teaching and learning, extension, projects and research, translates into a complexity quite different from the same concerns, for example, in Social Sciences. However, considering the object of this study, the perception of the use and importance of ICT, for teaching and learning, these differences do not arise.

Thus, in the field of teaching, which includes the undergraduate level and the postgraduate level, including the Masters, Doctorate and Full Teaching levels, they are also referred to as postgraduate teaching has a common context that allows for their joint study , with regard to teaching and learning practices using ICT. The general part of the academic education of higher education institutions includes the main theoretical and abstract elements, as well as the applied aspects associated with the specific knowledge of each area. Isaia and Bolzan (2001) argue that teacher training is a continuous learning process. Thus, the authors defend the relevance of the study carried out as a way of assessing the level of predisposition for practices associated with the use and exploitation of ICT in the teaching and learning processes.

In addition, Higher Education that takes place at Universities generally focuses on practical applications through the application of specific theories. In the current scenario of Higher Education in Brazil, there is an increase in the student population, also due to the government financing, through the Student Financing Program (FIES), a greater number of students in private higher education institutions. A larger, more diverse population also increased dropout rates. In this context, Gessinger et al (2016) propose the pedagogical use of technological resources as a strategy to qualify teaching and contribute to reducing evasion in higher education, making the use of ICT even more relevant, also due to the need for practical support combating evasion.

Regarding Education, the State of Pará has numerous educational institutions, the most reputable ones are located in the Metropolitan Region of Belém and in other medium-sized cities. Education in the State is positioned, in the Brazilian context, as being the twenty-sixth when compared to that of the other Brazilian states. Among the higher education institutions in the state, six are public academic institutions: Universidade Federal do Pará (UFPA); Federal University of Western Pará (UFOPA); Federal University of the South and Southeast of Pará (UNIFESSPA); Federal Rural University of the Amazon (UFRA); Pará State University (UEPA): and Federal Institute of Pará (IFPA).

Among the main private higher education institutions in Pará, the following stand out: the University of the Amazon (UNAMA); the Pará University Center (CESUPA); the Integrated Faculty Brazil Amazon (FIBRA); the Lutheran Institute of Higher Education of Santarém; the Pará Higher Education Center; and the Integrated Colleges of Tapajó.

The Map of Higher Education in Brazil (SEMESP, 2015, p. 168) describes that the State of Pará has 34 higher education institutions and 2% of enrollments are in classroom courses. The city of Belém has the highest number of enrollments, 85 thousand enrollments, corresponding to 68% of the students. The publication also narrates that in 2013 there was a 0.3% drop in enrollments in the private network of 56 thousand enrolled students dropped to 55.8 thousand enrollments. In the public school system, the opposite occurred, an increase of 9.6%, going from 63.5 thousand students enrolled to 69.6 thousand enrollments in 2013. Another relevant data regarding the face-to-face higher education of the State of Pará and that the In 2013, the number of students enrolled in face-to-face courses decreased by 2.4%, from 23 thousand students in 2012 to 22 thousand in 2013. In the public system, the fall was 4.9%, from 17 thousand in 2012. 2012 to 16 thousand in 2013.

IV. MATERIAL AND METHODS

The research comprised a case study with subjects as managers, students and teachers of a private Higher Education Institution in the city of Belém do Pará. It was an exploratory study, using a questionnaire for data collection. Marconi and Lakatos (1996) narrate that the choice of the method and technique used, depends on the objective of the research, the available financial resources, the team and elements in the field of investigation (ARAÚJO; GOUVEIA, 2018c).

Subjects from three different HEI areas were interviewed: Biological and Health Sciences, Exact Sciences and Technology and Applied Social Sciences, in the four physical units of CESUPA. The research chose to use the questionnaire, and non-probabilistic samples of the intentional or rational selection type were considered, with a total of 27 teachers interviewed, all 09 members of the

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pedagogical team, 19 students and all 13 course coordinators. The objective of the research was to raise the perception of the use and importance of ICT for teaching and learning practices in the context of higher education (ARAÚJO; GOUVEIA, 2018).

V. RESULTS AND DISCUSSION

TEACHERS' PERCEPTIONS

The first part of the survey maps the profile of teachers, identifying that the composition of masters is equivalent to 59% of the total, followed by doctors with 26% of the teaching staff, followed by 11% of specialists and only 4% of post-doctors. , with 56% of the total teaching exclusively at the HEI. This profile is in line with other Brazilian higher education institutions and also demonstrates a potential for growth in teacher training. On the other hand, it appears that the majority of teachers are in exclusivity, which translates into a significant work potential (FRY, KETTERIDGE; MARSHALL, 2009).

Half of the participants replied that they work Partially, that is, 12 hours or more during the week at the IES, the hourly workers, who work per class hour make up a total of 38% and the smallest part work full time, 12% of the total. total working 40 hours a week. It was found that 32% of the research participants work between 10 and 15 years at the institution, 24% work between 5 and 10 years, 16% between 1 and 5 years and with the same percentage of teachers over 15 years at the institution. In this context, we can say that the faculty has experience, with the majority having 5 or more years. On the other hand, there is a potential for overload for teachers to claim to be with 12 hours or more per week of teaching load. These values are also in line with those reported in the context of SEMESP (2015).

We can thus observe that in relation to the years that work in general in higher education, that is, whatever the institutions that work or have worked including the HEI itself, 63% has been working for more than 10 years in HEIs, 18% between 5 and 10 years, 15% between 1 and 3 years and 4% less than 1 year. It is noticed, therefore, that the teaching staff has relative experience with higher teaching - soon able to reflect on the use of ICT in the classroom and possess a personal experience that supports their perception (FRY; KETTERIDGE; MARSHALL, 2009).

The second part of the questionnaire addresses the identification of practices used by the traditional teaching methodology. The answers largely reflect the reality of HEI classrooms, expository classes, group activities, use of datashow and computer. These practices were mentioned a number of times in the questionnaire, which shows a low level of innovation in the way of transmitting knowledge. However, some research participants talked about interesting practices that should be disseminated in the faculty - there is a smaller set of teachers who undertake alternative teaching experiences in the classroom context (FRY; KETTERIDGE; MARSHALL, 2009).

Among the pedagogical practices mentioned are: the use of applications such as Kahoot and Plickers, which are question and answer applications that allow interaction between a group of students on their respective cell phones, Socrative, an application that follows more or less the line from Kahoot, allowing interaction between users, Padlet, which is a kind of community mural where students can create murals on different subjects, is a sheet of paper online. In this context, there are numerous practices that are being developed, as is the example of Martins e Gouveia (2019), using inverted classroom strategies; or using Facebook (MARTINS; GOUVEIA, 2019a) or WhatsApp (MARTINS; GOUVEIA, 2019b), for classroom support.

The second block of subjective research questions deals with the identification of the results of the practices adopted by the Traditional Teaching Methodology. The research participants agree that yes, the practices adopted generate learning, however some considerations were made, among them: the caveat that the use of conventional classes alone does not generate learning if there is no motivating element. This observation is in line with recent studies that propose new strategies to involve students and promote new teaching strategies in the classroom (WIEGEL, 2020).

The third block aims to identify the main factors that lead students to failure in school and the questions ask about what are the main learning difficulties of students in relation to teaching and learning.

Teachers were asked what are the main factors that lead students to poor school performance (not school achievement). In addition to the lack of interest, immaturity, comfort zone, gaps in prior knowledge, among other motivators referred to the lack of academic achievement, the need was identified for the student to learn to study and not just be led by the school, through assessment , certain subjects in certain situations. This was the most relevant contribution as an aspect that, in addition to the traditional references (FRY; KETTERIDGE; MARSHALL, 2009), which was pointed out for the non-realization of knowledge.

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Most of the research participants use technological resources in the classroom to solve the learning difficulties, most of them use computers and cell phones to access research on electronic sites. These practices are also in line with those described in (MARTINS; GOUVEIA, 2019a; MARTINS; GOUVEIAb).

In this context, it is important to highlight that the teacher, like any other professional, needs to maintain a continuous education, always aiming to follow the new demands of society, thus enabling the construction, socialization and confrontation of knowledge (WIEGEL, 2020).

Regarding the technologies that teachers would like to have in the classroom, tablets, computers, cell phones, new programs, mannequins, Internet connection were mentioned, among others. It is important to emphasize that even those who do not use technology in the classroom would like to use it. Thus, it is believed that, with incentive, its use can be enhanced, because at least apparently there is this desire on the part of teachers.

As for the actions that should be taken for the use of ICT in the classroom, aiming at improving the teaching and learning process, it is clear to the interviewees which actions to take - improvement and training. However, what has been demonstrated is the teachers' lack of attitude towards applying what they have learned, in order to incorporate new processes into their classroom practices. It is worth noting that the lack of continuing education and, also, the lack of disciplines in undergraduate courses focused on the use of ICT that still prevail in many educational institutions, make it difficult for teachers to use and explore them. . This difficulty ranges from the simple use of a computer to the design of a class and / or content to use in the teaching and learning processes.

On what are the actions that should be taken to overcome learning difficulties through the use of information and communication technologies, the most relevant are proposed: the Internet of good speed in the HEI for the use of applications; the teaching qualification for the use of ICT; multimedia equipment in classrooms and form forums on social networks to generate learning.

Finally, we sought to know what teachers would like to add because they consider it important in the context of the use of ICT in higher education. These, reaffirmed the importance of ICT in a context of globalization, allowing us to connect people to the world. They again defended that teacher training for the use and exploitation of ICT is fundamental, especially tools. cHowever, it was also stated that there are barriers to the use of certain tools (cell phones, access to Facebook, just to mention two examples). In this context, it is necessary to understand the obstacles to the use of ICT and promote the training of teachers so that the use is profitable and a context that enables their use, whether in operation, or in rules and modes of use in the classroom. An in-depth discussion of these conditions is developed in Wiegel (2020).

PERCEPTIONS OF STUDENTS

As for the gender of the research participants, it was well divided, 53% of the students according to the survey are male and 47% are female. Obtaining a sample in which the gender equality is patent.

The second question refers to the age range of the participating students. The result shows that most of the students participating in the research are between 20 and 25 years old, making up a percentage of 63% of the total, then both with 16% are those who are under 20 years old and those over 30 years old , while those between 26 and 30 years old occupy the smallest slice with only 5% of the amount. These values are in line with the age group considered to be the most common of the traditional higher education population (SEMESP, 2015).

At the end of the block of objective questions that outline the profile of the participating students, the academic semester of the interviewed student was identified: 32% of the students attend the 2nd semester, followed by the students who attend the 4th and 8th semesters with 16%, with 11% those in the 10th semester, in the 6th and 9th semesters have 10% of the students each and in the 7th semester 5% of the students.

The second part of the research is composed of subjective questions divided into 4 blocks. The first question in the first block asks the research participants whether they consider the way the classes are taught, the pedagogical practices used by the teachers in the classroom, and whether they are appropriate to the content exposed. Among the survey participants, 58% say they know the reason for the use of such pedagogical practices by teachers and 42% say they do not know why. There is thus an almost equal division between those who understand the methods used and those who do not understand why these methods are adopted in the classroom.

The positive points mentioned are associated with the teacher's mastery of the subject. The connection between the content seen in the classroom and everyday life was also listed as a positive factor. The negative points

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listed are associated with the way of teaching by some of the teachers who are considered very traditional: students argue that the classes merely expository generate discomfort and demotivation. They also emphasize the reading of articles in full in the form of a monologue without proper interaction with students. In practice, these aspects are pointed out by the literature and are recurrent, as already discussed in (FRY; KETTERIDGE; MARSHALL, 2009).

The second block of the research deals with questions about the identification in the students' view of the results of the practices adopted by the Methodologies associated with Traditional Teaching.

It is noticed with the result of 84% of the students affirm that the pedagogical practices adopted by the teachers make it possible for the students to learn that, in general, the teaching performance in the classroom is positive. This does not prevent 16% of students from pondering their responses with considerations and conditioning for the possibility of learning. It is worth noting that no student explicitly denied that the practice adopted by teachers is successful in learning, in addition, those who did not fully agree only made considerations and cited that there are in practice specific techniques for each course and discipline that justify certain approaches.

In the third block of the survey, participants answered their main learning difficulties. It is noticed that a good part of the research participants attribute the difficulties to the teaching and learning process and to tertiary factors, such as: the way the teacher “passes” content, little time available for reading, “heavy” content, many subjects at once, among other less common justifications. It is noteworthy that few students responded in such a way as to assume and bring responsibility for learning difficulties. It is observed in some speeches that the greatest difficulty when it is attributed to the student, are issues such as: lack of initiative for studies, laziness, and some disorders such as attention deficit and anxiety. Also at this point, the observations are in line with the literature and recent studies on the classroom (WIEGER, 2020).

Concluding the third block of research questions, the students participating in the research mentioned among the main factors that lead them to have learning difficulties in a content: monotony in class, lack of time for reading, lack of interest and accumulation of activities.

The last block identifies the changes that should occur in the Traditional Teaching Methodology with the use of information and communication technologies, with 89% saying that they use technological resources to try to overcome learning difficulties and only 11% do not. It is perceived that the use of technology is already part of the students' daily routine and that it is already a tool to elucidate questions of doubts and difficulties, and its use should be improved, both for students and teachers.

Therefore, it must be clear who does and what does, in a successful teaching and learning process, as students who do not even have clear procedures and practices that can help them assimilate the contents, will certainly have more difficulties. The teacher must, together with the student, lead the involvement of the parties and the motivation in learning.

PERCEPTIONS OF COURSE COORDINATORS

The initial questions were aimed at identifying a profile of the coordinators. The data collected show that the training time of the coordinators ranged from 8 to 34 years, an overall average of 20.5 years of training time, which can be considered high, and it is observed that 68% of education professionals have between 11 and 30 years of professional training and can then be considered experienced professionals.

Their specializations were also raised, taking into account postgraduate, Master and Doctorate qualifications. It was found that 46% of the coordinators have a specialization course, 68% of them have completed the Master's course, and that 38% have a PhD course. There is considerable potential for qualification here, considered to be higher education.

Analyzing the training time, it appears that 61% of the coordinators have more than 10 years of training time. It should be noted that the training of professionals in each area contributes to the improvement of their area of expertise. For example, the training of good education professionals, who master diverse teaching methodologies, provide an improvement in the teaching and learning relationship.

As for the time of experience as a coordinator at Cesupa, 54% of the coordinators have less than 5 years of experience in their activities. Even expanding the sample's scope a little more, it turns out that 73% have less than 10 years of experience as coordinators. Thus, 23% can be considered experienced professionals, as they have more than 10 years in the job.

With regard to acting in the classroom, directly with students, all Cesupa coordinators (100%) teach. In this context, having to do more at the same time prevails, thus modifying the coordinators' ways of thinking, feeling

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and acting, but also guaranteeing their connection to the field and being in direct contact with the students.

Still in the analysis of the context of the activities of Cesupa coordinators, we sought to know how many professionals performed activities in other HEIs. Thus, 15% of the coordinators are active in other HEIs. Highlight for the time that coordinators work in more than one HEI: one of them for 12 years, another for 23 years and another one who had worked for more than 5 years.

The second part, composed of subjective questions initially considers the identification of the role to be played by teachers in the current moment, with a limited view of the question, at the personal limit, but with a complementation between the answers that partially portray the reality experienced . Some clarified more what would be the role to be played by teachers in the current moment, being a tutor, someone who presents options and discusses them with the student, because the content is available to anyone, but the experience, the exchange is that enhances learning.

We also sought to know what the student's understanding of a good experience would be in the course. From the answers given, the coordinators understand that taking advantage of all learning opportunities to consolidate theoretical and practical knowledge, and especially the practical one. Additionally, it is also important to generate enthusiasm / motivation to learn; support reasoning and the scientific method; forming solid knowledge and being able to make practical applications. Finally, the monitoring, in addition to continuing; to foster student participation effectively in its transformation or development, making it an active and involved element.

It appears that the role of technologies in the teaching and learning process would be to assist the student of this generation, who has difficulty concentrating in dialogued expository classes; facilitate the development of knowledge, humanism, critical sense and ethical sense, in the student; facilitate the relationship between the teacher and the student; and to allow the development of new skills and competences.

As for the question that investigates what experiences involving students and ICT that they could share in this study, many projects were reported. Countless teachers developed experiences using cell phones, chats, video classes in their subjects; gamification platforms, among others.

The final question showed that Cesupa coordinators consider it important in the context of the use of ICT in higher education. They reported that teachers should try to find out more about the subject, as well as invest in training. In turn, HEIs must propose to students, rules and methods of using them, so that the learning process is not distorted through ICT. In addition, they must use the tools to enhance their development.

From the students' point of view, it was also possible to observe that teachers during the semesters tend to increase pedagogical practices, perhaps in order to hold attention and motivate students through adaptations of previously used practices.

PERCEPTIONS OF THE PEDAGOGICAL TEAM

The questions addressed for the interview were the same as those used with the course coordinators, since the pedagogical team (called COGRAD) is also considered as Manager, in the IES organizational structure.

Regarding the professional training of the team, it was found that 100% are graduated, covering the areas of Administration (01), Pedagogy (04) and Psychology (04). The training of team members is, therefore, aligned with the sector's mission and purpose.

Regarding the time of professional training, it is observed that 78% of education professionals have between 11 and 20 years of professional training and can then be considered as experienced professionals. This condition is evaluated as positive, since the experience comes from the pedagogical practice.

Then, the team's specialization began to be investigated, mostly composed of Masters and Doctors (56% and 22% respectively), with two people (22%) having a specialization course. Regarding training time, teachers have a variation of time ranging from 1 year to 17 years, with an average of about 10 years of training in general.

As for the length of experience, 5 respondents have up to 5 years of experience and 4 have worked between 6 and 10 years. Only two professionals have worked for less than a year, as CESUPA's manager and the others have experience in the function. Six of the nine respondents have more than five years of experience. Research participants were asked whether they also work as professors at CESUPA, three of whom responded positively and five are not professors at CESUPA and only one is a graduate professor - Specialization.

Still in the analysis of the context of COGRAD's activities, it was sought to know how many professionals performed activities in other HEIs, the interviewees answered that 100% work exclusively at CESUPA. This is

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due to the HEI's own policy in this case study, which does not allow managers to teach in other private HEIs.

The second part of the interview sought to understand the strategies for the use of information and communication technologies, in the context of CESUPA's teaching / student support team. In particular, what would be, in your opinion, the role to be played by teachers in view of the current moment. Due to the responses, it was observed that the role as a facilitator is well highlighted in the speeches, where the role of the teacher is to provoke knowledge and that the student is also an author in the teaching and learning process.

Another question, related to what is considered to be a good student experience in the course, the responses of the research participants revolve around the students' learning for application in professional life, as well as in methodologies used by teachers in the teaching and learning process .

Then, we sought to know the role of technologies in the teaching and learning process. The vision of a tool that makes it different in the teaching and learning process was mentioned, making it more dynamic, decentralized from the figure of the teacher as to the acquisition of knowledge, where he becomes the mediator and facilitator and no longer the figure central part of the process.

The next question investigated which experiences involving students and ICT could be shared in this study. Only one teacher had experience to share that it was the monitoring of the use of the Moodle platform by teachers, which leaves a lot to be desired in this regard, given that the use of ICT was mentioned as an important tool for the teaching and learning process. Contradicting them, they still don't use ICT in their classes.

The answers provided in this qualitative stage confirm the answers obtained in the first stage of the interview, when the majority of the team answered that they do not teach (do not work in the classroom). This can be harmful in a way, because as the team does not have experience in the classroom at the HEI, it is unable to visualize the practice of the HEI professors, and may suggest or give examples when teachers question. Additionally, students and the challenges posed by their profiles in particular do not experience first hand.

In presenting the teachers' view as a pedagogical team, it is important to highlight that several difficulties were identified: many of the teachers have years of training and did not have a pedagogical or continuing education, being unaware of information and communication technologies, their use and exploration in class. In addition, they reject their use or even feel afraid to use ICT. Teachers with more recent training suffer from the fact that many colleges still do not include in their curriculum subjects for use of ICT in the classroom. Thus, they feel lost to include them in their pedagogical practice. Others just reject the use, believing it to be unnecessary and that in no way contribute to learning, not making an effort to learn ICT.

VI. CONCLUSION

The research provided the analysis and discussion of the data collected from the questionnaires that allowed to form the individual perception of the interviewees and to confront this, with the view of the Pedagogical Team - Coordination of Graduation (COGRAD). It was possible to verify that their perceptions about the limits and possibilities of performance of teachers who work in the face-to-face higher education modality allow us to identify that they perceive that teacher training for the use of ICT is fundamental for their exploration in the context of teaching and learning. Teachers showing awareness of the importance of ICT as tools, however it was also found that there is an impediment to their practice, in addition to the need for training with them - creating barriers to change and the need to establish good practices and to stimulate them in the context of teaching practice. In this context, the obstacles to the use of ICT were perceived, believing that it is necessary to promote the training of teachers so that the use is profitable - creating strategies that must take into account not only ICT and its teaching, but an awareness prior to its importance and to concrete contexts of its application by teachers in processes, also concrete, of teaching and learning.

As for the view of the Student Body, that is, of students from the CESUPA community, the study allows students to believe that the way teachers work in the classroom in general, in fact generates learning, however presenting some areas to improve (use of large and dull texts, very traditional strategies, traditionalism, among other criticisms presented). It is important to note that some students mention the responsibility and the important role of the student, that the teacher exposes the content, but the student must deepen and seek knowledge himself - becoming more active.O estudo está alinhado com outros estudos da literatura ao apontar a necessidade de um aprofundamento das práticas de uso e exploraãop de meios digitais por parte de docentes e discentes. No caso dos professores, colocam-se barreiras associadas com a literacia tecnológica e o investimento de mudar as suas práticas, num esforço que tem de ser acompanhado. No caso dos alunos, uma consciência que os métodos em sala

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de aula, embora aceitáveis, necessitam de atualização e de considerar um papel mais ativo dos alunos.

The study made it possible to deepen the existing situation in order to constitute a subsidy to know the needs of the use of digital media in the process of educating educators, with the awareness that technologies permeate everyday life and their use in education has been increasingly most requested. Also allow us to realize that although there is a perception of the importance of ICT in the teaching and learning process, its real use is still subject to difficulties of understanding and on the part, in most or lesser degree, of all the groups studied.

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Implementation of the Welcome with Risk Classification in Emergency and Cardiological Emergency Services: Integrative Literature Review

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***Abstract*— Objective:** *Identify the repercussions and impacts of implementing risk classification in urgency and emergency services.* **Methodology:** *Integrative literature review that had its searches in the databases BDENF, LILACS AND PUBMED of articles published 2014 to 2020, with the use of the descriptors: User embracement, risk classification, triage, urgency, emergency, cardiology, nursing, nursing care. Data was systematized using the Content Analysis technique.* **Results:** *Analyzed 16 articles in which positive impacts were identified in the implementation of the risk classification, related to the ability of this device to organize the demand by prioritizing cases by severity, thus decreasing the chances of a prognosis with negative impacts, resulting from delay in treatment. However, users still know little about the logic of ACCR, which is a limiting factor in the process of implementing the instrument.* **Conclusion:** *It is essential to inform the population about the dynamics of using risk classification protocols in emergency services, as well as establishing training and permanent education for health professionals.*

***Keywords*— User Embracement; Triage; Ambulatory care; Cardiology;Nursing Care.**

I. INTRODUCTION

Emergency care services and hospital urgency and emergency services constitute one of the main entry points into the health systems used by users, whether these services are public or private1,2. Configuring themselves as a gateway, these services can most often present overcrowding, which associated with a deficiency in organization and flow processes, result in undesirable clinical outcomes. This fact directly affects users, health professionals and, consequently, health services and systems[1].

In this context, in 2009, the Ministry of Health (MS) implemented the Reception Program with Risk Classification (ACCR), which is a dynamic process of identifying and prioritizing care, aiming to distinguish critical cases from non-critical ones, thus prioritizing, who most needs immediate assistance. Worldwide, there are instruments used for user evaluation, among which the following stand out: the English Manchester Triage System (Manchester Protocol - MST), the Australian Australian Triage Scale (ATS), the Canadian Canadian Triage and Acuity Scale (CTAS) and the American Emergency Severity Index (ESI)[2].

In Brazil, the Manchester protocol is one of the instruments used in urgent and emergency services to assess users2. The Manchester Screening System, stratifies into five levels of severity and assigns, at each level, color and target time for medical care. It is structured in

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flowcharts with discriminators that guide the collection and analysis of information to define the patient's clinical priority3. The Manchester protocol must be applied by the nurse, a professional of the team indicated for the evaluation of the user's clinical condition, as it presents communication and evaluation skills, linked to the knowledge of the ethical-legal and technical-scientific principles that govern the profession[2].

In this context of reception and screening, it is essential that understanding is not limited to an attentive and friendly action by the professional, since welcoming implies the coordination of responsible and resolute care, crucial in urgent and emergency situations. Thus, this process must break down and eliminate barriers that hinder or impede the population's access to services. Through risk classification, equity is sought to be achieved, that is, prioritizing critical cases, regardless of the order of arrival. Welcoming is listening, reorganizing the work process, where the multiprofessional team becomes responsible for the user's demand being on the front line[2].

It is known that many emergency care services live in long lines where people dispute the service without any criteria other than the time of arrival. This lack of distinction of risks or degrees of suffering and severity results in the worsening of cases, often resulting in the death of people who were not attended in a timely manner[4].

In addition, the care of users in overcrowded emergency services can lead to adverse events and deteriorating working conditions, and provides questionable performance for the health system as a whole. In this sense, it is crucial to reorganize urgent and emergency services. The risk classification emerges as a clinical and organizational strategy to mitigate risks and damages arising from the asymmetries generated by access to services guided by order of arrival. The use of risk classification aims to minimize the risks and damages caused by the consequences of overcrowding and absence of pre-defined flows[1].

In this sense, considering the significant demand for urgent and emergency services and the need to continuously evaluate the results of assistance after the implementation of risk classification with the use of the Manchester protocol, the present study aims to identify the repercussions and impacts of the implementation of the risk classification in urgent and emergency services. Having as guiding question: How do the published articles address the implementation of reception with risk classification in urgent and emergency services, the repercussions and impacts?

II. METHODOLOGY

It is an integrative literature review, which consists of building a broad analysis of the literature, evaluating relevant research that supports decision-making and the improvement of clinical practice, thus cooperating for discussions about techniques and research results. , as well as reflections on future studies5. To carry out the integrative review, it is necessary to develop six steps. In the first stage, the guiding question was defined: How do the published articles address the implementation of reception with risk classification in urgent and emergency services, the repercussions and impacts?

In the second stage, the inclusion and exclusion criteria were established and a search was started in the databases to select the studies. The data sources for the research were the Latin American and Caribbean Literature in Health Sciences (LILACS), National Library of Medicine (PUBMED) and Database in Nursing (BDENF). Articles published in Portuguese, English and Spanish were selected, the search was carried out in the months of September and October 2020, using the following Health Sciences Descriptors (DECS): "Reception", "Risk Classification", "Screening" , "Urgency", "Emergency", "Cardiology", 'Nursing "," Nursing Care ". During the search, the Boolean operator “AND” was used, as it favors the intersection during the search.

The following inclusion criteria were adopted: original and complete articles that addressed the theme under study, in the period from 2014 to 2020. Theses, dissertations, books, materials not available in full free of charge, duplicate articles that did not address the topic of the review. In the third stage, the information to be extracted was defined. For data collection, an instrument constructed by the authors was used, containing the following variables: year of publication, journal, title, authors, language, type of study, objectives, level of evidence.

The fourth stage corresponded to the analysis, evaluation, inclusion and exclusion phase of the studies through a critical analysis of the selected articles. The fifth stage consisted of the interpretation and discussion of the results found. The sixth and final stage consisted of presenting the review and synthesis of knowledge.

Using the search strategy, 348 scientific articles were found, being: LILACS (119), PUBMED (127) and BDENF (102). The abstract was read, of which 190 were excluded, as they were out of the study period, because they were not available in full free of charge and because they did not address the topic of study, with 45 articles left

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for reading, 29 of which were excluded. after reading in full, with 16 articles included in the review. The Flowchart in (Figure 1) summarizes the construction of the corpus of this review.

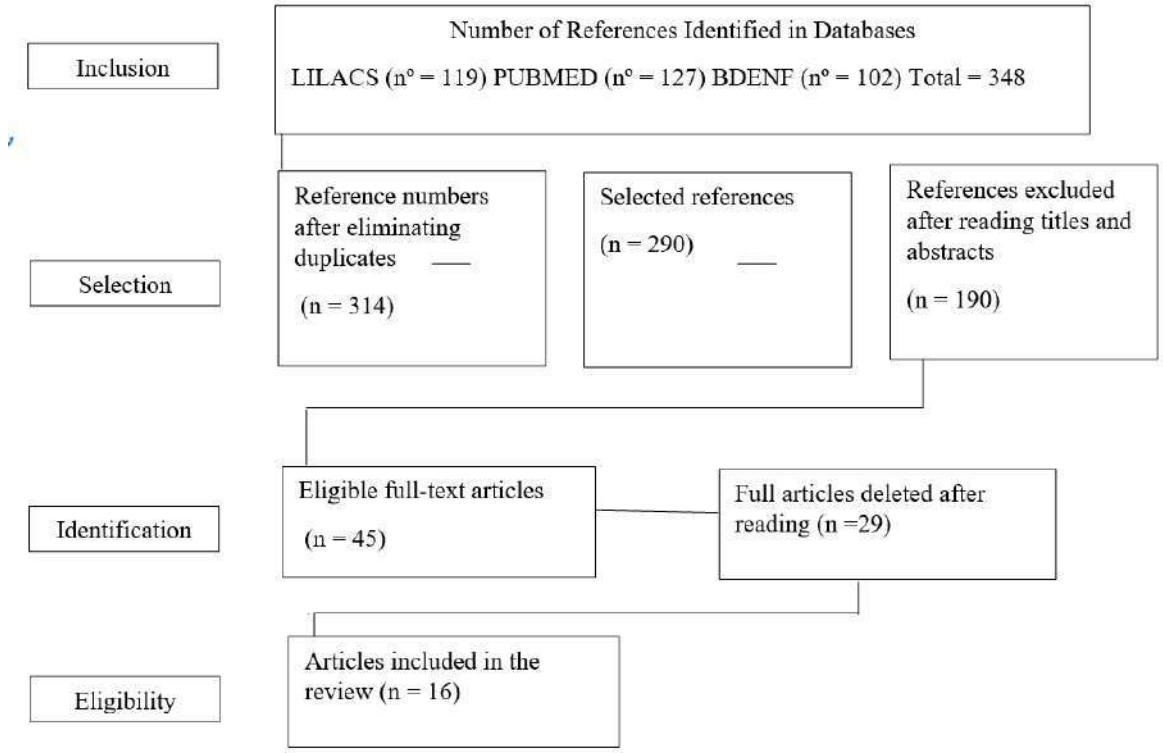

Fig.1: Flowchart of study selection

Source: Research data, 2020.

III. RESULTS

As a result of the search application, 348 articles were found. After applying the inclusion and exclusion criteria, 16 texts were selected for analysis. Of these, 1 article is in Spanish, 4 in English and 11 in Portuguese.

The distribution of information regarding the number of articles published per year and journal shows that in 2017 and 2019 there was an increase in the publication of articles related to the subject. It is noticed that the most used methodology was the quantitative study, covering 63% (10) of the total of analyzed articles. Afterwards, the qualitative study methodology is followed, with 37% (6).

The classification of six levels was used to rank evidence: Level I: evidence resulting from the meta-analysis of multiple controlled and randomized clinical studies; Level II: evidence obtained in individual studies with experimental design; Level III: evidence from quasi-experimental studies; Level IV evidence from descriptive studies (non-experimental) or with a qualitative approach; Level V: evidence from case reports or experience; Level VI: evidence based on expert opinions[6].

The systematization of the data occurred using the technique of content analysis of the theme following the following steps: pre-analysis; exhaustiveness rule; exploration of the material and treatment of data, inferences and interpretations and final presentation was made by the record according to analysis and presentation of the discussion[7].

The following is a list of articles selected and organized according to the title, authors, journals, objectives, type of study, level of evidence, language and year.

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Chart 1 - Articles selected according to: Title, authors, journals, objectives, type of study, level of evidence, language and year. Belém - Pará, 2020

TITLE	AUTHORS / PERIODIC	GOALS	KIND OF STUDY/ EVIDENCE LEVEL	LANGUAGE	YEAR
Reception with risk classification in urgent and emergency services: applicability in nursing	WEYKAMP, J.M; PICKERSGILL, C.S; CECAGNO, D; VIEIRA, F.P; SIQUEIRA, H.C.H BDENF	Identify the knowledge of nurses about the implementation of the Welcome with Risk Classification proposal, in an urgency and emergency service.	Qualitative, descriptive, exploratory study IV	Portuguese	2018
Reception and risk classification in urgent and emergency services: limits and possibilities an issue for nurses	ARAUJO, Y.B; FERREIRA, L.B.A; SANTOS, C.M; SILVA, A.T.M.F; GOMES, M.S.M BDENF	Analyze limits andpossibilities that permeate the reception and risk classification at the emergency door of a hospitalpublic in the city of Campos dos Goytacazes	Descriptive exploratory study with a qualitative approach IV	Portuguese	2015
Clinical demand for an emergency care unit, according to the Manchester protocol	DINIZ, A.S; SILVA, A.P; S, C.C; CHIANCA, T.C.M BDENF	Identify the clinical demand of patients attended by nurses in the classification ofrisk of an Emergency Care Unit, according to the Manchester protocol.	Quantitative descriptive study IV	Portuguese	2014
Implementation of the host with risk classification in an emergency care unit	SERRA, H.H.N; SANTANA, T.S; S,A.R; SANTOS, J.S; PAZ, J.S BDENF	Analyze the process of implementing welcoming with risk classification in the emergency department of a city in the regionrecôncavo da Bahia, Brazil.	Qualitative descriptive study IV	Portuguese	2019
Reception with risk assessment and classification in an emergency room: a comparative study	DEUS, G.A; FERREIRA, J.H; MONTANDON, D. S; GODOY, S. LILACS	Identify whether the risk classification carried out at the reception with risk assessment and classification of the emergency room is in accordance with the institutional protocol	Quantitative, retrospective, correlational, descriptive and cross-sectional study IV	Portuguese	2018
Reception and risk classification: perception of health professionals and users	CAMPOS, T.S; ARBOIT, E.L; MISTURA, C; THUM, C; ARBOIT, J; CAMPONOGARA, S LILACS	To know the perception of health professionals and users in relation to the reception with risk classificationin an urgency / emergency service	Descriptive exploratory study with a qualitative approach IV	Portuguese	2020

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Reception Analysis with risk classification in an emergency care unit	GOUVEIA, M.T; MELO, S.R; COSTA, M.W.S; SOUZA, J.M.M; SÁ, L.R; PIMENTA, C.J.L; FREITAS, K.N; COSTA, M; COSTA, T.F LILACS	Evaluate risk-rated host services performed in emergency care units	Cross-sectional and quantitative study IV	Portuguese	2019
Characterization of the attendance of a public emergency room according to the Manchester Screening system	SILVA, A.D.C; CHIANCA, T.C.M; PÁDUA, D.R; GUIMARÃES, G.L; MANZO, B.F; CORREA, A.R LILACS	To characterize the attendance of patients classified by the Manchester Screening System (MTS) in a large public hospital.	Descriptive study with a quantitative approach IV	Portuguese	2019
Implementation of the Manchester risk classification system in a municipal emergency network	SACOMAN, T.M; BELTRAMMI, D.G.M; ANDREZZA, R; CECÍLIO, C.O; REIS, A.A.C LILACS	Narratethe technology deployment experience of risk classification in the municipality of SBC	Experience report V	Portuguese	2019
Nurses' opinion on risk classification in emergency services	DURO, C.L.M; LIMA, M.A.D.S; WEBER, L.A.F LILACS	Assess nurses' opinion on risk classification in emergency services	Exploratory, quantitative study IV	Portuguese	2017
Users' perception of screening with risk classification in an emergency service in Cape Verde	SPAGNUOLO, R.S; SILVA, M.N.L; MENEGUIN, S; BASSETTO, J.G.B; FERNANDES, LILACS	Unveil users' conceptions about screening with risk classification in an emergency service	Qualitative research, based on the method “case study V	Portuguese	2017
Saturation of emergency services: Analysis of four hospitals in Medellín and strategy simulation	RESTREPO-ZEA, J.H; JAÉN-POSADA, J.S; PIEDRAHITA, J.J.E; FLÓREZ, P.A.Z LILACS	Identify and simulate strategiesto manage medical emergencies, seeking to mitigate saturation	Exploratory and analytical research IV	Español	2018

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Chest pain in emergent department risk stratification with Manchester triage System and heart score	LEITE, L; BAPTISTA, R; LEITÃO, J; COCHICHO, J; BREDA, F; ELVAS, L; FONSECA, I; CARVALHO, A; COSTA, J.N PUBMED	Describe the population with chest pain, to characterize the subgroup of patients with acute coronary syndrome (ACS) and to assess the prognostic value of Manchester triage system and of HEART score.	Retrospective observational study IV	English	2015
Evaluation of the Manchester triage system for patients with acute coronary symdrome	KIBLBOECK, D; STEINREUCK, K; NITSCHE, C; LANG, W; KELLERMAIR, J; BLESSBERGER, H; STEINWENDER, C; SIOSTRZONER, P PUBMED	Defined as the distribution of different MTS levels in patients with ACS; defined as a prespecified subgroup analysis of the MTS level distribution for gender, diabetic patients, different types of ACS (STEMI, N-STEMI and UAP) and age younger and older than 80 years.	Retrospective analysis IV	English	2019
Outcome assessment of patients classified through the Manchester Triage System in Emergency units in Brazil and Portugual	GUEDES, H.M; ARAÚJO, F.A; JÚNIOR, D. P; MARTINS, J.C.A; CHIANCA, T.C.M PUBMED	Evaluate the outcomes of patients' treatment classified according to the Manchester Triage System (MTS) in two large hospitals	Historical cohort study IV	English	2017
Validity of the Manchester Triage System in emergency care: A prospective observacional study	ZACHARIASSE, J.M; SEIGER, N; ROODS, P.P.M; ALVES, C.F; FREITAS, P; SMIT, F.J; ROUKEMA, G.R; MOLL, H.A PUBMED	To determine the validity of the Manchester Triage System (MTS) in emergency care for the general population of patients attending the emergency department, for children and elderly, and for commonly used MTS flowcharts and discriminators across three different emergency care settings.	Prospective observational study IV	English	2017

Source: Own research in the database BDENF, LILACS and PUBMED (2014 - 2020)

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IV. DISCUSSION

The theme of health care in urgent and emergency services permeates several discussions, among which the growing search for these services over the years stands out, this is due to numerous reasons, which may highlight socioeconomic, cultural issues, as well as the difficulty resolution of health demands in other parts of the health care network, which results in overcrowding of urgencies and emergencies[8]. According to national and international literature, emergencies are one of the doors of entry to health services [2,4,8,9]. These services constantly live in long lines, where people compete for care without any criteria at all. not be the arrival time[8].

Due to the imbalance between the supply and demand of emergency services, saturation is inevitable, which reflects in long waits, occupation of inadequate areas, use of chairs and even the floor for user care, high level of stress of health professionals and users[9]. Due to the lack of risk stratification or degree of suffering, as a result there is a clinical worsening of those who wait for care, causing in some cases the death of people due to the lack of assistance in a timely manner.[4].

In view of this reality, there was a need to incorporate new technologies in order to organize the flow of care in urgent and emergency services [4,8]. There is a need to adopt devices with the ability to contribute to the prioritization of care, organization of flow, optimization of resources and mainly relief of suffering and maintenance of life.[4].

Thus, the Ministry of Health (MS), through the National Humanization Policy (PNH), with the interest of exercising the principles of the Unified Health System (SUS) in the daily life of health services and thus improving health care of the population, points out the use of risk classification systems in users who seek care in urgent and emergency services [1,4,8,10]. The reception with risk classification (ACCR), consists of a PNH guideline, presented as an instrument that must be present in health practices, based on qualified listening and the ability to agree between the user's demand and the possibility of service response , that is, user embracement allows the active participation of the user as part of the health production process, aiming to promote the humanization of care, in order to face the deficiency in resolvability and quality of health services [8,10].

The reception to users must be based on the assessment with risk classification [10]. The ACCR consists of a dynamic process of identification and prioritization of care, which aims to identify the critical cases of non-critics. The process is based on the identification and consequent prioritization of users who need immediate / brief care and, subsequently, of cases with less clinical severity, by logic, care prioritizes according to the degree of complexity of the user, and not in order of arrival[1,2,8].

Studies indicate that the risk classification must be performed by a nursing professional with a higher education level, through consensus established jointly with the medical team in order to assess the potential for worsening the case and the degree of suffering of the user. The nurse has the skills and competences to explore the patient's complaint without the presumption of medical diagnosis, so this professional has been the most recommended, being legally supported to perform the ACCR in urgencies and emergencies[2,8,11,12,13,19].

It is essential to highlight that the ACCR occurs through protocols, are instruments that systematize the evaluation and offer legal support for the safe practice of nurses8. Among the instruments used worldwide for user evaluation, the following stand out: the English Manchester Triage System (Manchester Protocol - MTS), the Australian Australasian Triage Scale (ATS), the Canadian Canadian Triage and Acuity Scale (CTAS) and the American Emergency Severity Index (ESI)[2].

Among the models highlighted above, the most widespread is the Manchester Screening System4. The Manchester protocol was initially implemented at the Manchester Royal Infirmary, in the city of Manchester (1997), and is adopted as a standard protocol in several hospitals in Europe. It consists of 52 predefined clinical conditions linked to their respective guidelines or flow lines, from each of the risk classification levels. The classifications are divided into colors organized by level of severity and risk of clinical presentation, where: the red color (emergent) determines immediate care; the orange (very urgent) provides assistance in ten minutes; yellow (urgent), 60 minutes; green (not urgent), 120 minutes and blue (not urgent), 240 minutes[1,4,14, 15,16].

It is noteworthy that national studies that compare the MTS with an institutional protocol showed that it is more inclusive, increases the level of clinical priority in the occurrence of divergences between classifications and is able to predict which patients are more likely to have an unfavorable outcome[13]. A study carried out in order to analyze the organization and workflow in an emergency unit in an interior of the state of Rio Grande do Sul, which does not use a risk classification system, showed difficulties related to human resources, materials and flow users' disorder, highlighting the dissatisfaction of health professionals due to the large volume of non-urgent demand [10]. This finding corroborates the importance of

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establishing protocols to screen clinical cases in emergency rooms in order to prioritize critical cases, improve the flow , enhance the work of the multidisciplinary team and avoid worsening the patients' clinic.

A study showed the importance of using the Manchester protocol to screen for chest pain, where managing this emergency is one of the greatest challenges in the emergency room. Chest pain is responsible for 5 to 20% of all admissions to the emergency room. Accurate and rapid risk stratification is essential in the acute management of users with these symptoms, especially to identify those at immediate risk of complications, such as Acute Coronary Syndromes. It is difficult to discriminate against this group of patients, as there are a variety of clinical manifestations. Thus, to minimize this problem, several risk stratification tools have been developed in recent years, such as the Manchester screening system. The study concluded that patients with chest pain have very different levels of severity and the discriminatory power of the Manchester screening system should be used to assess this population[17].

Finally, studies have shown that the implementation of a screening instrument such as the ACCR is related to its ability to organize the demand by prioritizing cases by severity, thus decreasing the chances of a prognosis with negative impacts, resulting from treatment delay [8 , 18.19]. ACCR is based on one of the principles of SUS, equity, which consists of guaranteeing immediate assistance to those who need it most, in this sense one of the impacts to users, related to the use of screening in urgency and emergency, is to assist the client in a more humane and precise, reducing inequalities, that is, although all people have direct access to care, they are not equal in their health demands, thus, they have different needs, and must be treated according to their needs[18].

As a management tool, the implementation of the ACCR, proves to be effective for the bureaucratic issues existing between professionals and users, in which it is structured, a protocol that directs the functioning of the screening of users. Thus, the Ministry of Health chooses the risk classification as a strategy for changing the work of care, management and production of health care, aiming to meet the different degrees of need of users 18. A study pointed out that nurses judge the ACCR as an important device to qualify emergency care. Also highlighting that the Manchester System is organized as an ordering tool in emergency services and values the opportunity for care for patients who have more complex and risky clinical conditions[18].

The risk classification has an impact on support for assistance, admission and discharge from the hospital emergency department, being indicated as an instrument for ordering the flow of patients, according to the severity criterion. In addition, the risk classification is an instrument that organizes the work of the emergency service, with reference to the work of nurses in the risk classification, these professionals perform the clinical management of patients, organize the nursing team, the resources and materials of the service [19].

It is worth noting that despite the repercussions and positive impacts on the implementation of ACCR in urgent and emergency services, the studies indicate challenges, limitations and difficulties. The physical structure of many urgent and emergency services is still not adequate to the ACCR's proposal [18,19]. The adequacy of the environment and interventions focused on the structure and organization of the emergency service are necessary for efficient patient care in the risk classification[19].

In addition, many users do not understand the logic of the ACCR, which can contribute to users' dissatisfaction and questioning, as well as overcrowding of services, impairing the care of cases considered critical1[8,20]. A study also points out the question of the dimensioning of nurses to perform the risk classification. Nurses face an excess of demand to prioritize care for patients who seek urgency. The inadequacy of the number of nurses and other professionals in the emergency services in view of the excessive demand and conflicts resulting from the prioritization of care have been considered as factors that generate wear and emotional overload of the emergency professionals [19].

The studies also highlight the need for training professionals, especially nurses, for the proper use of the screening instrument. Periodic training is necessary to use classificatory protocols, since the training aims at the knowledge and identification of patients' needs in carrying out the risk classification[18,19].

V. FINAL CONSIDERATIONS

The RIL showed that many emergency care services live in long queues, overloaded, where the failure to distinguish the degree of risk of users generates several consequences, among them, the most damaging is the one that evolves to the worsening of the clinical condition of the user or even death, due to lack of assistance in a timely manner. In this sense, the Ministry of Health has been investing in devices such as the ACCR to enhance health care, the management of human and material resources.

The Reception with Risk Classification emerges as a device of the PNH in order to strengthen the principles of SUS, especially equity. Through institutionalized protocols, such as the Manchester protocol, it is intended to welcome, decide and resolve user demands in an emergency to avoid as little as possible the aggravation of their clinical condition, establish goals, organize the flow, enhance the work of the team multiprofessional, generating user, team and institution satisfaction.

It is known that the use of a triage system in emergency services generates positive results, as studies have well explained, but this process presents challenges and limiting factors that need to be considered in order to establish strategies to mitigate negative repercussions or to prevent the achievement of established goals. Studies have shown that users have insufficient knowledge about the logic of risk classification, in this sense it is essential to develop health education strategies in the various points of the network, be it primary, secondary and in the emergency room in order to make the user active in the process, this can mean a more informed population, reflecting on a respectful relationship between professionals and users, searching for other points of health care, with repercussions on reducing the lines of highly complex services.

It also highlights the need for permanent education of health professionals, for the appropriation of screening protocols, the essential scientific and technical knowledge in clinical judgment, as well as the constant reflection of the work processes that involve welcoming in urgency and emergency. The implementation of the ACCR is a constant construction and what is expected is that this device will enhance health care, broaden the scope of possibilities within the multiprofessional team, strengthen the principles of SUS and contribute to the resolution of the various impasses within health services. urgency and emergency.

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Analysis of legal responsibility for natural radioactive anomaly in the wild semi-arid region of Pernambuco

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Abstract**—***High concentrations of uranium-238 (^{238}U) and thorium-232 (^{232}Th) were found in rocks of the natural radioactive anomaly existing in the cities of Pedra and Venturosa located in the State of Pernambuco. The studies were carried out in a technical partnership between the former company NUCLEBRÁS and CPRM, in 1975. After exhaustive prospecting studies, the anomaly was considered economically unfeasible for mining. Although the anomaly was considered economically unviable, the inhabitants of the municipalities of Pedra and Venturosa are subject to high levels of natural radiation. In Brazil, the exploration of radioactive ores is the responsibility of the Union, and the National Nuclear Energy Commission (CNEN) is responsible for the management of such resources, with the Nuclear Industries of Brazil (INB) being responsible for mining activities. In CNEN regulations there are no radiological protection measures that must be adopted in the case of natural radioactive anomalies considered economically unfeasible. Thus, and within this context, the present study aimed to research, within the scope of Brazilian legislation, the legal responsibility for the natural radioactive anomaly of the cities of Pedra and Venturosa. For that, a bibliographic review search was used in the specialized literature. The results obtained showed that, legally, CNEN is responsible for the natural radioactive anomaly located between the cities of Pedra and Venturosa, and, therefore, it must adopt mitigation measures of radiological protection in the area where the anomaly is located.*

Keywords**—Law, Nuclear Law, Radioactive ores, Radioecology**

I. INTRODUCTION

In the state of Pernambuco there is one of the largest radioactive anomalies in Brazil, which is located between the cities of Pedra and Venturosa, in the region of Agreste Semiárido. The mineral prospecting research carried out by the former company NUCLEBRAS, in 1975, in partnership with CPRM, in the municipalities of Pedra and Venturosa, initially showed that the extraction of uranium ores was economically viable in the area that includes these municipalities, however, more detailed studies concluded that the depth of the deposit was shallow, which made its exploration unfeasible [1]. However, from the point of view of radioecological protection, this is very important, since mineral exploration works spread natural radioactive materials on two milk producing farms in the municipalities of Pedra and Venturosa. These materials are still in their respective locations until today. It is stated in Brazilian laws that the issue of the nuclear fuel cycle starts from the mining of uranium ores to the production of nuclear energy in the plants, with the Union having a monopoly on nuclear activities in Brazil. The exploration of radioactive ores in Brazil is also linked to mining law and the existing rules in the Mines Code must be observed [2]. Thus, there is an

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expectation that the Union will also be responsible for radioactive anomalies considered economically unviable, as is the case of that existing in the municipalities of Pedra and Venturosa.

Brazil is one of the most cited countries when it comes to the environment. The country has sought to balance its need for socio-economic growth with environmental requirements, being aware that environmental issues are of global interest, demanding, even from other countries, a transparent and competent attitude towards the environment. Article 225 of the Federal Constitution of Brazil establishes that "everyone has the right to an ecologically balanced environment, a good for the common use of the people and essential to a healthy quality of life, imposing on the Public Power and the community the duty to defend it and preserve it for the present and for future generations"[3]. Article 225 of the Federal Constitution of Brazil also covers the Brazilian nuclear issue, from the mineral exploration of uranium to the decommissioning of nuclear plants. All nuclear activities must be carried out in such a way that there is unrestricted preservation of the environment in all biotic and abiotic aspects, including preserving the human being from undue exposure to radiation. Exposure to radiation from natural radioactive anomalies considered economically unviable is also covered by the constitutional text.

Natural radioactive anomalies considered economically unviable need to be assessed within the context of radiological protection, considering all radioecological aspects. In natural anomalies, radioactive elements are associated with materials such as rocks and soils that are known in the specialized literature as NORM (Naturally-Occurring Radioactive Materials). However, in these materials, the concentrations of natural radionuclides vary widely, depending on their origin. The high concentrations of natural radioactive elements in materials expose humans to the risks of the effects of ionizing radiation. The municipalities of Pedra and Venturosa located in the AgresteSemiárido region of Pernambuco, currently have the largest natural radioactive occurrence in the state. Studies have shown that the inhabitants of the municipalities of Pedra and Venturosa are subject to high levels of natural radiation, significantly increasing the risk of cancer in the local population [4].

When a given population is exposed to radiation from natural anomalies considered economically unviable, strict laws are needed to deal with the issue of environmental radiological protection, especially when it comes to mitigating the possible effects caused on humans. The National Nuclear Energy Commission (CNEN) does not have in its normative measures measures that must be adopted for radiological protection in natural radioactive anomalies considered economically unfeasible. As a regulatory and supervisory body, CNEN should include in its normative provisions, monitoring studies in areas with natural radioactive anomalies, but which do not have economic interests. In the 1988 Constitution it is written that the monopoly, research and mining of nuclear ores and derivatives is a competence of the Union. INB (Nuclear Industries of Brazil), a company controlled by CNEN, is responsible for the exploitation of uranium, from mining and primary processing to the production and assembly of the fuel elements that power the nuclear reactors [2].

There should be normative provisions at CNEN that legislate about the possibility of creating remediation processes in areas with radioactive anomalies considered not economically viable. Depending on the situation of each anomaly, radioactive ores could be removed from the site and taken to a uranium processing unit, or more viable remediation processes could be established for each location. In 2015, 195 countries agreed that they can change the world for the better. This is being done by bringing together their respective governments, companies, media, higher education institutions and local NGOs to improve the lives of people in each country, by the year 2030. For this purpose, the so-called Sustainable Development Goals (SDGs) were created. which includes the protection of the environment and the protection of people. So, adopting mitigation measures in areas with natural radioactive anomalies considered economically unfeasible, means protecting the population's health against possible harmful exposures of ionizing radiation.

Therefore, and within this context, the present study aimed to investigate the Brazilian law, the legal responsibility of Organs competent bodies in relation to the mitigating measures that must be adopted in the area where there is a natural radioactive anomalous occurrence in the municipalities of Pedra and Venturosa, aiming to mitigate the effects caused by ionizing radiation in the local population.

II. METHODS

In the present work, the methodology of bibliographic survey in the specialized literature was used, with an emphasis on more general nuclear questions about radioecological research and nuclear legislation, focusing on natural radioactive anomalies considered economically unfeasible, specifying the case of natural radioactive anomaly existing in the municipalities from Pedra and

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Venturosa, located in the wild semi-arid region of the state.

III. RESULTS AND DISCUSSION

3.1 Main radioactive anomalies in the world

In the last few years, concern about the exposure of man to natural radioactivity has been growing. The natural radioactive series of ^{238}U and ^{232}Th and their decay products, as well as ^{40}K, contribute significantly to the increase in human exposure to natural radiation [5]. Materials that contain in their composition, these radioactive elements and their decay products, are named in the scientific literature of NORM. The term NORM is an acronym for naturally occurring radioactive material (Naturally Occurring Radioactive Material), which includes all natural radioactive elements found in the environment [6]. In the magazine Applied Radiation and Isotopes, in volume 49, number 3 of March 1998, entitled, Naturally Occurring Radioactive Natural in the Environment, topics related exclusively to the problem of natural radionuclides and their consequences for man and the environment were addressed. Several symposia and congresses have been held around the world with the purpose of discussing topics related to natural radionuclides. Of these, the symposium held in Amsterdam, the Netherlands, from September 8-10, 1997, stands out. This Symposium was entitled, International Symposium on Radiological Problems with Natural Radioactivity in the Non-Nuclear Industry. It was divided into six sessions, with different topics that mainly addressed topics related to regulation and legislation regarding natural radionuclides [7].

Countless countries, including Brazil, carry out studies on the concentrations of natural radioactive elements in biotic and abiotic systems, aiming to protect human beings from the harmful effects caused by radiation. Concern about the risks of increasing exposure to natural radioactivity is also present in Brazil. As determined by the National Nuclear Energy Commission (CNEN), the Institute of Radioprotection and Dosimetry (IRD) has been coordinating, since 1996, a very broad research program to assess the extent of the problem in the country (especially in the mineral sector), to define priority lines of research and propose action strategies based on the results obtained. In a broader sense, these results guarantee protection for workers in the sectors involved and the population in general. To broaden the discussion on the topic of natural radioactivity in the country, the IRD held in Buzios, Rio de Janeiro, in 2007, the Symposium entitled: The Natural Radiation Environment 8th International Symposium (NRE VIII) [8].

Locations with high amounts of natural radionuclides are called by the scientific literature of anomalous regions. Dosimetric, radiobiological and epidemiological studies have been carried out in residents of areas considered to be typically anomalous in Brazil, India, China, Iran, Austria, Sudan, United States, Canada and other countries [5].

In Brazil, the main anomalous areas are those associated with the natural occurrence of uranium and thorium. In the states of Espírito Santo, Rio de Janeiro and Minas Gerais, the main thorium anomalies are associated with monazitic sands [5]. The city of Poços de Caldas, in Minas Gerais, is located under an alkaline intrusion with high levels of uranium and thorium [9]. In Caetité, Bahia, Itataia in Ceará and Espinhara in Paraíba, uranium anomalies are associated with high concentrations of U_3O_8[8]. Brazil has the seventh largest uranium geological reserve in the world, with approximately 309,000 tons of U_3O_8[8]. Research on the concentrations of U_3O_8 in the amphibolytic calcio-silatic rocks existing in the cities of Pedra and Venturosa, located in the so-called “Milk Basin” of the state of Pernambuco, revealed a maximum value of 22,000 $mg.kg^{-1}$[1]. In addition to the element uranium, these studies also showed that the average concentration of ThO_2 in the rocks of these municipalities was approximately 100 $mg.kg^{-1}$[10].

Studies have shown that ^{238}U, ^{232}Th, its decay products and ^{40}K are found in the soil, due to the weathering of the rock that contains these radionuclides [11] [12]. Once in the soil, these elements are easily absorbed by plants, reaching animals and then man [12]. When ingested or inhaled by humans, natural radionuclides are incorporated into a specific organ, which can generate various malignancies, including the most fearful of all, cancer. Due to the fact that the municipalities of Pedra and Venturosa are located in the region with the highest dairy cattle production in the state of Pernambuco, the consumption of milk and dairy products is an important way of incorporating natural radionuclides into the local population. Studies carried out on dairy farms in the municipalities of Pedra and Venturosa, showed that the consumption of milk and dairy products is the primary route for the intake of natural radionuclides by the local population [4].

3.2. The radioactive anomaly in the AgresteSemiárido region of Pernambuco

In 1975, the former company NUCLEBRAS (Brazilian Nuclear Companies) and MRRC (Mineral Research and Resources Company) carried out geological

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studies in the Northeast region of Brazil, and identified 263 natural radioactive anomalies, however, only one of them presented high concentrations uranium and thorium [13]. In the years 1977 and 1978, the former NUCLEBRAS carried out a new geological survey and profiling project that became known as the Venturosa Project - Assessment of areas [13]. These studies identified high levels of uranium and thorium in rocks existing in an area of dairy farms in the municipalities of Pedra and Venturosa, near the Ipanema River. Maximum U_3O_8 values of 22,000 ppm and 100 ppm of ThO_2 were found in the rocks of the region [10].

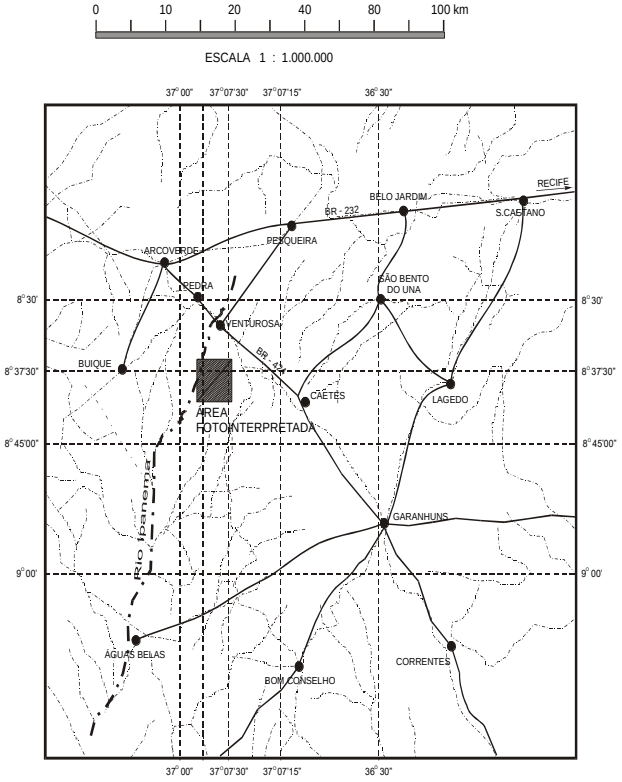

Fig 1. Map of the area delimited for study (photointerpreted area).
Source: Silva et al. (2004).

In 1986, the Venturosa Project was reevaluated, and georadiological research was resumed with the purpose of evaluating the economic viability of the primary exploration of uranium mineralizations[14]. In 1988, photointerpretation studies were carried out on an area of 100 km^2 in the municipality of Venturosa (Figure 1), and also in its surroundings, where an area of approximately 20 km^2 was delimited, which houses the main primary uranium mineralizations of the municipality [13]. In this area are located the main farms producing milk and dairy products in the municipalities of Pedra and Venturosa, being the object of study of this research.

Figures 2 and 3 show outcrops of rocks containing uranium and thorium ores in dairy farms in the municipalities of Pedra and Venturosa, respectively. Figure 4 shows cattle ranching and planting forage palm on a farm in Venturosa.

Fig 2. Rocks containing uranium ores in the municipality of Pedra.
Source: Silva and Costa Júnior (2019).

Fig 3. Rocks containing uranium ores in the municipality of Venturosa.
Source: Silva and Costa Júnior (2019).

Fig 4. Cattle breeding and planting of forage palm on a farm in Venturosa.
Source: Silva and Costa Júnior (2019).

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3.3. Radioecological studies carried out in Pedra e Venturosa

Researchers from the Nuclear Energy Department (DEN) of the Federal University of Pernambuco (UFPE) carried out several studies on the natural radioactive anomaly located between the cities of Pedra and Venturosa in Pernambuco. They analyzed biotic and abiotic samples, and many scientific data on the area were published in different national and international journals. From the radioecological point of view and the environmental radiological protection, the natural radionuclides ^{226}Ra, ^{228}Ra and ^{210}Pb were considered the most important.

3.3.1. Natural radionuclides in rocks and soils

The first studies on the presence of natural radionuclides in rocks and soils from the radioactive anomaly of Pedra e Venturosa were carried out by Santos Júnior [15]. According to this author, the amphibolytic calcium-silicate rocks, a type of rock existing in the region, showed concentrations of uranium-238 (^{238}U) and radio-226 (^{226}Ra) ranging from 16,567 to 95,980 Bq.kg^{-1} and 14,018 to 83,567 Bq.kg^{-1}, respectively. In the case of soil, the concentrations of uranium-238 (^{238}U) and radio-226 (^{226}Ra) ranged from 22 to 268 Bq.kg^{-1} and 14 to 367 Bq.kg^{-1}. In another study, Santos Júnior et al. [16] determined concentrations of radium-228 (^{228}Ra) in soil samples, ranging from 73 to 429 Bq.kg^{-1}.

Soils contaminated with monazitic sand processing residues in the state of São Paulo, presented concentrations of ^{228}Ra and ^{226}Ra ranging from 153 to 33,000 and from 50 to 6,500 Bq.kg^{-1}, respectively [17]. In these soils mitigation measures were adopted for remediation. It is observed that some values of the concentrations of ^{228}Ra and ^{226}Ra in soil samples from the radioactive anomaly of the cities of Pedra and Venturosa are within the range of values determined by Lauria and Rochedo[17]. This indicates that a more detailed study would be necessary to verify the possibility of mitigation measures for remediation in the soils existing in the locality of the radioactive anomaly of the Pernambuco and Pedra de Venturosa cities.

In the studies carried out by Silva et al. [18], high concentrations of radioactive lead (^{210}Pb) were determined in samples of rocks and soils from the radioactive anomaly of Pedra e Venturosa, whose values ranged from 3.2 to 201 kBq.kg^{-1} and 195 to 86,400 Bq.kg^{-1}, respectively. The big problem with the ^{210}Pb element is that, in addition to being radioactive, it is also quite toxic to animals, plants and humans.

3.3.2. Natural radionuclides in forage plants

The mechanism of incorporation of natural radionuclides in forage plants varies considerably. In natural conditions, ^{226}Ra is transported directly from the soil to the roots [9]. On the other hand, the presence of ^{210}Pb in forage plants is mainly due to the natural fallout of ^{222}Rn [19][9]. Forage plants efficiently absorb natural radionuclides. Studies carried out on dairy farms in the cities of Pedra and Venturosa, show that forage palm (*Opuntia ficus-indica*), bufell grass (*Cenchrus ciliares*) and elephant grass (*Pennisetum purpureum*) consumed by dairy cows, absorbed high amounts of ^{226}Ra (SILVA et al., 2004), ^{210}Pb [18] and ^{228}Ra [20].

3.3.3. Natural radionuclides in milk and dairy products

Natural radionuclides are efficiently transferred from forage plants to cow's milk [21][22]. Scientific studies that address the presence of natural radionuclides in fresh cow's milk samples coming directly from producing farms are quite scarce in the specialized literature. In the samples of milk and fresh products collected in the farms producing the cities of Pedra and Venturosa, concentrations of ^{226}Ra [23] [24], ^{210}Pb [25] and 228Ra [26].

3.3.4. Natural radionuclides in the human body

The transfer of ^{226}Ra, ^{228}Ra and ^{210}Pb in the soil-forage-milk-plant system is one of the main internal exposure routes in man, due to the consumption of milk and dairy products [27].

^{226}Ra and its decay products are responsible for the largest fraction of the internal dose received by man, due to natural sources. When ingested or inhaled, their decay products offer a high potential risk to human health and may induce the appearance of cancer [28].

^{228}Ra is an element of great radioecological interest, as, like ^{226}Ra, it is present in water and food eaten by humans. Radium is an element chemically similar to calcium and accumulates mainly in the human skeleton. Ingestion of radium can induce the appearance of sarcoma in the bones [29].

A high incidence of bone cancer was found in women who painted watch faces with luminescent paint composed of ^{226}Ra and ^{228}Ra, in the period from 1913 to 1926. These people tuned the brush with their tongue, thus ingesting the radio isotopes [30]. Postmortem studies, carried out on the bones of these women, showed several types of sarcomas in their skeletal structures [29].

Food intake is recognized as the most important route of contamination with ^{210}Pb in man [31]. Once ingested, this radionuclide is deposited in the liver and

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bones, and can induce various types of health damage. ^{210}Pb is preferred to deposit in the trabecular and cortical bones [31]. Approximately 70% of the ^{210}Pb present in the human body is deposited in the bones, the rest being distributed in the soft tissues [31]. The accumulation of ^{210}Pb in the bone occurs through ion exchange between Pb^{+2} and Ca^{+2}, hence the metabolic similarity of lead with calcium in the body, although the metabolic mechanisms are not necessarily identical [32]. Environmental radioprotection studies carried out by Silva et al. [4] and Silva and Costa Júnior [20] showed that the systematic intake of milk and derivatives containing ^{226}Ra and ^{228}Ra, by the population of the cities of Pedra and Venturosa, considerably increases the concentrations of these elements in the bones, resulting in an increased probability the occurrence of sarcoma and osteosarcoma.

3.4. Analysis of nuclear damage

After different radiogeological studies carried out by the former company NUCLEBRAS on the natural radioactive anomaly existing in the cities of Pedra and Venturosa, it was found that, from the point of view of uranium exploration, it was economically unfeasible. However, no study has been carried out to verify the presence of radioactive elements in the food chain of the local population. Thus, no study has been carried out to verify the population's exposure levels to natural radiation. The arguments presented in items 3.3.1 to 3.3.4 lead us to a discussion about the possibility of expanding the legal questions about the nuclear damage caused by natural radioactive elements.

In Brazil, nuclear damage is associated only with nuclear activities, since all activities that use nuclear energy are classified as dangerous and have imminent risks of accidents. Thus, the concept of nuclear damage does not include damage caused by NORM (Naturally-Occurring Radioactive Materials) - Naturally Occurring Radioactive Materials to humans, which automatically excludes all natural radioactive occurrences. However, item d) of paragraph XXIII of article 21 of the 1988 Constitution [3] says that: "civil liability for nuclear damage does not depend on the existence of guilt". This truly opens up the range of discussions on third party liability for nuclear damage. Since the population of Pernambuco's cities of Pedra and Venturosa is exposed to high levels of NORM, who is responsible, in this case, for the legal responsibility for nuclear damage?

Law No. 6,453, of October 17, 1977, provides for civil liability for nuclear damage and criminal liability for acts related to nuclear activities [33]. This law defines nuclear damage:

Article 1 - For the purposes of this Law, it is considered:

(...)

VII - "nuclear damage" means the personal or material damage produced as a direct or indirect result of the radioactive properties, their combination with the toxic properties or with other characteristics of the nuclear materials, which are in or derived from a nuclear installation. sent;

Law No. 6,453 / 77 is also specific on civil liability for nuclear damage:

Art. 4 - Civil liability for the repair of nuclear damage caused by a nuclear accident will be exclusive to the operator of the nuclear installation, under the terms of this Law.

Analyzing the entire Law No. 6,453 / 77, it was found that there was no civil liability for damages caused by exposure to radiation from naturally occurring radioactive anomalies, and which mitigating measures should be adopted for these cases.

Law No. 4118/62 [34] gave CNEN the responsibility for exploring the ore and nuclear material existing in the Brazilian territory. Currently, CNEN's competences are supported by Law 7781/89 (BRASIL, 1989), which still includes its responsibility for all radioactive minerals existing in the national territory. CNEN's subsidiary, INB is responsible for the exploitation of uranium, from mining and primary processing to the production and assembly of the fuel elements that power the reactors of the nuclear plants. INB also acts in the area of physical treatment of heavy minerals with the prospecting and research, mining, industrialization and commercialization of monazitic sands and obtaining rare earths (JORGE, 2014).

The Federal Constitution of 1988 [3] was very specific in the matter of the Brazilian Nuclear Program, and mainly in the exploration of the existing nuclear ores in the national territory:

Art. 21. The Union is responsible for:

(...)

XXIII - explore nuclear services and installations of any nature and exercise a state monopoly on research, mining, enrichment and reprocessing, industrialization and trade in nuclear ores and their derivatives, in compliance with the following principles and conditions:

a) all nuclear activity in national territory will only be admitted for peaceful purposes and with the approval of the National Congress;

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b) under permission, the marketing and use of radioisotopes for research and medical, agricultural and industrial uses are authorized;

c) under permission, the production, commercialization and use of radioisotopes with a half-life of two hours or less are authorized;

d) civil liability for nuclear damage does not depend on fault;

177. The Union's monopoly consists of:

(...)

V - research, mining, enrichment, reprocessing, industrialization and trade in nuclear ores and minerals and their derivatives, with the exception of radioisotopes whose production, commercialization and use may be authorized under permission, in accordance with paragraphs b and c of item XXIII of the caput of art. 21 of this Federal Constitution. (Wording given by Constitutional Amendment nº 49, of 2006).

Therefore, legally, CNEN is responsible for all natural radioactive anomalies existing throughout the National Territory, including those considered economically unviable, as is the case with the anomaly in the Pernambuco and Pedra de Venturosa cities. Thus, it is the responsibility of CNEN to adopt mitigation measures to remedy or remove the NORM existing on the dairy farms in the cities of Pedra and Venturosa. In addition, according to the law, CNEN itself must be held legally liable for any damages caused to third parties resulting from exposure to natural radiation. Therefore, as a regulatory body for nuclear activities in Brazil, CNEN must create a regulation that legislates on what measures should be adopted in relation to natural radioactive occurrences that have high levels of NORM, including those considered economically unviable.

IV. CONCLUSION

Based on Brazilian laws, the National Nuclear Energy Commission (CNEN), through its subsidiary Nuclear Industries of Brazil (INB), is responsible for the radioactive anomaly that exists in the cities of Pedra and Venturosa, both located in the Agreste Semiarid Region of the State.

CNEN is responsible for establishing mitigation measures for the remediation or removal of NORMs from the area where the radioactive anomaly of the cities of Pedra and Venturosa is located.

CNEN must create a norm of standard procedures that must be applied specifically to cases of natural radioactive anomaly, to avoid third party exposure to high levels of radiation.

CNEN should be responsible for the nuclear damage eventually caused to third parties who are exposed to radiation from natural radioactive anomalies.

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Influence of Different Distances of Pecking Motion on Cyclic Fatigue Resistance of Reciproc Blue Files

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Abstract**—** *The aim of the present study was to evaluate the influence of different distances of pecking motion (in-and-out axial movement) on the cyclic fatigue of Reciproc Blue files (VDW, Munich, Germany). Forty-two instruments were subjected to a dynamic cyclic fatigue test using a stainless-steel artificial canal with a 69° angle and 2.5-mm radius of curvature in a custom-made device that allowed the instruments to rotate freely inside the simulated curved canal in a reciprocating movement with different distances of pecking motion until fracture occurred. Fourteen instruments were tested in each group at three different pecking depths at a constant pecking speed of 2.5 mm/s: G(2.5): 2.5-mm depth, G(5.0): 5-mm depth, and G(7.5): 7.5-mm depth. The time to fracture and the number of cycles to fracture (NCF) were recorded. Data were analyzed using analysis of variance (ANOVA) followed by the post hoc Tukey test, with a significance level of 5%. The fracture surface of the fragments was examined by scanning electron microscopy. The results demonstrated that the time to failure and NCF significantly increased as the pecking distance increased. The mean time to fracture and NCF were significantly lower in G(2.5) compared to the G(5.0) and G(7.5) groups ($P < 0.001$). There were no statistically significant differences in the parameters between G(5.0) and G(7.5) ($P > .05$). The results show that different distances of pecking motion can significantly extend the life span of rotary files. Appropriate pecking motions in the root canals are recommended to prevent the breakage of nickel-titanium rotary instruments.*

Keywords**—Dynamic cyclic fatigue resistance. Instrument fracture. Nickel-titanium. Pecking motion. Reciproc Blue.**

I. INTRODUCTION

Despite the advantages of nickel-titanium (NiTi) instruments, metal fatigue and subsequent breakage of rotary engine-driven files represent a potential problem during root canal instrumentation. NiTi files have been shown to fracture due to torsional failure or cyclic fatigue (KIM et al., 2012; PEDULLA et al., 2016; SILVA et al., 2018). Torsional fracture occurs when the tip of the instrument is locked in the canal while the shaft continues to rotate (WALIA et al., 1988; LOPES et al., 2011). Cyclic fatigue is the result of repeated compressive and tensile stresses accumulated at the point of maximum flexure in a curved canal, causing the metal's structure to break down and ultimately leading to fracture (PRUETT et al., 1997; PARASHOS et al., 2006).

The cyclic fatigue resistance of NiTi instruments increases significantly when operated in reciprocating motions compared to continuous rotation (PEDULLA et al., 2013). Furthermore, heat treatment of these instruments significantly improves their flexibility and resistance to fatigue (ZINELIS et al., 2007; GENERALI et al., 2019). Reciproc Blue NiTi reciprocating files undergo a specific thermal treatment that results in a visible thin blue titanium oxide layer on the surface of the files and increases flexibility and cyclic fatigue resistance (PLOTINO et al., 2014; DE DEUS et al., 2017).

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Although some studies do not take into consideration the impact of environmental temperature in fatigue tests, it has been shown that an increase in temperature significantly influences the cyclic fatigue behavior of NiTi instruments (PLOTINO et al., 2018; DE VASCONCELOS et al., 2016; DOSANJH et al., 2017). Tests performed at simulated body temperature reproduce the real behavior of instruments under clinical conditions. The manufacturers of NiTi instruments recommend their use with back-and-forth axial movement in the root canal. These movements during instrumentation give the instrument a longer time interval before it once again passes through the highest stress area and increases the time until fracture occurs (DEDERICH et al., 2017). Dynamic cyclic fatigue tests simulate the pecking motion performed by the operator under clinical conditions (ZUBIZARRETA-MACHO, et al., 2019).

The aim of the present study was to evaluate the influence of different distances of pecking motion on the dynamic cyclic fatigue of Reciproc Blue files at body temperature in simulated curved canals. The null hypothesis is that the distance of pecking motion does not significantly affect the time to failure or the number of cycles to fracture (NCF) of endodontic reciprocating instruments.

II. MATERIALS AND METHODS

The sample size was calculated a priori with the G*Power 3.1.9.2 software (Heinrich-Heine-Universität Dusseldorf, Dusseldorf, Germany). Three groups (n=14) were formed to obtain a power of 80% and an alpha error probability of 0.05. Fourteen instruments per group (G) were tested at three different pecking depths (in-and-out movement): G(2.5) 2.5-mm depth, G(5.0) 5-mm depth, and G(7.5) 7.5-mm depth. A constant back-and-forth speed of 2.5 mm/s was used in all groups. Under an optical microscope (Alliance, São Carlos, SP, Brazil), each instrument was inspected at 25x for defects or deformities before the experiment and none of them was discarded.

Forty-two Reciproc instruments (Reciproc Blue R25) with a .08 taper and 25 mm in length were tested in a simulated canal, notched in the stainless-steel metal block. The canal was 24.8 mm long and 3.5 mm deep, with a straight cervical segment of 9.0 mm, 2.5 mm radius of curvature, 69° angle of curvature, a curved 2.15-mm long segment, and a straight apical segment of 13.3 mm. The canal was 2.0 mm wide in the widest coronal portion, tapering to 1.0 mm in the narrowest apical portion (Figure. 1). The canal was covered with an acrylic plate to prevent the instruments from slipping out and to visualize the rotating files. A synthetic oil (Super Oil, Singer Co Ltd, Elizabethport, NJ) was applied to reduce friction of the file as it touched the artificial canal walls.

A customized dynamic cyclic fatigue testing device was used in this study. A stainless-steel metal block with the artificial canal was positioned vertically on a hotplate stirrer (Fisatom, São Paulo, SP, Brazil). The temperature inside the simulated canal was measured with a laser thermometer (MT-320 Minipa, Joinville, SC, Brazil) and was kept constant at 36 ± 1oC. The temperature inside the canal and synthetic oil was controlled with a digital infrared laser thermometer (Qingdao Tlead International, Shandong China) pointing into the canal. This temperature confirmation was performed for each file to be tested.

The instruments were coupled to a 6:1 reduction handpiece (Sirona Dental Systems GmbH, Bensheim, Germany), which was aligned to the axis of the artificial canal and powered by a torque-controlled motor (Silver Reciproc; VDW, Munich, Germany) using the preset program ‘‘RECIPROC ALL’’ as recommended by the manufacturer. The handpiece was fixed in a mobile unit powered by an electronically controlled servomotor (SAVOX SC-12 56T69; Savox, Taichung, Taiwan) to allow a precise and reproducible continuous up-and-down pecking movement of each file inside the artificial canal.

The instruments were inserted 22 mm into the simulated canal; a silicone stop was placed on each instrument to ensure that depth. The mechanical system of axial movement was activated and immediately exerted a retraction movement of 2.5 mm (G-2.5), so that the file was inserted 19.5 mm in the metallic canal (initial position), immediately the file started the axial movement 2.5mm forward and 2.5 back, simultaneously the instrument started the reciprocating movement. For the G-5.0 and G-7.5, the mechanical system exerted 5.0 or 7.5 mm of retraction movement, respectively, so that the file was inserted 17 mm or 14.5 mm deep in the canal (starting position), respectively, and started a 50 mm forward and 5.0 mm backward on the G-5.0 and 7.5 mm forward and 7.5 mm backward on the G-7.5.

To ensure accurate analysis of the time to fracture, video recording was performed simultaneously to determine the time (in seconds) from the beginning of instrument rotation to the exact time when fracture occurred. The NCF for each instrument was calculated by multiplying the time to failure (seconds) by the rotational speed (rpm), divided by 60. A rotational speed of 300 rpm was used following the manufacturer’s instructions. For each instrument, the time to fracture was recorded and the

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experiment was interrupted when fracture was detected visually and/or audibly.

The fractured surfaces were analyzed under a scanning electron microscope (6360LV Scanning Electron Microscope; JEOL, Tokyo, Japan). The instruments were arranged horizontally to identify plastic deformation, and the cross-sectional area of the fractured segment was analyzed to verify the fracture pattern of the instruments in each group.

Statistical analysis

The NCF and time to failure were compared between groups by one-way analysis of variance followed by the post hoc Tukey test (SPSS for Windows 19.0; SPSS Inc., Chicago, IL), adopting a significance level of 5%.

III. RESULTS AND DISCUSSION

The mean time to fracture is shown in Table 1. The statistical tests showed a significant difference in fracture time when different pecking distances were used. The time to fracture increased with increasing pecking distance. The cyclic fatigue resistance was significantly lower in G(2.5) compared to the other groups, with a mean of 32.5 seconds ($p < 0.001$). No significant difference was found between G(5.0) and G(7.5), which exhibited a mean time to fracture of 46.29 and 48.43 seconds, respectively.

The mean NCF values are given in Table 2. No significant difference was found between the two groups with longer pecking depths [G(5.0): 231.43 cycles and G(7.5): 242.14 cycles]. However, the NCF was significantly lower for the short pecking depth [G(2.5)], with a mean number of cycles of 162.5 ($P < 0.001$).

Scanning electron microscopy analysis

The SEM images of the fracture surfaces showed similar and typical features of cyclic fatigue, including ductile morphological characteristics on the fractured surfaces of all instruments and no plastic deformation in their helical shafts (Figure 2).

When NiTi rotary and reciprocating instruments are introduced into a root canal, an in-and-out axial movement is required to prevent locking of the file tip and torsional breakage (PALMA et al., 2019). The amplitude of an individual pecking motion may vary from professional to professional with load variations. The present results indicate that the pecking distance (in-and-out movement) is another factor that determines the resistance of rotary NiTi instruments to cyclic fracture, as well as temperature and angle of curvature.

In this study, an artificial canal with a radius of curvature of 2.5 mm and a severe (SCHEINEIDER, 1971) curvature angle of 69° in the cervical region was used, simulating a condition that can be found in clinical practice (CONSTANTE et al., 2007). Constante et al observed that, although most mesiobuccal canals of mandibular molars are curved in the middle third of the root, the same proportion was found in the cervical and apical regions of the samples (24.64%). Estrela et al evaluated 1,200 root canals using CBCT and found that 73.25% had a curvature in the cervical third on coronal images.

The fatigue resistance of the files decreases as the environmental temperature increases (PLOTINO et al, 2018; DE VASCONCELOS et al, 2016). According to Hulsmann et al, fatigue resistance tests conducted at room temperature should be avoided. In the current study, dynamic cyclic fatigue of the instruments was tested at temperature 36 ± 1oC, considering intracanal temperature 35°C ± 1°C and body temperature of 37°C ± 1°C (DE VASCONCELOS et al., 2016; DE HEMPTINNE et al., 2015).

To better simulate clinical situations, axial in-and-out movements with an amplitude of 2.5, 5.0 and 7.5 mm were performed in this study during the cyclic fatigue assessment. Similar studies have used axial movements ranging from 1.0 to 8.0 mm (KIM et al., 2012; DEDERICH et al., 1986; LI et al., 2002; RAY et al., 2007; LOPES et al., 2013; DE DEUS et al., 2014; OZYUREK et al., 2017; KESKIN et al., 2018; TOPÇUOGLU & TOPÇUOGLU, 2017).

The overall results of the present study demonstrated that pecking motion is an important factor to prevent the cyclic fracture of reciprocating instruments in curved canals and indicate that cyclic axial movement may significantly extend the life span of engine-driven files. The time to fracture and the NCF decreased significantly with decreasing pecking distance. Thus, the null hypothesis tested was rejected. The NCF and time to fracture were significantly smaller in G(2.5) compared to the longer pecking distances [G(5.0) and G(7.5)] ($P < 0,01$).

Cyclic fatigue fracture of the file occurs because of repeated compressive and tensile stresses accumulated at the point of maximum flexure in a curved canal (LOPES et al., 2013). Therefore, when longer in-and-out movements are used, the stress is distributed over a broader area throughout the instrument shaft within the curvature of the artificial canal (DEDERICH et al., 1986; LI et al., 2002), a fact that may explain the current results. On the other

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hand, in the case of shorter in-and-out movements, the stresses are concentrated in a small area of the instrument, which reduces the time to fracture and the NCF (DE DEUS et al., 2014).

Despite the inherent limitations of an in vitro study, the results obtained suggest that short back-and-forth movements should be avoided during root canal instrumentation, so that the stresses are not concentrated in a single area of the instrument. A longer pecking distance allows a longer time interval before the instrument once again passes through the highest stress area. This prevents the concentration of tensile and compressive stresses within the curved section, thus promoting stress distribution along a wider portion of the instrument and increasing the NCF (PALMA et al., 2019; LI et al., 2002).

IV. FIGURES AND TABLES

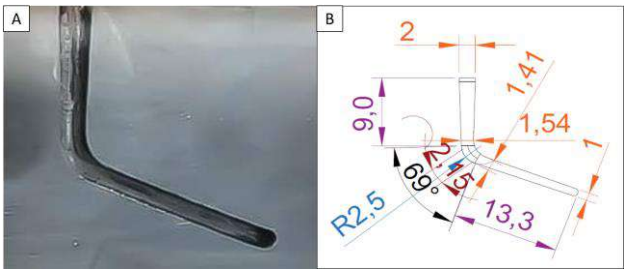

Fig. 1: (A) Stainless steel artificial canal used in the cyclic fatigue tests. (B) Geometric and dimensional characteristics of simulated curved canal.

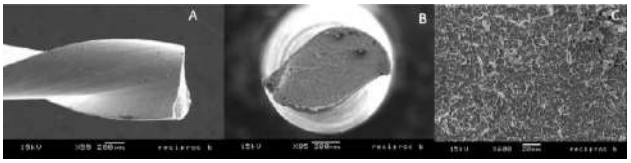

Fig. 2: Scanning electron microscopic analysis of the fractured surfaces of the tested instruments after cyclic fatigue test showing (A) no plastic deformation observed on the helical shaft (original magnification x 55) and (B, C) morphologic characteristics of the ductile type observed at the fractured cross sections (original magnification B x 85 and C x 600).

Table.1: The time to fracture in Seconds (Mean ± Standard Deviation [SD]) of Different Groups with Different Pecking Distances

Distance	Mean	SD	Min – Max	p value
G2,5 mm (n=14)	32.50 a	10.04	17 – 51	<0.001
G5.0 mm (n=14)	46.29 b	11.29	33 - 76	
G7.5 mm (n=14)	48.43 b	10.39	32 – 65	

Max, maximum; Min, minimum; SD, standard deviation.

Different superscript letters in the same column indicate statistic differences among groups (P < .05).

Table.2: The Number of Cycles to Failure (Mean ± Standard Deviation [SD]) of Different Groups with Different Pecking Distances

Distance	Mean	SD	Min – Max	p value
2,5 mm (n=14)	162.50 a	±50.18	85 – 255	<0.001
5.0 mm (n=14)	231.43 b	±56.45	165 - 380	
7.5 mm (n=14)	242.14 b	±51.95	160 – 325	

Max, maximum; Min, minimum; SD, standard deviation.

Different superscript letters in the same column indicate statistic differences among groups (P < .05).

V. CONCLUSION

In conclusion, within the limitations of this study, the results suggest the use of a longer pecking distance during instrumentation of curved canals with reciprocating files. However, further in vitro and in vivo studies are necessary to confirm this suggestion. In addition, it would be necessary to have additional file systems being tested to show the effect of pecking distance is consistent across multiple brands.

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Innovation in the Brazilian Electricity Sector: current scenarios and trends

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Abstract**—** *There are three main trends in the electricity sector in upcoming years: digitalization, decentralization and decarbonization, changes that are an opportunity for utilities to become more profitable through innovation development. In this scenario, the establishment of cooperation networks between large companies of the electricity sector and start-ups may be a solution to foster innovation, and the purpose of this article is to analyse whether this solution may also be suitable for the Brazilian context. In order to discuss and characterize the innovation process in the Brazilian electricity sector companies, a review of the service innovation literature and regarding the role ofstart-ups to innovation generation in the electricity sector was carried out. Furthermore, data from the latest edition of the Brazilian National Technological Innovation Survey (PINTEC) was selected in order to analyse the main characteristics of innovation in the Brazilian Electricity Sector. The results from this article confirms findings from specialized literature that states that service companies have a larger outward degree of innovation development in comparison to inward innovation, which, in turn, confirms the importance of network relationships for companies to gain access to a broad and versatile set of resources for innovation.*

Keywords**— electricity sector; large companies; innovation; start-ups; Brazil.**

I. INTRODUCTION

The service sector can be defined as the set of economic activities that produce time, place, form, and psychological benefits. Thus, the sector involves very distinctive activities, such as personal services, technological services, corporate services, non-profit services, and services for distributing goods and information. Services are different from products, because services are intangible and subject to regulation and production and consumption of services are normally simultaneous (Miles and Metcalfe, 1997; Kon, 2004).

During a long period, the studies of service activities played a secondary role in company performance analyses. As demonstrated by Kon (2004), even traditional entities that classify economic activities, such as the United Nations (UN) and the United States Census Bureau, have differences regarding service sector classification, due to the nature of related activities.

The economic performance analysis in developed and developing countries show a growing importance of the service sector from the end of 20th century, both referring to job generation and added value generation (Calabria et al, 2013; Kubota et al, 2010; OECD, 2005; Burdon *et al.*, 2015). Calabria et al (2013) show evidence of the growing importance of the service sector at the macroeconomic level and its role in the microeconomic dynamics, as recent transformations in industrial structures address to a product/service integration(Howells, 2000). In this sense, Gallouj and Djellal (2010) created a new classification of service activities and discussed the importance of such

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activities for corporate innovation and performance. Calabria et al (2013) claim that a scientific field of study regarding the service sector was created in the 2000s, with contributions to different areas, such as service innovation, management, engineering, design, and marketing. The contributions to the field suggest that value creation in the service sector is done with customers (Chen et al, 2014; Van Riel et al, 2013; Gustafsson et al, 2012; De Vries, 2006). In this context, innovation activity assumes an increasing collaborative nature (Rusanenet al, 2014).

These discussions are important to analyse the strategies of the electricity sector distribution companies (DISCOs), which involve a natural monopoly activity in a regulated public services environment. There are three main trends in the electricity sector in the world in upcoming years: (i) digitalization: new downstream will provide new services and transform the energy supply approach to a service-based model; (ii) decentralization: expansion of renewable energies with intelligent network management and peer-to-peer markets in which consumers are at the centre of the process; (iii) decarbonization: the generation of electricity will continue to be transferred in a constant and continuous form to a more sustainable mix, due to the Paris Agreement (Eurelectric, 2016; Honebeinet al, 2012; Livieratos & Lepeniotis, 2017). Besides that, the diffusion of Distributed Generation (DG) and some recent regulatory and technological changes are introducing a new scenario for market diversification. The fact that consumers may now produce their own energy, becoming producers/consumers or prosumers, sets new challenges for the DISCOs, which may lose part of their income due to customers energy generation, reinforcing the importance of promoting innovations.

The changes that the electricity sector is going through are an opportunity for utilities in the electricity sector to become more profitable, because the development of new forms of innovation allows the appropriation of gains from the operation, and companies want to have a more relevant role for society(Wood, 2016; Butler, 1981; Johnson & Bate, 2003).More innovation development has been repeatedly identified as a common denominator of successful enterprises (Piperopoulos & Scase, 2009; Vaccaro et al, 2010; Borjesson & Lofsten, 2012) In this sense, the establishment of cooperation networks between large companies of the Brazilian electricity sector and start-ups may be a solution to foster innovation. The companies in the electricity sector may also set partnerships with technological parks, incubators, and accelerators, as well as organise competitions and awards for innovative start-ups.

The article analyses innovation characteristics of Brazilian electricity sector companies based on the concept of service innovation and data from results of official statistics. For this purpose, a review of the service innovation literature was carried out to serve as a basis for the study of innovation in the Brazilian electricity sector. In addition, contributions regarding the role ofstart-ups to innovation generation in the electricity sector were presented, with an emphasis on the different ways in which start-up scan contribute to R&D strategies in companies in this sector. Finally, data from the latest edition of the Brazilian National Technological Innovation Survey (PINTEC) were selected in order to analyse the main characteristics of innovation in the Brazilian sector.

The article is divided into five sections in addition to this introduction. The second section briefly exposes the recent results of studies on service innovation and shows how service innovations are related to organisational innovations. The third section presents the role start-ups may play in developing innovations in the service sector and analyses the possible implications of the focus on service innovation for corporate strategies in the electricity sector. The fourth section details the methodology used in the article. The fifth section discusses in detail the main innovation characteristics of the Brazilian electricity sector. The article ends with a conclusion that condenses the main discussion points of this analysis.

II. SERVICE INNOVATION PROCESS

According to OECD (2005), innovation is a continuous process that companies constantly use to enforce changes in products and processes and to search for new knowledge. Innovation can be classified in four types: (i) the implementation of a novel or significantly improved product (good or service); (ii) a new process; (iii) a new marketing method; or(iv) a new organisational method in business practice, organisation of workplace, or external relations (Schumpeter, 1942). The goal is to achieve an increase in productivity and/or commercial performance, materialised in different adaptations related to company demand, such as improvement in the product quality, new positioning, or entrance in new markets, or associated with corporate production capacity.

The innovation process is an idiosyncratic process where firms individually intend to answer to the particularities of their markets or to transform markets from the organisational learning they have accumulated: greater capacities will result in more possibilities to capture opportunities (RICYT, 2001). In order to explain the set of learning efforts that enable different capabilities, Lall

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(1992) and Bell and Pavitt (1993) created a classification of different types of corporate technological learning considering differences on investment mobilization, production, and relationships between firms and the economy.

Most innovation activities in developing countries are related to organisational streamline and modification or improvement of existing technologies(RICYT, 2001). In thiscontext, innovations will tend to be less developed in internal R&D departments within companies and more likely to be acquired form other companies or institutions. Therefore, it is necessary to pay attention to the company's external relations and to the conditions where such relations are built on. Thus, company-specific aspectssuch as lack of specialised, trained personnel or cost of factors, as well as external economic aspects such as raised costs and deficiencies in demand of different sectors, legal factors such as tax regulations or rules will become barriers for innovation (Rajapathirana; Hui, 2018). Barriers may also be established by factors that compose the innovation scenario, such as macroeconomic uncertainty, deficiencies in logistic infrastructure, institutional fragility, lack of social awareness on innovation, and corporate nature of risk aversion, among others(RICYT, 2001). These aspects explain the importance of several instruments of public policies for business and training support (Mazzucato, 2015; Chaminade and Edquist, 2010).

The organisational change is an extremely significant aspect in the innovation process, because it impacts the company's performance and its absorption capacity. Knowledge plays a core role in increasing productivity and economic growth, not only in technology-intensive industrial sectors, but also in traditional manufacturing and in different activities across the service sector(Gallouj et al, 2015; Mina et al, 2014; Hu et al, 2009; Dogdson & Hinze, 2000).

There is an increasing focus on studies and publications on innovation in the service sector (Dotzel, Shankar & Berry, 2013; Ordanini & Parasuraman, 2010; Carlborg, Kindström & Kowalkowski, 2014;Toivonen& Tuominen, 2009).According to Witell et al (2016), specialized literature defines service innovation through an assimilation (Ko& Lu, 2010; Pearson, 1997), demarcation (Hertog et al, 2011; Agarwal & Selen, 2009) or synthesis perspective (Gallouj & Weinstein, 1997; Sundbo, 1997; Drejer, 2004). The demarcation approach defines service innovation as a new or considerably changed service in the company or the introduction of a new or completely changed innovation process for the company(Hertog et al, 2011), which is a good approach to explain innovation in a specific sector, (Witell et al, 2016) such as the electricity sector.

In the service sector, innovation activities tend to be organised less formally and have a more incremental, continuous and less technological nature (Chae, 2012; OECD, 2005). In other words, service innovation activities tend to be more based on exploitation, when companies innovate based on its own resources, than on exploration, when companies search for new resources to innovate.T hese activities may include significant improvements referring to how they are provided, the addition of new functions or features to existing services or the introduction of services. Nonetheless, there is a greater convergence in the *modus operandi* of industry and services, with the interchange of competition, technological, and organisational standards between both these segments: industrial activities are becoming more dependent on intangible inputs, while some service segments are depending more on investments in physical resources such as logistics, transportation, and telecommunications networks (Howells, 2000). These factsmay eventually complicate the identification of service innovations in terms of isolated events.

To define service innovation it is alsoworthwhile to stress the analysis of such activity. A pioneering effort in such direction was made by Soete and Miozzo (1989), who adapted the taxonomy proposed by Pavitt (1984) to industrial companies in order to characterize different innovation possibilities in the service sector. According tothese authors, the companies in the service sector can be classified as follows: science-based services and specialised suppliers; production- and scale-intensive services; network services; and supplier-dominated services. Science-based services and specialised suppliers include knowledge-intensive business services (KIBS); their dynamics have attracted a lot of attention from researchers due to their important role in organisational innovation (Miles, 2003). Examples of these services include computer science, Research and Development (R&D), as well as jurisdictional consultancy services. Financial services are examples of production- and scale-intensive services, because they need provision of several back-office tasks. Network services depend on physical networks to be provided, such as telecommunications and transportation services. Finally, in supplier-dominated services innovations are derived from equipment innovations. Examples of supplier-dominated services include health and personal services, for instance catering, beauty services and retail sales. Metcalfe and Miles (1997) observed that utility services, such as the provision of water, gas, electricity, may be characterised as network

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services, even if this classification is not usual among studies in the sector.

The subsequent studies on service innovation took several directions. Some studies adapted the concepts developed for the industrial sector to the service sector (Barras, 1986;Utterback&Abernathy,1975); others were based on empirical approaches, using available statistics; while other studies emphasised the role of the user-producer interaction underlying the service innovation in order to discuss the traditional innovation division in product and process innovation(Gallouj & Savona, 2010). According to Gallouj and Savona (2010), there are still several doubts to be answered by studies on service innovation due to the wide range of activities in the sector and the specificities of their production. These authors suggest that the role of consumers in the innovation process needs to be better analysed, as empirical studies are still focused on trying to explain the role of service activities in productivity. Also, there are research areas that need to be explored, such as utility services, environmental services, and social services. The dominance of studies on KIBS in the literature of service innovation leads us to pose the following question: which capabilities are needed for innovation in other service types?

Hidalgo and D'Alvano (2013) demonstrate that many service companies have a larger outward degree of innovation development than their inward degree of innovation development, reinforcing the fact that innovation processes in this sector possess greater emphasis on consumers and suppliers than in other segments. In addition, the authors demonstrate that service firms engage in a general cooperation mode, rather than an organizational cooperation mode, considering suppliers, consumers, universities and R&D centers in their innovation processes, without having a preference for any specific type of innovation.

Rusanen et al (2014) also claim that service firms use network relationships to gain access to a broad and versatile set of resources for innovation, such as know-how, contacts, information, learning environments, financing, software, and reputation. The authors point out that firms seek access to strategic resources for service innovation in a wide variety of actors, such as consumers, suppliers, social contacts, consultants and universities, which reinforces the importance of networks in which firms are embedded. The study also points out that most of the key relationships to access resources that are important for innovation are informal, such as social contacts, arm's-length relationships, close exchange relationships, and development relationships.In this sense, start-ups have a key role in fostering scalable and repeatable innovation (Blank, 2010). As defined by Blank (2010), start-ups are companies created by a group of people searching for a repeatable and scalable business model working under extreme uncertain conditions. And they are also recent, dynamic, lean and rapidly scalable companies that can develop innovations for consolidated sectors due to their organizational characteristics, in addition to developing new business models and processes (Ghezzi, 2017; Mian et al, 2016; Bandeira et al, 2016; Baek & Neymotin, 2016; Anthony, 2012).

Authors that study entrepreneurship consider the creation of new firms is a significant mechanism for conceiving and diffusing innovations (Acset al, 2006; Baraldi et al, 2018; Ciabuschi et al, 2012). Based on this assumption, empiric studies in different countries have been trying to identify the determinants for the creation ofstart-ups. These studies show that the regional concentration of highly qualified human resources is a determining factor of start-up creation (Fritsch & Falck, 2002; Ikeuchi & Okamuro, 2010). Nevertheless, not all start-ups survive with competition. Therefore, the availability of qualified human resources and a favourable environment to the creation of new firms are necessary conditions, but not sufficient, to creating innovative start-ups in the service sector.

To sum up, one of the results of innovation is organizational learning and the improvement of the firm´s capabilities related to organizational learning enables firms to take more advantage of market opportunities. The review of the literature on service innovation presented in this section suggests that electricity companies may be characterized as network companies and as such are strongly dependent of external innovation provided by suppliers, consumers and other member of their network. In this sense, start-ups may play a key role in a company's networks to foster innovation in the electricity sector. We will address this issue in the next section.

III. THE ROLE OF START-UPS IN THE DEVELOPMENT OF SERVICE INNOVATIONS

The companies in the electricity sector may be considered as network companies, because they organise themselves in a physical distribution network that ensures the provision of utilities. Therefore, the R&D strategy in electricity sector companies should focus not only in the development of internal learning, but also in the establishment of cooperation networks, as service innovation depends on interactions with users and suppliers, as previously discussed. Furthermore, empirical studies on spatial concentrations of innovative activities

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show that the electricity sector develops technology based on cooperation networks (Corsatea & Jayet, 2014). Utility companies usually outsource research activities, enabling other producers of technologies to develop new solutions for electricity from alternative sources due to the ongoing energy transition.

In 2015, DISCOs invested approximately R$ 12.3 billion on the purchase of new equipments, on personnel training, on awareness campaigns, on network expansion, consumer attendance, and actions against thefts and frauds (ABRADEE, 2016). Therefore, companies are performing great efforts to improve their capabilities to foster their competitiveness. The strategies of companies in the electricity sector can be based on three aspects: innovation, diversification of activities or internationalization (Whittington, 1993; Dojic, 2017).Ratinen and Lund (2014) report that the basic characteristics of an innovation-based strategy are directly related to the creation of new business opportunities, such as start-up support programs.

That is because as shown by Criscuolo et al (2012) the service sector start-ups are more likely to develop product innovations and register higher innovation returns than established firms. For scale-intensive services, the size of the companies in the sector leads them to outsourcing especially in activities that demand higher agility in developing innovations. For example, companies in the financial sector may recur to cooperation with start-ups to develop new services such as applications for customer interaction. Companies in the supplier-dominated services segment may benefit from cooperation with start-ups, since they can act as providers of new solutions to offer better services. For example, the lodging and catering sector has been strongly impacted by the diffusion of applications provided by start-ups that facilitate price comparisons and enable reserves. Smaller-sized establishments in this sector often need to introduce organisational innovations to adjust themselves to demands created by such applications. Network service companies, such as companies in the electricity sector, may recur to start-ups to develop specific technological solutions for certain regions or to introduce differentiated services in their set of services for consumers.

In this context, in Europe, in order to maintain their leading position, large companies in the electricity sector are developing Corporate Venture Capital (CVC) programs to foster start-ups. These programs integrate a set of initiatives that may constitute a broader Open Innovation approach. In general, CVC-led investments focus on the development of networks and new technologies (Livieratoset al, 2017). For start-ups, these programs represent quick access to the markets and knowledge networks. This led to the creation of private incubators with a focus on creating new businesses, in an accelerated way (Grimaldi&Grandi, 2005; Becker&Gaassman, 2006)

Starting in 2010, nine of the ten largest companies in the European electricity sector have structured initiatives to promote start-ups in the Corporate Venture Capital modality(Livieratos et al, 2017). The role of venture capital in the electricity sector is to provide financing for high-risk, innovative research that can lead to the development of market effective start-up companies, as well as profitable and efficient technological solutions for the energy sector (Moore&Wustenhagen, 2004).

In Brazil, large companies in other segments of the service sector, such as the information and communication technology sector, have been implementing strategies of engagement and promotion of start-ups(Gelwan, 2015).In the electricity sector, start-up programs started to be developed in 2016. Currently, six Brazilian electricity sector companies started developing initiatives to support start-ups, inspired by an open innovation approach: CPFL Energia S.A.; EDP Brasil S.A; AES S.A.; Enel Brasil S.A.; *Companhia Energética de Minas Gerais* S.A. (CEMIG); and *Companhia Paranaense de Energia* S.A. (COPEL) (Lima et al, 2018). Studiyng the results of these initiatives we can better understand the benefits of the program to promote innovation in the electricity sector.

Because, as shown in this section, electricity companies and start-ups can cooperate with each other through these partnerships, the biggest challenge for the consolidation of start-ups lies in creating a network of relations with other actors that may help and support these nascent companies (Baraldi et al, 2018).On the other hand, large network companies want this relationship, wherestart-upsmay play a crucial role in assuming risks and grabbing opportunities for technological development, as they are more disposed at assuming risks than larger established companies (Spenderet al, 2016; Aaboen et al, 2013). And finally, since large companies in the sector will need to be increasingly aware of aspects such as security, accessibility and sustainability, they will progressively seek to operate and collaborate with other actors, such as start-ups, to find and develop innovative solutions

In fact, there are several examples of technological devices developed by start-ups that contribute to incremental innovations in the electricity sector, such as applications to facilitate energy exchange among prosumers (Rutkin, 2016), conversion and plug-in systems for electric cars, smart devices for the electricity networks (Electronics Weekly, 2011), among others. In the next section we start

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to study the challenges and improvements on the Brazilian sector.

This section investigated the role that start-ups may have in the development of innovations in the companies of the service sector. It also presents a discussion about their contribution to a transforming electricity sector, since large companies in the sector will need to be increasingly aware of aspects such as security, accessibility and sustainability. To do this, they will progressively seek to operate and collaborate with other actors, such as start-ups, to find and develop innovative solutions.

IV. METHODOLOGY

In order to discuss and characterize the innovation process in the Brazilian electricity sector companies, this article is structured in three parts. The first part (section 2) of this research consisted of a literature review on the concept of service innovation based on books and scientific articles.The scope of this search included the most cited studies of Google Scholar and Plataforma Sucupira[1] on the field of Service Innovation, as well relevant studies from recent decades. This section aimed to create the basis for the discussions on innovation strategies in Brazilian electricity sector companies, start-up programs and innovation surveys. The second part (section three) consisted of analysing the contributions of the specialized scientific and technical literature regarding possible benefits start-ups to innovation in the service sector, in order to identify implications that start-ups could have in R&D strategies of electricity sector companies.For this, a literature review from the electricity sector and regarding the relationships between companies, start-ups and networks was done.

The third part (section five) of this article seeks to analyse the innovation rates of the Brazilian electricity sector. For this purpose, primary and secondary data from the PINTEC[2]was used. The PINTEC is a Brazilian innovation survey carried out every three years – the last edition, published in 2020, spanned from 2015 to 2017 – to serve as a basis for the construction of innovation indicators regarding the innovation activities of national companies. According to Bernardes (2005), the recognition of the significance of the service sector for generating revenue and richness led to the production of innovation and R&D statistics in this sector in developed countries, as those of EUROSTAT. In addition, international statistical agencies such as Unesco and Unctad are measuring the innovation process in the service sector.

In Brazil, according to thesesame authors, the production of information on service innovation is still incipient, and the first efforts can be found in studies from SEADE Foundation (PAEP) and, more recently, in the inclusion of some service classes in the Innovation Survey of the *Instituto Brasileiro de Geografia e Estatística* (Brazilian Institute of Geography and Statistics) (IBGE). From the 2014 survey onwards, the PINTEC presents the results for industrial sectors (extraction and transformation) and selected service sectors separately. PINTEC also reports the electricity and gas sectors separately, which enables innovation trend analysis in the electrical sector.Data analysis was based on three categories: extractive and manufacturing sector, electricity and gas sector, and service sector in general. This division was done in order to map out innovation trends of the electricity sector *vis-à-vis* the industrial and services sector as a whole.

The Electricity and Gas sector - section D of the National Classification of Economic Activities (CNAE) 1 - is composed of three groups: (i) generation, transmission, and distribution of electricity (CNAE 351); (ii) production and distribution of gaseous fuels through urban networks (CNAE 352); and (iii) production and distribution of steam, hot water and air conditioning (CNAE 353). Companies with 500 or more employees were included in their totality in the survey. Another important characteristic is that the sample size was scaled to ensure that the estimator of people occupied in each stratum had a variation coefficient of 12% and had a loss rate of 15%. Based on a 15% loss rate at the end of the survey, 84 companies were effectively researched, representing a universe of 468 companies in Brazil. Among the 84 companies surveyed in the three categories of CNAE presented, 78 were from CNAE 351; 5 were from CNAE 352; and one from CNAE 353. Therefore, it can be stated that the data referring to the research developed by PINTEC is a good proxy of the electricity sector, since it corresponds to approximately 93% of CNAE's section D.

V. INNOVATION IN THE BRAZILIAN ELECTRICITY SECTOR

The electricity industry basically consists of power generation plants located across the country and of energy transmission and distribution lines that form the so-called

[1] Plataforma Sucupira is a platform used to collect information, carry out analyzes and evaluations, as well as being the reference base for the Brazilian National Graduate System (SNPG).

[2] PINTEC definition and survey. Availabe in: https://www.ibge.gov.br/estatisticas/multidominio/ciencia-tecnologia-e-inovacao/9141-pesquisa-de-inovacao.html?=&t=o-que-e Access: 02/04/2020.

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"network industry". As all consumed energy must be instantaneously produced, the whole system is connected (ABRADEE, 2016). Due to such features referring to product intangibility, instantaneous production and consumption, and dependence on a physical network, as discussed previously, the electricity sector may be classified - especially its distribution segment - as a sector that consists of *network services* (Metcalfe; Miles, 1997). As they are utility services, their efficiency is associated with access and quality of the delivered product and to uninterrupted availability.

The Brazilian federal government has already begun to implement actions to change electricity generation in the country in the next years, with initiatives such as the simplification of rules for energy generation in homes and commercial buildings; a change in the taxation of produced energy; and an industrial investment stimulus in the sector, with reductions both in the import tax of photovoltaic modules to supply the internal market and in export taxes (Dantas; Pompermayer, 2018).

The Brazilian federal government is responsible for policies concerning the electricity sector and its regulation. Companies are responsible for production, transportation and energy commercialization. The energy generation and commercialization segments may be characterised as competitive segments, due to the existence of many enterprises and also the fact that their product (electrical energy) is homogeneous. The segments that provide energy transportation (transmission and distribution) are natural monopolies: due to their physical structure, competition between two agents in a same concession area is not economically viable. The price regulation model or regulation by incentives predominates in these two segments. Thus, companies operate in a context of concession contracts, managed by the Brazilian Electricity Regulatory Agency (ANEEL) (ABRADEE, 2016).

The Brazilian electricity sector R&D Program coordinated by ANEEL, which aims to promote innovation development and was structured tohelp companies overcome technological challenges, will be analysed. This program obliges electricity sector concessionaires of the distribution, transmission and generation segments to annually invest a percentage of their net operational revenue (NOR)in R&D projects. According to the available data, this program mobilised approximately US$ 1,55 billion[3] between 2000 and 2017in 4,400 R&D projects, revealing a great success in mobilising resources (Castro et al, 2018).

[3] R$ 8,1 billion reais: exchange rate of commercial dollar, 31 of July of 2020.

A study conducted in 2011 (Figueiredoet al, 2011)indicates that researchers engaged in projects linked to ANEEL's R&D program developed significant scientific and technological production due to the project's development model. The projects carried out within the scope of ANEEL's R&D program are usually developed with other actors, organizations and institutions, such as research institutes, supplier companies, universities and even start-ups.

The statistics of the PINTEC research may be used to analyse results from ANEEL's R&D program and innovation in the electricity sector in general. This survey makes it possible to identify the main results achieved and how these results contributed (or not) to the electricity sector transformation.

According to the PINTEC data for the 2015-2017 period, in a universe composed of 116,962 companies with 10 or more employed staff in the country in all segments,39,329 implemented novel or significantly improved products and/or processes, which corresponds to a general innovation rate of33,6%.

Graph 1presents the distribution of companies by type of innovation, that is product, process, or marketing and organisational innovations. The same company can conduct more than one type of innovation.Thus, it is possible to verify that 28,44% of the electricity and gas companies, of a total of 594 companies, declared that they had developed product and process innovations in this period.The electricity and natural gas sectors have lower innovation rates than the service and industrial sectors. Previous PINTEC surveys all pointed to this tendency of the electricity sector to having lower innovation rates than other sectors. In comparison with the previous PINTEC survey, that encompassed the period from 2012 to 2014, there was a decrease in the innovation rate, which was 35%. This decrease may be related to the period of economic and political crisis in Brazil from 2015 to 2017, as the other sectors also had an expressive decrease.In 2017, Brazil continued to feel the effects of the recession, which helps to explain the reduction in the rate of innovation and the level of R&D investments in the Brazilian economy in this period. In times of crisis, company investment in innovation is often not seen as a priority. The reduction in the role of public policies for innovation is evident in the percentage of innovative companies that received some kind of public support to innovate. This is the result of the reduction of various public policies. In 2014, for example, the amount disbursed inform of credit for innovation activities by the Funding Authority for Studies and Projects (FINEP) and by the Brazilian Development Bank (BNDES) totaled

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around R$ 8 billion, but in 2017 the total amount was around R$ 4.3 billion. Furthermore, many of FINEP's instruments for innovation promotion virtually disappeared in 2017 (De Negri et al, 2020).

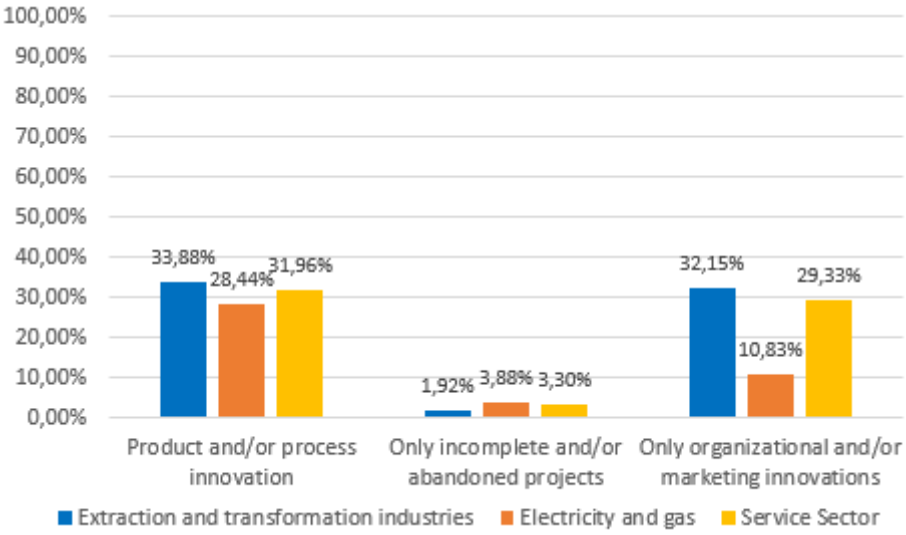

Fig.1: Brazil: Percentage of companies that conducted product, process, and organisational innovation by activity sectors, 2015-2017

Source: Authors, based on IBGE (2020)

The reports of the previous survey editions showed that process innovations always predominated when compared to product innovations. Process innovations declared to the PINTEC survey are mainly introduction of new or substantially improved methods for production, new methods to implement internal logistics of inputs and products, and increments in production service activities. In the service sector, innovation involved changes in equipment or software.

When only product and process innovations are considered, it is possible to validate the studies previously cited in this article that indicate that product and process innovation in the service sector, especially in the Electricity and Gas Sector, depends on cooperation. Graph 2indicates that product innovation is mainly developed by companies. However, it is possible to observe that, among other sectors, the electricity sector presents the lowest development rate of product innovations within a particular company. In the electricity sector, the development of innovations by other companies or through cooperation corresponds to more than half of the total.

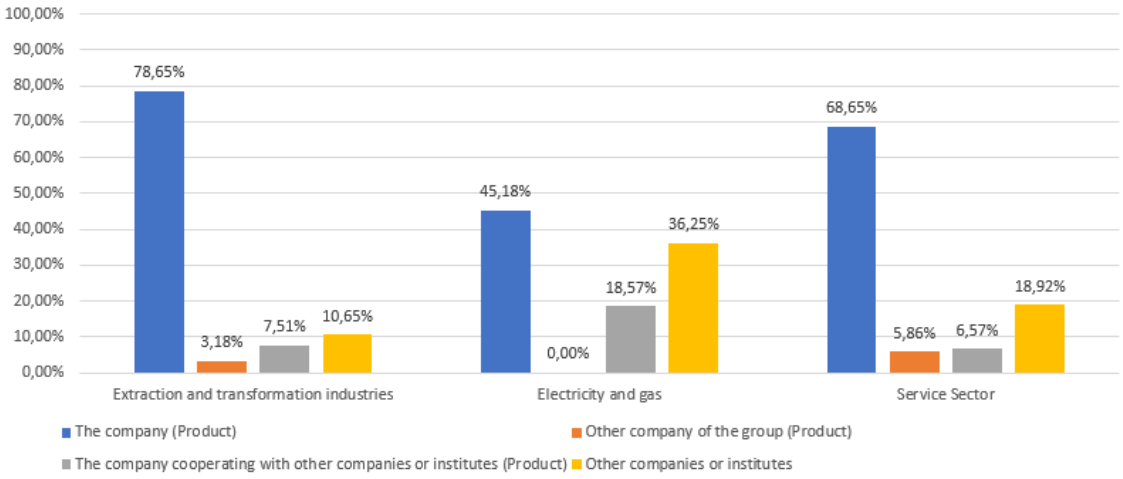

Fig.2: Brazil: Percentage of companies that developed product innovationsby sector, 2015-2017

Source: Authors, based on IBGE (2020)

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Graph 3 indicates that cooperation is important for process innovation in the electricity sector, as companies may individually have difficulties to reunite all competences needed to implement innovation. Regarding process innovation, the percentage of companies that develop innovations in cooperation with other companies or institutes is more than four times higher than the percentage verified in the service sector and in the sector of extraction and transformation industries.

Electricity sector companies have higher rates of product and process innovation in partnership with other companies due to the fact that the sector is more intensive in external R&D acquisition and also due to ANEEL's R&D program, which obliges companies to invest in innovative projects with other actors of the ecosystem such as suppliers and universities.

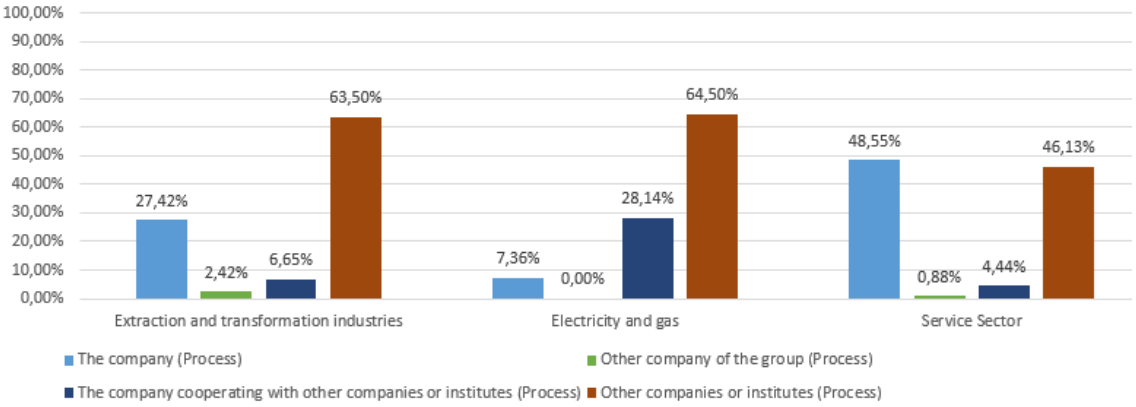

Fig.3: Brazil: Percentage of companies that developed process innovations by sector, 2015-2017

Source: Authors, based on IBGE (2020)

Referring to the direct and indirect impacts of innovations on the competitive capacity of companies, they were considered as being more relevant to maintain market participation than to increase market participation. In the electricity and gas sector, the main impacts for companies in relation to the implementation of innovation were the increased productive capacity (54,78%), reduced environmental impact and/or health and safety impacts (53,78%), and reduced production costs (51,28%); and the main obstacle for companies to conduct innovation, or reason for not innovating, were the high costs for developing innovations(78,58%). This result suggests that the increase in competitiveness caused by innovations was more related to a predominantly defensive strategy, intended to maintain the company's position in the market, even though there were specific objectives of increasing productivity and added value (IBGE, 2014).

In the electricity sector, regulation in service provision may intensify the adoption of defensive and conservative strategies. However, most companies (65,81%) in this sector also stressed that organisational rigidity was an obstacle for innovation. Electricity sector companies are large public companies or concessionaries that operate in a strongly regulated market. In this context, transaction costs related to terms for authorisations, evaluations, and approvals of ANEEL's R&D program create rigidity in companies and also in their operational environment. This happens because there may be differences between regulation business timing: when the transformations in the sector are fast, the stockholders may decide that companies must abandon outdated themes, but the company is obliged to continue with them in order to comply with regulation and to meet the requirements of the R&D program. Thus, there can be a mismatch between regulation and achievement of economic results.

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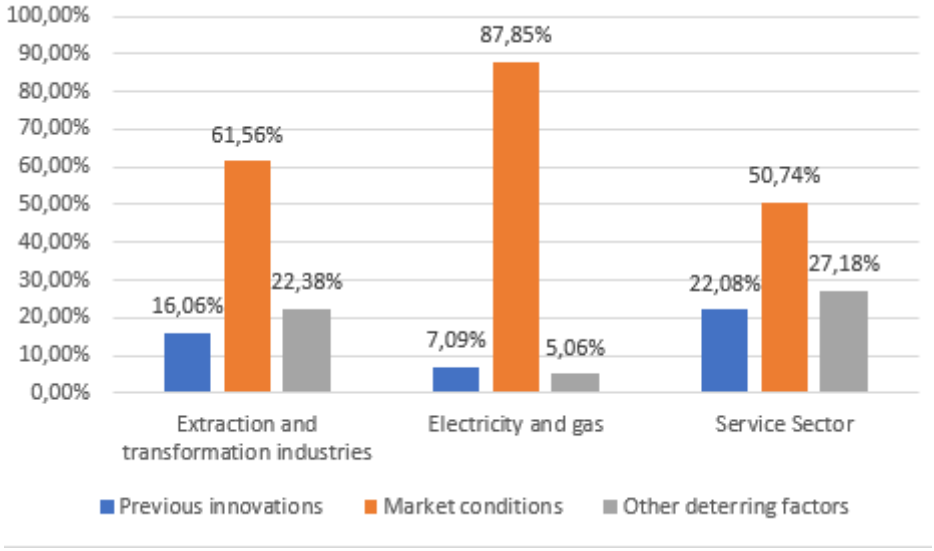

Fig.4: Brazil: Main reasons for not innovating, 2015-2017

Source: Authors, based on IBGE (2020)

All PINTEC editions indicate that, in Brazil, innovations result more from other innovative activities than from the company's internal R&D efforts. Examples of activities developed by companies include lesser novelty degree activities, training activities, new marketing or organisational methods, or the acquisition of external knowledge or capital goods that are not part of R&D. In the 2017 edition, this pattern repeated itself once again, with significant participation of innovations associated to "machinery and equipment purchase" (65,3%), "software purchase" (62,4%), and "training" (49,7%) in the electricity sector. External acquisition of R&D was one of the most significant innovative activities in the electricity sector (65,17%), although in the services and industry sectors it ranked the lowest innovation amongst all other activities.

Graph 5 presents the distribution of companies according to the degree of significance that companies attributed to their main product innovations. Product innovations in the electricity sector are more focused on product improvements that already exist in the company.

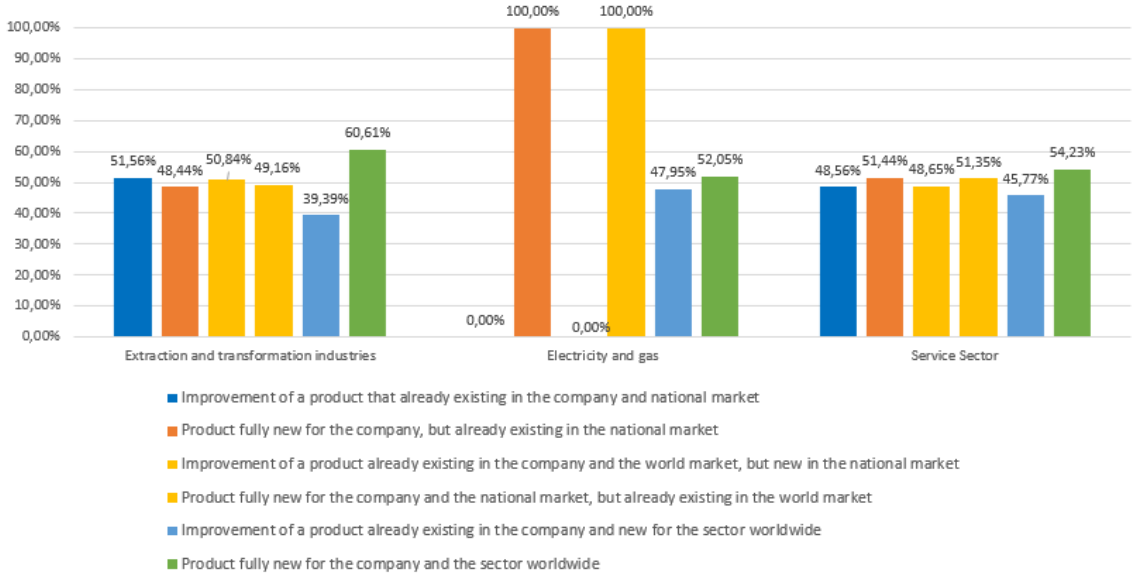

Fig.5: Brazil: distribution of companies according to the novelty degree of the main product, 2015-2017

Source: Authors, based on IBGE (2020)

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Graph 6 presents the distribution of companies according to the degree of significance that companies attributed to their main process innovations. Process innovations in the electricity sector are developed both for company improvement and to adapt the companies to the changes that take place in the national sector or that respond to global demands.

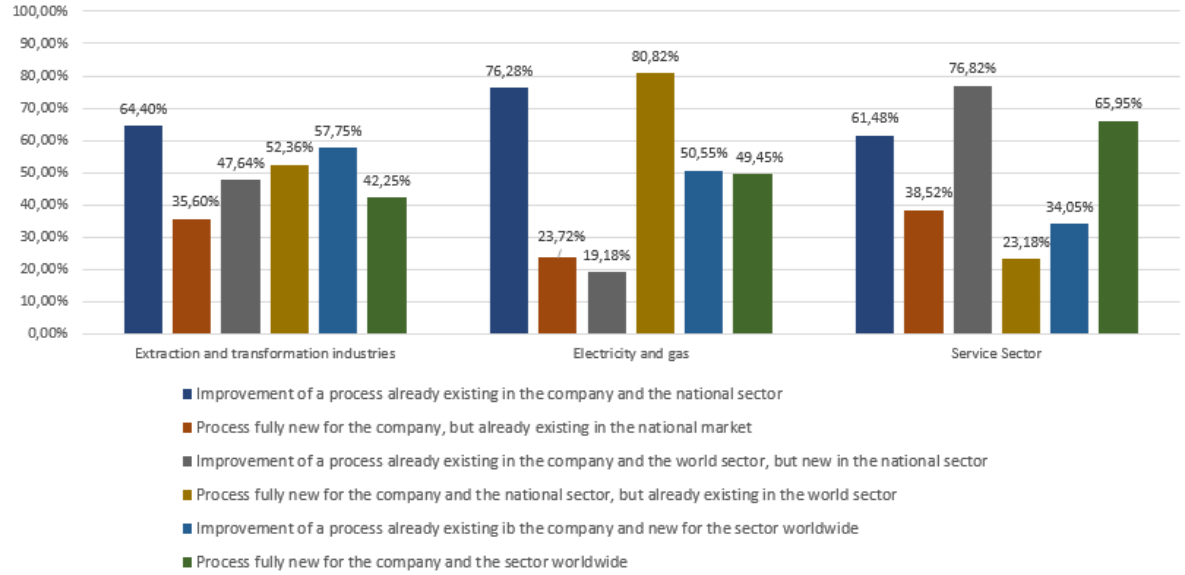

Fig.6: Brazil: distribution of companies according to the novelty degree of the main process, 2015-2017

Source: Authors, based on IBGE (2020)

PINTEC also provides data on marketing and organisational innovations because the survey considers that the concepts of product and process innovation are not sufficient to discern other significant elements of the innovative activities that compose the complex innovation processes(IBGE, 2016). Therefore, Graph7 presents organisational and marketing innovations in all sectors. In this case, the electricity follows the same trend as other sectors and has more innovations related to management techniques and work organization. However, unlike other sectors, it has lower levels of innovations related to design and marketing.

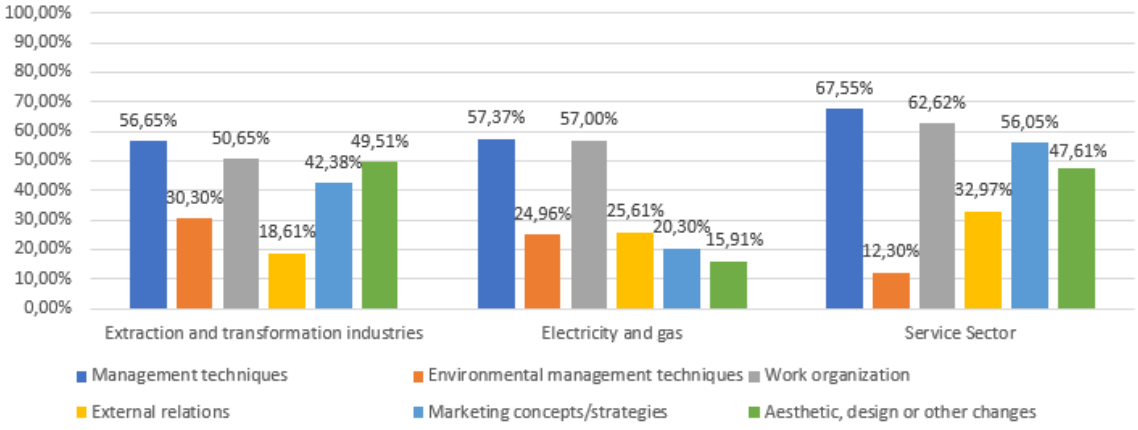

Fig.7: Brazil: Percentage of organisational and marketing innovations by sector– 2015-2017

Source: Authors, based on IBGE (2020)

Finally, based on information related to the specificities of the innovation process in the service sector and with the results from the PINTEC survey on the innovative profile of the electricity and gas sector, we can infer some conclusions about the standard of service innovation in the electricity sector: (i) technological innovation is mainly

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focused on processes and depends less on internal R&D activities and more on other innovative activities, such as development through cooperation; (ii) there are expressive efforts in non-technological innovations, that emphasize organisational changes and aim to improve companies by reducing their administrative or transaction costs, collaborating to improve access and understanding of non-codified external knowledge. Such efforts are focused on work organisation and human resources training.

The technological management strategy of the Brazilian electricity sector companies requires special attention to the capacity for setting more dynamic and flexible external relations that can decrease risks and rigidity in decisions concerning innovation. Currently, the strategy of several companies in the electricity sector consists of performing R&D in partnership with science and technology institutions or higher education institutions, ending the partnership once the project is completed. As noted by CGEE (2015), DISCOs do not have infrastructure to develop technological products, because such activity is not the focus of their business. In the current scenario of technological transformation in the sector, there may be an opportunity to foster new ways of organizing relations with other firms or public institutions according to new cooperation models. The establishment of new types of collaborations with research organisations or consumers, new methods for integration with suppliers, outsourcing activities, or the introduction of subcontracting are possible cooperation models (OECD, 2005).In such a context, the creation and acceleration of companies and start-ups represents an alternative to prepare electricity sector companies to the current dynamic business environment, especially in core themes of the sector. The United Nations Sustainable Development Goals for provision of clean energy and technological innovations in storage and generation are movements that are happening worldwide and are becoming a source of pressure for adjusting competitiveness, even if this only involves learning to use future innovations (Hak et al, 2016).

To sum up, PINTEC data points out that electricity companies are more dependent on external innovations than other companies surveyed. This opens opportunities for startups to provide services to electricity companies. As mentioned in this section 6 out of 75 Brazilian DISCOs (8%) have ongoing programs and initiatives to connect their businesses with startups.

VI. CONCLUSIONS

The current scenario indicates deep technological transformations in energy distribution activities, with an increase in distributed generation and the diffusion of energy storage. These transformations represent new challenges to companies, especially for companies in the distribution segment, which can lose part of their revenue. Furthermore, companies in the Brazilian electricity sector must ensure quality services every hour and day of the year and increase their consumer engagement.

The innovation strategy of companies in the Brazilian electricity sector enables them to improve their learning capacity and the absorption of existing technologies, which can lead to further developments in acquired technology and of new products and processes. Such process requires special attention to the changes in work organisation, because the learning process also brings about the possibility for companies to absorb workers tacit knowledge. Therefore, the social relations set among agents directly or indirectly responsible for innovation must be considered.

As pointed out in this article, electricity sector companies may be classified as network companies. Utility services, such as electricity sector companies, may be classified as network companies. Specialized literature suggests that service companies have a greater outward degree of innovation development, which reinforces the fact that consumers and suppliers are important for companies in these sectors. Furthermore, companies in the service sector use network relationships to gain access to a broad and versatile set of resources for innovation. In this sense, start-ups may play a key role in a company's networks to foster innovation in the electricity sector.

The literature presented in the first section of this article suggests that service companies have a larger outward degree of innovation development in comparison to inward innovation, which reinforces the fact that consumers and suppliers are important for companies in these sectors. This may be confirmed in the Brazilian electricity sector from the PINTEC data: 7,36% of companies developed process innovation inside their own company, while 64.5% of the companies carried out process innovation with other companies, institutes or partners. Regarding product innovation, the PINTEC data demonstrates that the electricity sector presents the highest development rate of this specific type of innovation with other companies in comparison to other sectors (service sector in general and extraction and transformation industries).

Companies in the Brazilian electricity sector tend to adopt mature technologies that have been already tested by the market, and, therefore, appear in the PINTEC survey as having relatively small innovation capacity in comparison to the other sectors analysed in the survey. These features

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reinforce the ongoing challenges for companies in the electricity sector posed by technological changes, especially in the distribution segment, as well as by adjustments in regulation regarding the provisions that aim to foster clean energy generation.

The PINTEC data indicates that there are also considerable efforts in non-technological innovations in companies of the Brazilian electricity sector (57,37% of the companies in the sector developed management techniques and 57% developed work organization innovations), that emphasize organisational changes and aim to improve companies by reducing their administrative or transaction costs, collaborating to enhance access and understanding of non-codified external knowledge.

In order to overcome the challenges of the current energy transition and the ongoing transformation of the electricity sector, the development of relational capabilities and cooperation will be even more significant activities for companies to develop innovations. Therefore, the development of partnerships with research and education institutions and the structuring ofstart-up support programs are strategic for companies in the sector. It should be noted that the establishment of such partnerships do not necessarily involve high investments in companies. These partnerships can also serve as a way of attracting qualified human resources for the development of new companies. As previously seen, dynamic sectors in the industrial sectorand in the service sector have already been adopting this model, and the participation of other companies in the innovation process is increasing. Companies in the service sector use network relationships to gain access to a broad and versatile set of resources for innovation. In this sense, start-ups may play a key role in a company's networks to foster innovation in the electricity sector.

Companies of the European electricity sector have been developing start-up support programs since 2010. In Brazil, this trend is relatively newer in the electricity sector (starting in 2016). Since market conditions are major barriers for companies to the innovate in the Brazilian electricity sector start-up programs may be an alternative to develop new and reconfigured solutions for companies in the sector at a relatively reduced cost.

As shown in this article, the way that innovations are developed by companies in the Brazilian electricity sector indicates the need for setting long-term partnerships to overcome their organisational rigidity and to foster innovation development. Start-up involvement in partnerships may provide interesting benefits for companies, such as access to complementary technologies and training, and the possibility for start-ups to act as intermediaries between energy distributors and prosumers. However, by analysing the PINTEC survey data presented in this article regarding cooperation, it is not possible to infer if partnerships established by companies are only set to purchase technology or whether there is effectively joint innovation development. Future research could be carried out by deepening the results of recent startup support programs in Brazilian electricity sector companies to analyze the impact of these initiatives in terms of innovation generation and diffusion.

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Survey of the floristic composition and the structure of spontaneous vegetation present at green corn cultivated in organic no-tillage system

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Abstract**—** *The control of spontaneous plants is one of the biggest challenges faced by organic no-tillage system (NTS). Thus, the use of cultural practices that help on it becomes relevant. The objective of this research was to evaluate the population density, the level of infestation and fresh and dry weight of spontaneous plants community of the green corn cultivated in organic NTS. The trial was conducted in a randomized block design, with six replications and five treatments, consisting of three soil coverings in the organic NTS and organic and conventional systems using intensive soil tillage without covering. For soil covered treatments was used millet as grass specie and* sunn hemp *as leguminous specie as well as the intercropping between both species. The green corn (AG 1051 hybrid) was sowed at 1.0 m. between rows and 0.20 m. between plants. Infestation, density and fresh weight and dry weight evaluations of spontaneous plants were performed on the V5 (five developed leaves) stage of corn. The use of single millet straw and intercropped straw provided a reduction of the infestation percentage and absolute spontaneous plants density. Both organic and conventional intensive soil tillage systems without covering showed higher relative density for the specie Galinsoga quadriradiata. The highest relative densities in organic NTS were attributed to Amaranthus* spp.*, C. rotundus and Oxalis* spp.*. The percentage of infestation by spontaneous plants did not reach the level of economic damage in any of the treatments studied since the average productivity of ears without straw had been within the Brazilian average (9,000 to 15,000 Kg ha*$^{-1}$*).*

Keywords**— *Crotalaria juncea, Pennisetum americanum, organic farming, weed management.***

I. INTRODUCTION

"Weed plant" is the most widely term used in studies related to agriculture referring to plants that grow where they are not welcome causing some type of damage. [1, 2] However, these plants do not always bring damage depending on the phase of the crop cycle they germinate, [3] also fulfilling other functions such as contributing to the biodiversity and dynamics of beneficial insects, [4] serving as plants that indicate the chemical and physical situation of the soil, [5,6] and as soil protective plants, mobilizers or nutrient cyclers. [7] Thus, the term "spontaneous plant" was chosen to be written on this research referring plants that germinate and grow

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spontaneously in agricultural environments, but not always being harmful to cultivated plants.

In contrast to the conventional system, the management of spontaneous plants in organic cultivation must be carried out considering those benefits they bring to the agroecosystem. Therefore, rows of spontaneous plants should be kept outside the cultivation area and in the divisions of the cultivation plots. Properly in the organic area cultivation the Normative Instruction – N.I. n. 007 of MAPA, of May 17, 1999 [8] advises that the management should be carried out through diversify techniques such as: a) mechanical means of control; b) biological control; c) inert coverage which does not cause contamination and pollution - at the certifier discretion; d) solarization; e) seeds and seedlings free from invasive plants, use of fresh or dry vegetation cover on the soil; f) crop rotation and g) allelopathy. [7] However spontaneous plants should not be eliminated indiscriminately but rather the level of economic damage caused by the infestation should be defined and the factors that affect a harmful coexistence between spontaneous plants and crops of interest should be understood. [9]

In regards to the management of spontaneous plants, the use of mulch in NTS has been considered as an excellent alternative since if it is well formed and evenly distributed over the soil surface acts physically and mechanically over the bank of seeds of spontaneous plants decreasing its germination rate. [10, 11, 12, 13, 14]

This physical and mechanical control occur by reducing the incidence of light and variation in soil temperature and by inhibiting the germinative process of seeds that have a small amount of reserves in their diaspores. [12, 15, 16] The presence of straw also favors the biological and chemical control of the spontaneous community: a) the first occurs through the population of microorganisms increasing which can destroy the seeds of spontaneous plants [17] and b) the second through the release of allelopathic compounds that can inhibit the growth of the community. [18, 19, 20]

However, the NTS uses in organic agriculture is one of the great challenges for research today because as opposed to the management applied to conventional NTS there are no desiccant herbicides neither post-emergent herbicides recommended for organic agriculture. [9, 21] Therefore is crucial for the management of spontaneous plants in organic agriculture grow plants in the off-season of crops in the form of green manure with grasses and legumes that produce a large amount of straw as well as show allelopathic potential. [15, 22, 23]

Several trials have been performed from North to South of Brazil about the effect of the use of different cover plants in spontaneous plants management in varied comercial cultures. [24, 25, 26, 27, 28, 29, 30]

Working on techniques of agroecological agriculture Gama (2019) [30] evaluated the effect of soil cover plants on the suppression of spontaneous plants and productivity on the sustainable guarana agroecosystem in the state of Amazonas. *Brachiaria ruziziensis, Canavalia ensiformis and Mucuna deeringiana* were tested. *B. ruziziensis* suppressed 100% of the infesting plants at that area showing excellent soil coverage and high production of phytomass.

Parizotto *et al*. (2018) [27] also using agroecological techniques of cultivation at Santa Catarina State, evaluated the effect of black oats, rye, vetch, and black oats + rye + vetch on spontaneous plant control and the yield on canned cucumbers field. About the spontaneous plants the conclusion was the pre-planting of black oat and rye coverings had the best suppressive effect. In turn, Ferreira (2016) [24] aiming to study the agronomic performance of organic green corn and the population dynamics of spontaneous plants at that area after the green manures cultivation at the Rio de Janeiro state, evaluated the previous cultivation of sunn hemp, black beans pig, black mucuna, sunflower and sorghum, concluding that the cover with sorghum proved to be the most efficient on plant biomass production and spontaneous plants control.

Therefore it must be considered that the efficiency in the management of spontaneous plants is linked to factors such as: a) which type of covering is used; b) the amount of straw is possible to be produced depending on the edaphoclimatic conditions existing; c) if the straw is well distributed on the soil; and d) the composition of the seed bank of spontaneous plants of the area. Thus, it is necessary to establish a broader knowledge of the likely effects of the regular use of cover plants in the rotation or intercropping, [9, 31] for each type of agroecosystem to be studied.

This manner this research aimed to evaluate the population density, the infestation level and the fresh and dry weight of the spontaneous plants comunity existing on the organic green corn in NTS at mountain region of the Espirito Santo State- Brazil.

II. MATERIAL AND METHODS

The work was conducted at the Agroecology Reference Unit (ARU) of INCAPER in Domingos Martins-ES, Brazil (20 ° 22 '16.91 "S and 41 ° 03' 41.83" W), at an altitude of

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950 m. In this region average maximum temperatures in the warmer range between 26.7 and 27.8 ºC and the average minimum temperatures in the cooler months range between 8.5 and 9.4ºC. Annual average rainfall is 1,800 mm.

The entire ARU has been cultivated under organic management since 1990 with an area of 2.5 ha subdivided into 15 permanent fields where horticulture experiments are conducted. In the first ten years of research the focus was mainly on the generation of technologies for management of organic compound, of soils and of crops. From the 10th to the 20th year of the project the priority was researches about the planning of organic systems and the generation of soil management technologies that were long-lasting considering the cumulative effects of several years of cultivation. [32]

The general organic management of soils of fields has been carried out through the recycling of biomass using crops rotation also grasses and legumes plants appropriate to supply cultural remainings to the soil; through the application of organic compound inoculated with poultry manure; and practices such as green manure, use of mulch, crop rotation, applications of biofertilizers via soil and leave and other which lead to recycling, mobilization and availability of nutrients. It is worth mentioning that fertilizations with organic compound have been carried out on the basis of 15 t ha^{-1} (dry weight) for most crops resulting in an average annual contribution of 22.5 t ha^{-1}, considering the average of 1.5 cultivation of vegetables per year, per field. [32] These were the characteristics of the organic compound used in fertilizations from 2009 to 2011: N, P, K, Ca and Mg; 2.0, 1.2, 1.5, 6.0 and 0.6 dag kg^{-1}, respectively; Zn, Fe, Mn, Cu and B: 223, 16.1, 804, 50 and 36 mg.dm^{-3}; MO: 48 dag.kg^{-1}; and C/N: 13/1.

This research was conducted at the 05 field in 720 m² of area that is in NTS since 2009.

The field was divided into plots physically isolated by concrete slabs buried at 0.40 m depth where were conducted successive cultivations under summer and winter covering plants as well as intercropping between both. The evaluated species were cabbage on sunn hemp and maize; eggplant on white lupine and black oats; green corn on black oats and white lupine; cabbage on corn and sunn hemp; green corn over corn and sunn hemp; green maize again on white lupine and black oats because the previous field was lost by attack of capybaras; cabbage on white lupine and black oats; and lettuce on black oats, and white lupine.

The trial was conducted from September 2019 to March 2020. The chemical characterization of its soil was performed before its implementation at a depth of 0-20 cm and it is shown in Table 1.

Table. 1: Means of the chemical characteristics of the soil before the implementation of the trial

Attributes	G	L	G + L	OS	CS
pH H_2O	6,9	6,8	6,9	6,8	5,4
P (mg dm^{-3})	870,9	975,8	1076,0	971,4	145,3
K (mg dm^{-3})	623,0	445,4	463,0	387,0	197,0
Ca ($cmol_C$ dm^{-3})	13,2	13,4	14,2	14,6	5,5
Mg ($cmol_C$ dm^{-3})	3,4	3,5	3,7	3,4	0,8
Al ($cmol_C$ dm^{-3})	0,0	0,0	0,0	0,0	0,1
H+Al ($cmol_C$ dm^{-3})	1,7	1,7	1,7	1,6	4,5
SB ($cmol_C$ dm^{-3})	17,8	18,4	19,3	18,6	6,8
t ($cmol_C$ dm^{-3})	17,8	18,4	19,3	18,6	6,9
T ($cmol_C$ dm^{-3})	19,5	20,1	21,0	20,8	11,3
MO (dag kg^{-1})	5,1	5,4	5,5	5,1	3,6
Zn (mg dm^{-3})	33,1	43,0	45,4	45,7	12,9
V(%)	91,2	91,3	92,0	92,3	60,3
Fe (mg dm^{-3})	60,6	57,0	56,4	58,0	134,4
Mn (mg dm^{-3})	96,6	102,5	104,7	102,0	82,7
Cu (mg dm^{-3})	2,1	1,83	1,74	2,0	5,3
B (mg dm^{-3})	0,6	0,4	0,5	0,6	0,3

CS – conventional system without straw; OS – organic system without straw; G – organic NTS with grass straw; L – organic NTS wit legume straw; G + L – organic NTS with grass + legume straws.

It was installed in a randomized block design, with six replications and five treatments, totaling 30 experimental plots with dimensions of 6.0 x 4.0 m, with a total area of 24.0 m² and a useful area of 16.0 m². The treatments consisted of three soil coverings in the organic NTS (G - organic NTS with grass straw; L - organic NTS with legume straw; G + L - organic NTS intercropping) and two systems without covering and with tillage system, one organic and the other conventional (OS - organic system without straw; CS - conventional system without straw). For treatments under soil cover were used millet (*Pennisetum americanum*) as the grass specie, sunn hemp (*Crotalaria juncea*) as legume specie and the intercropping between both species.

The cover plants were sown on September 25, 2019 both in single and intercropped crops spaced 0.33 m between rows. The density of seeds in single crops was 29

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grams per parcel for millet (12 kg ha^{-1}) and 91 grams per parcel for sunn hemp (38 kg ha^{-1}). Sowing densities and seed costs were reduced by half in intercropped crops due to planting in alternate rows.

Weeding was carried out between the lines of the cover plants at 18 days after the emergence of corn (DAE) and the irrigation according to observation of visual aspects of the cultures and previous practical experiences of ARU field employees.

The cover crops were mowed with a motorized backpack mower at 82 days after sowing. Samples of these plants were collected using a square measuring 1x1m on a side randomly placed in each experimental plot. Sub-samples were taken from these samples to quantify fresh weight and dry weight. For drying the sub-samples was used an oven with forced air circulation at 65ºC for a period of 10 days.

Planting fertilization was performed on the same date that the cover plants were mowed using organic compound at a dose of 17.89 t ha^{-1} (dry matter) uniformly distributed by haul over all experimental plots in organic management. These were the characteristics of the compound: N, P, K, Ca and Mg; 2.8, 0.7, 5.0, 3.3 and 0.5 dag kg^{-1}, respectively; Zn, Fe, Mn, Cu and B: 151.4, 13014, 455.3, 45.3 and 9 $mg.dm^{-3}$; C.O: 18.4 $dag.kg^{-1}$; and C/N: 6.5. In the plots in conventional cultivation the planting fertilization for corn was carried out with 280 kg ha^{-1} of urea according to soil analysis and fertilization recommendation according to the Lime and Fertilization Recommendation System program. [33] There was no application of supplementary fertilization in coverage in the plots in organic cultivation in order to understand the effect of N from straw; nor in the plots in conventional cultivation so that there would be no competitive advantage from this treatment over others.

The suitable for consumption in the form of green maize the hybrid AG 1051 was sown on December 19, 2019 using a special for NTS manual seeder adopting a spacing of 1.00 m between lines and 0.20 m between plants with a density of four seeds per hole. Subsequently it was thinned to one plant per hole recommending a population of 50,000 plants ha^{-1}. A greater number of seeds were sown per hole to avoid failures in planting as the presence of birds that feed on seeds and newly emerged plants was found in the area.

Weeding was carried out between the lines of the plots in organic and conventional systems at 23 and 38 DAE corresponding to the V5 and V10 stages of corn according to observation of visual aspects of the culture and previous practical experiences of the URA field employees.

The percentage of soil covered by spontaneous plants was evaluated in the V5 stage of corn. The samples were collected in all experimental units using a Sony Cyber-shot DSC-W690 digital camera (16.1 megapixels) positioned at 1m. above the ground. The percentage of infestation by spontaneous plants was measured by the computer system SISCOB®, developed by Embrapa Instrumentação Agrícola which shows the percentage of soil covered by spontaneous plants in each photograph obtained.

Also in V5 stage of corn using a square measuring 0.50 m on the sides randomly placed in each experimental plot the population density of spontaneous plants was quantified and after this the plants were collected by plucking in order to quantify fresh weight and dry weight also in the V5 stage of corn. The process was repeated four times. In each sample the species of spontaneous plants were identified and counted, as well as the absolute and relative densities were determined in the different treatments. All material in the square was collected, weighed and taken to the forced air circulation oven at 65ºC, until reaching constant weight, to determine the total dry matter. Spontaneous plants were weeded manually using a hoe soon after the evaluations were done.

The data on the percentage of soil covered by spontaneous plants were transformed by the function $y = \arcsen [\sqrt{((x)/(100))}]$, being submitted together with the characteristics fresh weight and dry weight, to analysis of variance and the means compared by Tukey test ap> 0.05 probability.

Principal component analyzes were performed group the five treatments, by means of visual examinations in graphic dispersions. For statistical analysis, the program R [34] was used.

III. RESULTS AND DISCUSSION

Twelve different species of spontaneous plants belonging to nine botanical families were identified in the experimental area. "Asteraceae" was the family found with the greatest number of times. Lorenzi (2000) [35] highlights that the plants of this family are among the pioneers to establish themselves in recently tillage soils, having from 3000 to 6000 viable seeds per plant, easy dispersion mechanism and seed dormancy in the soil, which can germinate up to five years after its burial.

Both conventional and organic systems without coverings quantified very close values for absolute density as 242 spontaneous plants m^{-2} and 229 plants m^{-2} respectively.

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In the organic systems with cover, there was a reduction in the absolute density of spontaneous plants to 53, 155 and 65 plants.m^{-2} for the treatments "soil covered by millet", " sunn hemp" and "intercropping between both species", respectively (Table 2).

Table. 2: Absolute densities of different species of spontaneous plants identified in treatments

	Absolute Density (plants m^{-2})				
Espécies	**SC**	**SO**	**G**	**L**	**G + L**
Amaranthus spp.	1.5	2	13	102	31.5
A. absinthium	-	-	6	-	4
C. benghalensis	-	-	-	1	-
C. rotundus	7	12	13	14	16.3
D. sanguinalis	2	2	3	4	1
E. indica	1	1	-	2	-
E. heterophylla	1	1	1	4	2
G. quadriradiata	210	189	-	-	-
Oxalis spp.	7.5	7	1	23	6.8
R. obtusifolius	-	-	2	2.5	2
S. oleraceus	-	-	-	-	-
S. arvensis	12	14.5	-	3	1
Total	242	229	53	155	65

In comparison to a research performed in the same area by Favarato (2014) [31] this present study showed a significant reduction in absolute densities, which in that occasion varied from 96 plants.m^{-2} for the treatment soil covered by grass, to 1169 plants.m^{-2} for the treatment conventional system. The number of different species found in the area also decreased from 14 to 12 indicating, one more time, the importance of using the no-tillage system in a permanent way

Table 3 shows a higher relative density of the specie *Galinsoga quadriradiata*, both in the conventional system (CS) and in the organic system without straw (OS). This specie has several characteristics that predispose it to a rapid population increase and consequently to a high rate of infestation; including rapid seedling development, ability to flower after a short period of vegetative growth, production of flowers and fruits during the development cycle, production of several generations in a single development cycle, genetic self-compatibility and production of a large number of viable seeds in varying environmental circumstances. [36] And, as it is a positive photoblastic plant, [37] the type of management used in the systems mentioned had a large contribution to the high rate of infestation of this species, as it includes soil turning with exposure of seeds to solar light.

Table. 3: Absolute densities of different species of spontaneous plants identified in treatments

	Relative Density (%)				
Species	**SC**	**SO**	**G**	**L**	**G + L**
Amaranthus spp.	0.6	1	24.9	65.8	48.7
A. absinthium	-	-	12	-	6.2
C. benghalensis	-	-	-	0.6	-
C. rotundus	3	5.4	24.6	9.1	25.3
D. sanguinalis	0.7	1	6	2.6	1.5
E. indica	0.4	0.4	-	1.3	-
E. heterophylla	0.4	0.4	1.9	2.4	3.1
G. quadriradiata	86.9	82.6	-	-	-
Oxalis spp.	3.1	2.9	26.8	14.6	10.5
R. obtusifolius	-	-	3.8	1.6	3.1
S. oleraceus	-	-	-	-	-
S. arvensis	4.9	6.3	-	1.9	1.5

Despite the use of intensive management in soils without mulch there was a low relative density of *Cyperus rotundus* (Table 3). According to Machado *et al*. (2005) [38] and Bangarwa *et. al*. (2012), [39] the use of the conventional system favors the propagation and establishment of this specie due to the break in dormancy caused by the division of the tuber chain and the elimination of apical dominance exercised by the distal tubercle. However, in this case, the low density of *C. rotundus* can be attributed to interspecific competition with species of higher relative density present in the area.

In organics NTS were observed higher relative densities of *Amaranthus* spp., *C. rotundus* and *Oxalis* spp., respectively (Table 3). The presence of these species in the area can be explained by the high production rate of seeds of the genus *Amaranthus*, as an example we have the specie *Amaranthus retroflexus*, which can produce up to 117 thousand seeds per plant. [40] These seeds, being very light, are easily dispersed by the action of wind and water. [41] In a study carried out by Wilson (1980), [42] seeds of 77 weed species were found in a main irrigation channel, with *Amaranthus retroflexus* having the highest frequency, accounting for 40% of the total seeds. In addition, the presence of straw on the soil favors species that have negative photoblastic germination, such as *Amaranthus*

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caudatus, as verified by Gutterman et al. (1992) [43] in study related to this specie.

On the other hand *C. rotundus* for having aggressive characteristics of survival and dissemination, is known as one of the most difficult species of spontaneous plants to be controlled that exists whatever the agricultural system work in. [44, 45] However, Vaz de Melo *et al*. (2007) [46] found in their research that in the conventional NTS, with no restrictions on the use of glyphosate for initial desiccation of spontaneous plants, the control of *C. rotundus* was more efficient than in the organic NTS, in that only the use of straw on the soil did not demonstrate efficiency.

In Brazil, the largest number of "shamrock" species belongs to the genus *Oxalis* L. [47] They are aggressive perennial plants, difficult to control, which have vegetative propagation as an exclusive form of dissemination and establishment. [41] Marshall (1987) [48] in a study performed with 3 specific species of the genus Oxalis, reports the difficulty of controlling these species using both leaf herbicides and cultural control methods. Jakelaitis (2003), [49] studying the population dynamics of the weed community present in the research area, found that there was a greater accumulation of biomass for the *Oxalis latifolia* in the corn crop in NTS.

No statistical differences were observed between treatments for the fresh weight and dry weight variables (Table 4). However, for the percentage of soil covered by spontaneous plants, the CS and OS treatments showed a higher average than the other treatments, followed by treatment L. The treatments G and G + L had the lowest percentages of covered soil, with no statistical differences between them. These results corroborate those shown in Table 2 and indicate that the use of mulch on the soil reduces both the percentage of infestation and the absolute density of spontaneous plants in the cultivated area. The presence of the cover on the soil reduces not only the luminosity, but also the alternation of temperatures in the soil, in addition to releasing allelochemical compounds during the decomposition of the phytomass resulting in a decrease in the germination rate of several species. [50, 51, 52]

Table. 4: Means of the percentage characteristics of soil covered by spontaneous plants, fresh weight and dry weight.

Treatment	Covered soil (%)	Fresh weight (g)	Dry weight (g)
G	12,57 c	14,07 a	2,22 a
G + L	15,17 c	27,48 a	3,53 a
L	35,72 b	70,47 a	7,89 a
SC	63,36 a	42,21 a	3,95 a
SO	70,76 a	70,45 a	6,13 a
Média[1]	39,52	44,94	4,74
CV (%)	14,45	89,03	86,78

[1]Means followed by the same letter vertically do not differ by Tukey's test at 5% probability.

Trezzi and Vidal (2004) [18] and recently Felito (2020) [53] observed, respectively, a reduction of 41% in infestation and up to 55% in the absolute density of spontaneous plants, comparing areas under cover plants with uncovered control.

Theisen *et al*. (2000) [54] testing the germination of spontaneous plants under covered and uncovered soil concluded that there was a higher incidence of *Brachiaria plantaginea* under uncovered soil and attributed the result to the reduction of the quantity and modification of the quality of the light that reached the seeds caused by the presence of the cover on the ground. Silva (2016) [55] highlights that the increase in the amount of phytomass on the soil, in addition to the physical impediment to the entry of light, also promotes greater regulation of the soil temperature, which provides a decrease in the germination of the specie *Amaranthus deflexus*, since this species is classified as positive photoblastic and also presents a higher emergence rate in bare soil situations where temperature changes.

The use of millet as the grass specie in the composition of straw in organic NTS resulted in good control of the spontaneous community (Table 4) and this can be explained due to its rapid initial growth, covering the soil quickly; [56] due to its general ability to generate a good amount of phytomass, regardless of whether it is grown single or intercropped, as Meschede (2007) [57] also observed in his trial with different types of cover plants; and due to its allelopathic potential. Pereira (2014) [58] concluded in his study that greater control of spontaneous plants was observed in the treatment in which millet was used single, although the treatment that provided the greatest accumulation of dry matter was millet in intercropped between sunn hemp. Carvalho (2012) [59] also found its allelopathic action, since among all the cover plants tested, millet was the one with the highest percentage of control of *Brachiaria brizantha*, *Sida rhombifolia*, and *Emilia sonchifolia*, even having produced only 0.97 $t.ha^{-1}$ of phytomass in those conditions, a value considered extremely low.

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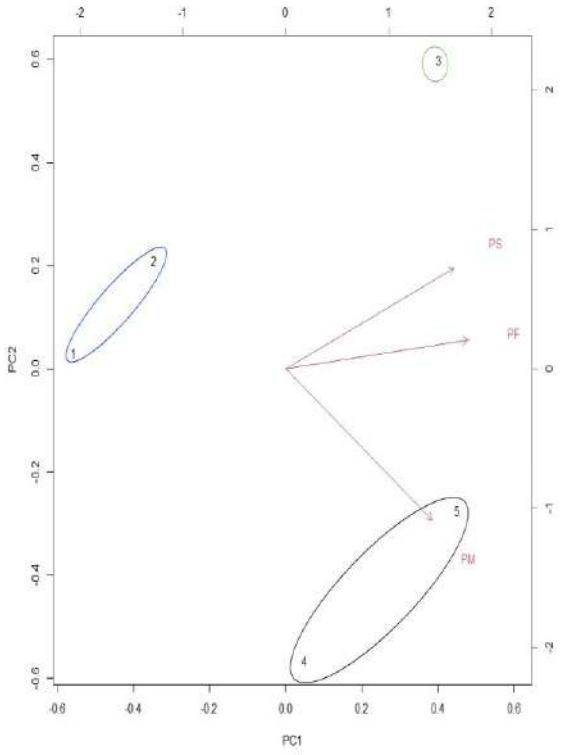
The graph in Fig. 1 shows the dispersion of the 5 treatments regarding the characteristics percentage of soil covered by spontaneous plants, fresh and dry matter, and the dispersion can be observed based on the coordinates related to the first two main components, CP1 and CP2, that formed 3 distinct groups and that the two components absorbed 99.81% of the variation existing in the original characteristics, with CP1 with 81.69% and CP2 with 18.12%. The first group was formed by treatments G and G + L, the second by treatments CS and OS and finally, the third by treatment L. The results shown in Fig. 1 confirm those presented in Table 4.

It can be seen in the Biplot CP1 x CP2 graph in Figure 1 that the variable that most contributed to CP1 was fresh weight. As expected, a strong correlation was observed between the variables fresh weight and dry weight, according to the acute angles between them. For CP2, the percentage of soil covered by spontaneous plants was the variable that contributed most.



Fig, 1: Dispersion diagram in relation to the first two main components of the five treatments: 1-G; 2-G + L; 3-L; 4-CS; 5-OS; as to the relative density (%).

Characteristics: weed percentage - MT; fresh weight - PF and dry weight - PS

The graph in Fig, 2 shows the dispersion of the 5 treatments in terms of absolute density, and one can observe the dispersion based on the coordinates related to the first two main components, CP1 and CP2, which formed 3 distinct groups and that the two components absorbed 89.23% of the variation existing in the original characteristics, with CP1 with 56.43% and CP2 with 32.81%. The first group was formed by the CS and OS treatments, the second by the G and G + L treatments and finally, the third by the L treatment.

It can be seen in the Biplot CP1 x CP2 graph in Fig. 2 that the variables that contribute to CP1 are species A, C, G, H, I, J and K. There were also strong correlations between variables A, G and I conform to the acute angles between them. For CP2, B and F were the variables that contributed most.

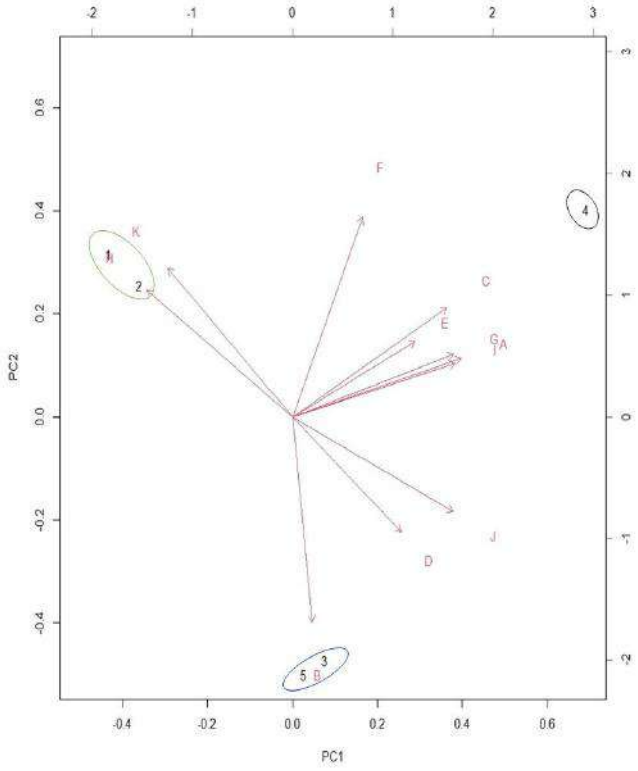


Fig. 2: Dispersion diagram in relation to the first two main components of the five treatments: 1-CS; 2-OS; 3-G; 4-L; 5-G + L, regarding absolute density (plants m^{-2}).

species: A - *Amaranthus spp.;* B - *A. absinthium;* C - *C. benghalensis;* D - *C. rotundus; E* - D. *sanguinalis;* F - *E. indica;* H - *E. heterophylla;* I - *G. quadriradiata;* J - *Oxalis spp.;* K - *R. obtusifolius;* L - *S. arvensis.*

The graph in Fig. 3 shows the dispersion of the 5 treatments in terms of relative density, and one can observe the dispersion based on the coordinates related to the first two main components, CP1 and CP2, which formed 3 distinct groups and that the two components absorbed 90.56% of the variation existing in the original

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characteristics, with CP1 with 63.62% and CP2 with 26.94%. The first group was formed by treatments CS and OS, the second by treatments G and G + L and finally, the third by treatment L.

It can be seen in the Biplot CP1 x CP2 graph in Fig. 3 that the variables that contribute to CP1 are species B, C, D, E, H, I, J and K. There were also strong correlations between variables A, C and F conform to the acute angles between them. For CP2, A, C and F were the variables that contributed most.

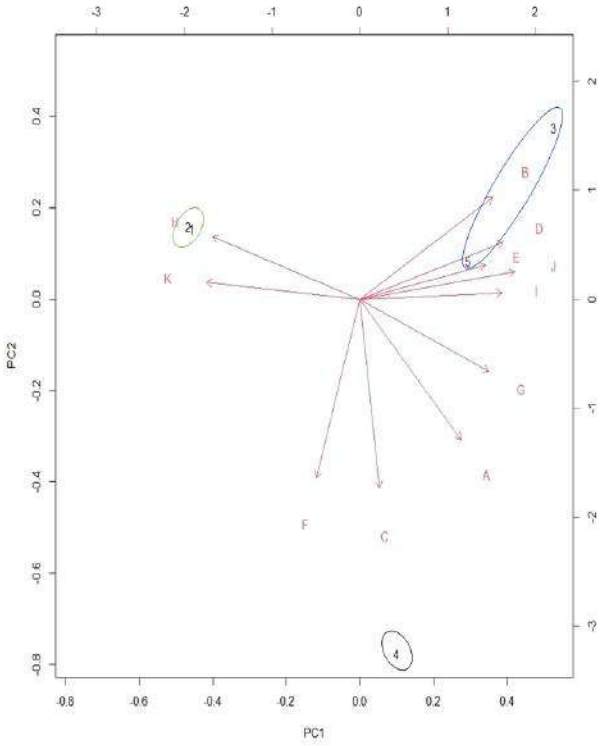

Fig. 3: Dispersion diagram in relation to the first two main components of the five treatments: 1-SC; 2-SO; 3-G; 4-L; 5-G + L, regarding relative density (%)

species*:* A - *Amaranthus spp.;* B - *A. absinthium;* C - *C. benghalensis;* D - *C. rotundus;* E - *D. sanguinalis;* F - *E. indica;* H - *E. heterophylla; I* - G. *quadriradiata;* J - *Oxalis spp.;* K - *R. obtusifolius;* L - *S. arvensis.*

IV. CONCLUSIONS

- The use of single millet straw or intercropped between sunn hemp, in the organic NTS causes a reduction in the percentage of infestation and in the absolute density of spontaneous plants.
- Treatments with intensive soil management systems have a higher relative density for the specie *G. quadriradiata*. The highest relative densities in organic NTS are attributed to the species *Amaranthus* spp., *C. rotundus and Oxalis* spp.
- The percentage of infestation by spontaneous plants does not reach the level of economic damage in any of the treatments studied, since the average productivity of ears without straw is within the Brazilian average, which is between 9,000 to 15,000 Kg.ha^{-1}

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Sleep in pandemic times - COVID-19

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Abstract**—** *The effects of the pandemic on long-term mental health of the population submitted to isolation and anxiety due to the perspective of being contaminated or due to the economic distress are an emerging issue to the healthcare community to be faced in the years to come. Possible interventions to improve sleep quality during the pandemic like avoid reading or watching news regularly and, especially, before going to bed and interact positively with other household members are recommended. Further investigation of the symptoms caused by this physiological modification is necessary to handle what can be manifested by severe sleep disorders.*

Keywords**— pandemic, anxiety, COVID-19, WHO.**

I. INTRODUCTION

Corona Virus Disease (COVID-19) outbreak took place on December 2019 at Wuhan, China, and spread throughout the world, leading to declaration of a pandemic by the World Health Organization (WHO) on March 11th, 2020. Its exponential spreading is due to easy transmissibility from person to person, through respiratory droplets or contaminated objects and surfaces, allied to an incubation period that exploit the current transport globalization, which creates a true worldwide pandemic. As of November 02th, about 46 million people have been infected by the new SARS-CoV-2 worldwide, according to the WHO. COVID-19pandemic containing measures can be extremely harmful in view of the abrupt changes that individuals have been undergone, whether in habits, behavior and even in the psychological aspect, reflected in quality of life and quality of sleep[1].

Biological clock activity requires synchronizers for the sleep-wake cycle to function effectively and provide a good sleep night and a more profitable day. Because of this, conditions such as reduced daily exposure to light and increased exposure at night, mainly through cell phones or other screens, tend to change the rhythm of the biological clock and disrupt sleep latency, bedtime and waking and wake time[2,3]. Psychological consequences of the pandemic caused by social isolation, excessive news spread by the media and lack of adequate medical / psychological support have influenced the quality of sleep in the population. Although they are temporary changes, if not treated in time and correctly, they can progress to long-term disorders, including sleep disorders and stress and depression[4].

During social isolation, individuals' sleep time tends to be longer, while their quality is reduced. In addition, individuals who make use of digital media a few hours before bedtime usually sleep and wake up later, being higher this time to workers than for students. Another important fact to be reported is that individuals with lower quality of sleep have higher rates of depression, anxiety and stress, as well as a greater association between suicidal thoughts and insomnia[3,5,6].Insomnia and shorter sleep duration have

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been more prevalent in adults with children and with reported family stress. Moreover, when compared to other occupations or individuals in total isolation, health professionals have a higher rate of poor sleep quality. The change in circadian rhythm can have several consequences, as shown in Table 1,wherewe list possible interventions to improve the quality of sleep in the population[5–9].

Table 1: Consequences of changes in circadian rhythm and possible interventions to improve sleep quality during the pandemic

Consequences	Interventions
Poorsleepquality	Avoid reading or watching news regularly and, especially, before going to bed.
Insomnia	Reduce use of screens 1-2 hours before bedtime
Anxietydisorder	Set a time to sleep and wake up every day
Depressivedisorder	Performexercises
Suicidalthinking	Interact positively with other household members
Stress	Go to bed only at bedtime
Moodchanges	Keep the room with low light and no noise
Posttraumatic stress disorder	Seekpsychologicalassistance

Source: Authors themselves, 2020

II. CONCLUSION

The effects of the pandemic on the quality of sleep in the population are still matter of research, the consequences of anxiety and social isolation can have a significant negative impact on the sleep-wake cycle of individuals. Further investigation of the symptoms caused by this physiological modification is necessary to handle what can be manifested by severe sleep disorders. Population must be informed about the importance of sleep hygiene to improve the quality of life, and its importance for control of COVID-19 pandemic long-term mental health symptoms.

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Qualitative and Quantitative aspects of Pitaya with the use of low doses of a Compound based on Remineralizer and Organic Fertilizer.

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Abstract— *The validation of the compost developed based on organic fertilizer and remineralizer makes it possible to add value for both organic fertilizers and crushing companies. The use of national raw material and the potential for demands for organic products, with low cost due to the use of industrial waste, contributing to the environment in the reduction of contaminants and sustainable management. Given the above, the work aimed to characterize and evaluate the viability of Pitaya with the use of low doses of a remineralizer compound and organic fertilizer. The research was developed and applied to a rural property located in the Alto da Serra district, Chapecó-SC. The experiment was conducted with Pitaya, in a randomized block design (DBC), 3 replications and 7 treatments. The plots were distributed by lot, totaling 21 plots, the plants were fertilized with compost based on organic fertilizer and remineralizer. The treatments have the following compositions: T1-0% control (without fertilization); T2-100% remineralizer (2kg); T3-100% organic fertilizer (2kg); T4-50% remineralizer (1kg) + 50% organic fertilizer (1kg); T5-25% remineralizer (0.5kg) + 75% organic fertilizer (1.5kg); T6-75% remineralizer (1.5kg) + 25% organic fertilizer (0.5kg) and T7-poultry litter (2kg). The collected data were submitted to Analysis of Variance by the F Test and the differences between the means were compared by the Tukey Test ($p \leq 0.05$). The use of the soil remineralizer with the fertilizer provides increased productivity and fruit revenge, with 2 T / ha being more productive. The treatment with the compost with 50% organic fertilier and 50% remineralizer obtained the highest number of flowers and fruits per plot, highest productivity and the highest financial return, and already in the second year of implantation, the first crop of the crop is paid for. all production and investment costs, showing technically feasible. The treatments do not influence the physical and chemical characteristics of Pitaya fruits. The culture of Pitaya managed with low doses of the compost presents technical and economic viability and shows a promising fruit due to its rusticity, productivity and functional and nutraceutical properties.*

Keywords— ***Agroecology. Technical viability. Economic viability.***

I. INTRODUCTION

In 2018, according to data from the National Fertilizer Diffusion Association (2019), Brazil consumed around 35 million tons of NPK fertilizers (Nitrogen, Phosphorus and Potassium), 80% of which was imported, nitrogen increased by 86%, highlighting the country as one of the largest producers and exporters of agricultural products in the world and an important consumer market for fertilizers.

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Agrominerals and soil remineralizers can overcome the country's dependence on inputs for agriculture, especially in the import of potassium. In addition to the sustainable use of this material in agriculture, adding value to the miner, reducing costs in agriculture, promoting local cooperation networks and generating income in the region where it is located (LICHS *et al*., 2019).

The search for alternative sources of agricultural fertilization addresses one of the bottlenecks in the fertilizer sector, which is the unavailability of basic raw materials, logistics, tax and environmental issues (BNDES, 2012). The study was carried out thinking of a joint solution both for the environmental problem caused by the waste dust from the quarries, as well as its use as a remineralizer of the plants. Its use facilitates the performance and dynamics of mycorrhizal fungi, promoting a better absorption of nutrients available to the soil, generating a beneficial symbiosis for plants. The remineralizer can supply the demand of organic producers in the production of healthier food produced with less impact on the environment (BERGAMAN *et al*., 2014).

Brazil is the world's third largest fruit producer, after China and India, with around 45 million tons a year, of which 65% are consumed domestically and 35% are destined for the foreign market (EMBRAPA, 2019). The edaphoclimatic conditions are favorable for fruit growing, especially tropical ones, and the cultivation of Pitaya in aroused interest by farmers for its rusticity, precocity, good productivity and added value. Fruit that is exotic is also called “dragon fruit” on the foreign market, with good acceptance by consumers, for its nutritional quality and organic production (CHAVES, 2016).

Pitaya has potential for both the domestic and foreign markets, which makes its cultivation promising from an agronomic and economic point of view (JUNQUEIRA *et al*., 2002). It is marketed as an ornamental plant in European countries and in the United States, but its greatest use is in the food industry because it has functional properties due to the presence of bioactive compounds (MELLO, 2014).

The validation of the compost developed based on organic fertilizer and remineralizer makes it possible to add value for both organic fertilizers and crushing companies. The use of national raw material and the potential for demands for organic products, with low cost due to the use of industrial waste, contributing to the environment in the reduction of contaminants and sustainable management.

Given the above, the work aimed to characterize and evaluate the viability of Pitaya with the use of low doses of a remineralizer compound and organic fertilizer.

II. MATERIALS AND METHODS

The research was developed and applied in a rural property located in the Alto da Serra District, Chapecó-SC. For the development of the compost, organic fertilizer and remineralizer were used, formulated in the proportions of 25%, 50%, 75% and 100% for each product. The Remineralizer used in the compost was obtained from the extraction of basalt by the grinding process resulting in powder and passed through a 200 sieve to obtain the remineralizer. After the sample was collected and sent to the Laboratory of Development and Characterization of Materials of FIESC, SENAI / SC in Criciúma-SC, to carry out the chemical analysis and verification of the amounts of macro and micronutrients. The experiment was conducted with Pitaya, in a randomized block design (DBC), 3 replications and 7 treatments. The plots were distributed by lot, totaling 21 plots, the plants were fertilized with compost based on organic fertilizer and remineralizer. According to soil analysis performed a sample per block, and interpreted according to the Soil Chemistry and Fertility Commission - RS / SC (2016), there were high levels of macro and micronutrients.

To verify the response regarding the effect of the remineralizer, 2 kg per plant was added, with 2 tons per hectare of the compost based on rock powder and organic fertilizer in the proportions of 25%, 50% and 100%. The treatments in the experiment have the following compositions: T1- 0% control (without fertilization); T2- 100% remineralizer (2 kg); T3 - 100% organic fertilizer (2 kg); T4- 50% remineralizer (1kg) + 50% organic fertilizer (1kg); T5- 25% remineralizer (0.5 kg) + 75% organic fertilizer (1.5 kg); T6- 75% remineralizer (1.5kg) + 25% organic fertilizer (0.5kg) and T7- poultry litter (2kg). The T7 poultry litter treatment was analyzed in the recommendations for poultry litter (5 to 8 lots), according to the Soil Fertility and Chemistry Commission - RS / SC (2016). The applications were divided between the vegetative and reproductive stages. The fruits were harvested on March 28, 2019, 36 days before anthesis. The crop yield was determined from the random sampling of one fruit per treatment, considering the fruit count for the production estimate (kg / ha) . Between the phenological period, the flower counting was carried out, percentage of revenge being carried out a sample of three plants per block in the treatments between the months of December to March. The months factor yield was analyzed by counting the number of flowers (NFLT), fruits (NFRT)

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and percentage of revenge (V%) during the phenological period that comprised the months of December / 2018, January, February and March / 2019) to identify the highest occurrence. Economic viability was determined by surveying the necessary investments for the implantation of the orchard, projecting revenues, operating costs and economic indicators for each treatment, according to Krupp (2015).

To determine the physical-chemical characterization, the following analyzes were performed: pH with reading in a digital pot; soluble solids expressed in brix degree (ºBRIX) as a percentage; total acidity determined by volumetry with NAOH (sodium hydroxide) 0.1n with 0.1% phenolphthalein indicator and the Total Acidity (AT) / Soluble Solids ratio (ºBRIX), all methods described according to Instituto Adolfo Lutz (2008). The collected data were submitted to analysis of variance (ANOVA) by the F test and the differences between the means were compared by the Tukey test ($p \leq 0.05$), with the aid of the statistical analysis program SISVAR (FERREIRA, 2011).

III. RESULTS AND DISCUSSION

The analysis of variance shows that there was a statistical difference between the treatments used for the characteristic fruit weight and production kg / ha, a significant effect ($p \leq 0.05$) of the compound factor (rock powder and organic fertilizer) in relation to the variable responses to fruit weight per plot (g) and production (kg / ha). Regarding the weight of the fruits per plot, it appears that in the T6 treatment (75% remineralizer and 25% organic fertilizer), 329.28 greater weight of the fruit was obtained. And higher production was in the T4 treatment (50% remineralizer + 50% organic fertilizer) with 8,997.98kg / ha, differing statistically from the other treatments, followed by T3 (100% organic fertilizer) and T2 (100% remineralizer) with 6,549, 60.

Studies carried out by Marques (2010) verified associated manure of bovine and chicken with bioclastic granules, obtained greater productivity, fruit quality and financial return. For Santos and Mendonça (2000), the use of rock powder had positive effects on the production and productivity components of the potato crop, the highest total potato production was 11.07 T / ha, achieved with the dose of 2, 33 T / ha of rock dust, 13.28% in relation to unfertilized treatment. It is believed that the highest total potato productivity is due to the solubilization of rock powder (MB4) and the release of its nutrients present as phosphorus (formation and production of tubers), potassium, calcium, magnesium and micronutrients.

The analysis of variance revealed a significant effect ($p \leq 0.05$) of the compound factor (rock dust and organic fertilizer) in relation to the variables responses: number of flowers per plot (NFLT), number of fruits per plot (NFRT) and revenge (%).

Regarding the percentage of flowers per treatment, the T4 treatment (50% remineralizing and 50% organic fertilizer) obtained the highest number of flowers with 15.50, followed by the T3 treatment (100% organic fertilizer) with 12.17 flowers and T5 (25% remineralizer and 75% organic fertilizer) with 10.83 flowers. Treatment T7 (100% poultry litter) of 4.0 flowers per plant was limited in the applied dosage. The same observed in Marques (2010). The same plant can present flower buds at an early stage, development, green fruits and ripe fruits in the same reproductive period. These periods were verified in the beginning in the summer and in the autumn, the high temperatures influencing the reproduction. Regarding the percentage of fruits per treatment, the T4 treatment (50% remineralizer and 50% organic fertilizer) obtained the highest number of fruits with 13.0, followed by the T3 treatment (100% organic fertilizer) with 10.75 fruits and T2 (100% remineralizer and 75% organic fertilizer) with 8.50 flowers. Treatment T7 (100% poultry litter) of 2.83 fruits per plant was limited in the applied dosage. The period of fruiting evaluated from anthesis until the end of the period of complete maturation varied from 35 to 45 days, with average temperature and precipitation, of 26ºC and 40 mm respectively.

For Marques (2010) the maturation period was 30 to 40 days. Lima (2013) found that the complete maturation varied from 35 to 45 days, with average temperature and precipitation, of 21.8 ºC and 150.6 mm, respectively. For Silva (2011), the development of red pitaya fruits is dependent on the conditions of the growing place (temperature and precipitation). Regarding the percentage of revenge per treatment, the T4 treatment (50% remineralizing and 50% organic fertilizer) was higher with 67.33%, followed by the T2 treatment (100% remineralizing) with 59.16 and T1 (without fertilization) with 58.58%. Treatment T3 (100% organic fertilizer) 42.67. As for the quantitative analysis in relation to the period of greatest occurrence, the flowering and fruiting months factor, the analysis of variance revealed a significant effect ($p \leq 0.05$) of the flowering / fruiting months factor in relation to the variables responses number of flowers per plot, number of fruits per plot and revenge (%). From the technical data of production of each treatment in the experiment it was possible to verify the productivity, it can be observed that the highest production and productivity was obtained in the T4 treatment (50% remineralizer + 50% organic

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fertilizer) with 8,997.98 kg / ha and 4.49 kg per plant, followed by treatment T3 (100% organic fertilizer) with 7,126.30 kg / ha and 3.56 kg per plant and T2 (100% remineralizer) with 6,549.60 kg / ha and 3, 27 kg per plant. The treatment with 50% dosage of remineralizer and organic fertilizer obtained greater production and productivity per plant.

The average unit cost and profit margin, where the lowest cost was in the T4 treatment (50% remineralizer + 50% organic fertilizer) of R $ 2.32 of average unit cost and R $ 12.68 followed by the T3 treatments (100 % organic fertilizer) R $ 2.94 average unit cost and R $ 12.06 profit margin and T2 (100% remineralizer) of R $ 3.04 average unit cost and R $ 11.96 profit margin. The economic indicators used for feasibility analysis can be concluded that the T4 treatment (50% remineralizer + 50% organic fertilizer) compared with the other treatments was the one that had the highest production per area with 8,997.98 kg / ha and highest productivity per plant 4.49 kg. As well as the highest revenue per hectare of R $ 134,969.70, the best net result of R $ 114,138.93, the lowest average unit cost per kg of fruit produced by R $ 2.34 and the highest profit margin R $ 12.68 . It achieved a better profitability of 85%, a profitability of R $ 228%, a shorter return on investment with 0.43 years, requiring a total of or R $ 20,830.77 equivalent to 15% of the total revenue, values described in the breakeven point . Marques et al. (2011) found greater productivity and greater financial return after three years of implantation of the orchard with fertilizers with bovine manure added to chicken litter. Regarding the physical characteristics, it can be concluded that no significant differences were found between the treatments, and the treatments with the compost with remineralizer and organic fertilizer did not influence the quality of Pitaya fruits. The longitudinal and transverse diameters varied. For the longitudinal diameter the smallest was in the treatment at T7 (100% poultry litter) with 8.80 cm and the largest in T5 with 9.96 cm. And the smallest transverse diameter was in treatment T4 (50% rock dust and 50% organic fertilizer) with 6.37 cm and larger in treatment T1 (control, without fertilization) with 7.42 cm.

For the characteristics of soluble solids, titratable acidity, soluble solids and SS / AT ratio, no significant differences were found between treatments, and it can be inferred that treatments with remineralized organic fertilizer compound did not influence the quality of Pitaya fruits. The same observed by Costa (2012) who demonstrates that the type of fertilization does not interfere with the chemical characteristics of the fruit, and may be influenced by the fruit's maturation stage. The pH obtained variations between treatments, the lowest pH was in T7 (100% poultry litter) with 4.99 and the highest was in T1 (control, without fertilization) and T6 (75% rock powder and 25% organic fertilizer) with 5.11. Magalhães (2017) obtained variations from 3.16 to 5.52, with a sharp drop between the 21st and the 28th, the pH reduction occurs due to the accumulation of organic acids, and the increase due to the consumption of these organic acids in the breath.

IV. CONCLUSION

Under the conditions in which the present research was conducted, the results obtained allow us to conclude that: Pitaya culture managed with low doses of the compound presents technical and economic viability. The use of the soil remineralizer with the fertilizer provides increased productivity and fruit revenge, with 2 T / ha being more productive.

According to the results, the largest flowering period occurs in the months of December and January and for fruiting and percentage of avenging the highest occurrence is in the months of January and February, and the treatment with the compost with 50% organic fertilizer and 50% remineralizer obtains the largest number of flowers and fruits per plot. The application of 50% organic fertilizer + 50% remineralizer is the treatment that provides the highest productivity and the highest financial return, and already in the second year of implantation, the first crop of the crop pays all production and investment costs, showing technically feasible.

The treatments do not influence the physical and chemical characteristics of Pitaya fruits. Pitaya's culture shows a promising fruit due to its rusticity, productivity and functional and nutraceutical properties.

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Development and Characterization of Porous Alumina for Controlled Drug Release

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Abstract— *Alumina is a bioceramic material used in the biomedical area as implants and as drug delivery material; it is considered an inert material, presenting good mechanical properties. Drug delivery is the process of transporting and releasing drugs into the human body in a controlled manner. Due to its characteristics, alumina was chosen as a carrier, since it must have adequate porosity to store and release the drug when implanted or grafted. Starch was used as a sacrificial material to improve porosity in the sample. Alumina samples with 5% and 10% starch addition were compared to pure alumina in relation to its porosity and mechanical properties. X-ray diffraction test confirmed the presence of the corundum structure in the alumina. The tensile strength limit by diametral compression and Young's modulus of samples presented the same value, and approximately half of the value when compared to pure alumina. Regarding porosity, the scanning electron microscope was relevant to highlight the porosity and grain differences in the samples. The mercury porosimetry assay was performed to quantify the porosity percentage, which increased with starch content and decreased with increasing final sintering temperature. In general, increasing sintering temperature reduced drug release, and increased starch content increased drug release. Therefore, it can be concluded that the samples with 5% starch presented the highest drug release in the proposed analysis.*

Keywords— ***Alumina, Drug Delivery, Implants, Porosity.***

I. INTRODUCTION

The area of biomaterials is an area in constant growth. New biomaterials are being developed, while existing ones are being improved on a daily basis, as well as their syntheses and production processes [1]. Some of these materials are used in implant components in the human body, with the aim of replacing diseased body parts. These materials must not produce toxic substances when in contact with the body and must be compatible with body tissues [2]. There are reports of alumina being used as biomaterial in several unsuccessful applications, until its use by Sami Sandhaus as a dental implant in the first half of the 1960's [3]. Consisting of aluminum-oxygen bonding, commercial alumina is usually presented as α-Al_2O_3, where the oxygen ions are organized in a compact hexagonal arrangement with the aluminum ions in two thirds of the octahedral places [4, 5]. Its mechanical properties and its minimum porosity directly depend on the purity of the alumina [4, 6]. For correct femoral implant function, the alumina sphere must present high mechanical resistance to replace the head of the femur. Failure in this type of implant requires a relatively complex surgery. In this way, the implant laboratories focused on processes to obtain high purity alumina, materials presenting low porosity, in addition to the introduction of zirconia as a reinforcement material along with alumina in some applications [7, 8].

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However, for alumina to be used as an implant and drug carrier, it must have adequate resistance and present pores in its structure, respectively. For a femur implant, for example, the porosity process required for controlled release would be impracticable. However, a dedicated implant for an area that is not subjected to constant mechanical stress, such as cranial implants, may be feasible. Cranial implants do not undergo frequent mechanical stresses, impacts, or wear [9]. Therefore, the possibility of porosity is acceptable, and may even bring benefits to this type of application. Porous ceramics could allow the growth of connective or bone tissues in the implant [10].

The implanted materials must have mechanical properties and density as similar as possible to the replaced bone. Table 1 lists some materials that present such characteristics. In addition to the materials presented in Table 1, hydroxyapatite [9], titanium and several titanium alloys (Ti-6Al-4V, Ti_{cp}, Ti-15Zr, Ti-19.1Nb-8.8Zr, Ti-41.2Nb-6.1Zr e Ti-25Hf-25Ta) [11] can also be used in bone growth treatments. Two relevant mechanical properties must be considered: the tensile strength limit (TSL), which considered the greatest stress that the material can achieve in a stress vs strain diagram, and the Young's Modulus (YM), which represents the elasticity of the material. YM is obtained by the coefficient between stress and strain at given points in the elastic region of the stress x strain diagram [10, 12, 13].

Pure alumina has low porosity when sintered. This results in excellent mechanical characteristics when compared to other materials (maximum resistance to abrasion/flexion/compression, Young's modulus, hardness, impact resistance). However, it restricts the absorption of actives, essential for controlled release. The inclusion of pores in alumina will provide the possibility of the absorption of a higher amount of actives and consequently, improve the controlled drug release process.

The production of meso/macro porosity can be achieved with the addition of organic compounds in the ceramic. An example is the production of ceramic suspensions with starch particles, where starch acts as a gelling agent [14]. During heating in hot water, the starch passes its gelation point, where the rheological characteristics, such as viscosity, are drastically changed, precisely by passing from solid to gel [15]. After the inclusion of starch to the alumina, the mixture is sintered. The organic material is burned and released, forming pores in the alumina.

For the purpose of carrying and controlled release of drugs, alumina can be used in the form of macroscopic implants, acting as a “sponge” [16]. Thus, the main purpose of this article is the development of porous alumina for drug carrying and be used as cranium implant. For this, the porosity and the mechanical properties of alumina must be taken into consideration, which are two types of antagonistic properties.

II. MATERIAL AND METHODS

Alumina was donated from Treibacher Schleifmittel Brasil Ltda. Starch was purchased from Alphatec. Bupivacaine Hydrochloride (BUP) was provided by Dr. Eneida de Paula from the Department of Biochemistry at University of Campinas (Unicamp).

2.1 Preparation of samples

Starch samples were mixed in hot water (90 ºC) under magnetic stirring until reaching the gelation process. The starch samples (5% and 10% by weight for alumina) were then slowly poured over alumina. The mixtures were placed in the jar mill (SOLAB SL 34) and mixed for 48 hours at 150 rpm. After that, the material was left to dry at room temperature (without ventilation or kiln) for approximately one week. After drying, the material was ground in a mortar and pistil and sieved through a 53-µm sieve (Bronzinox - 270 Mesh).

2.2 X-ray diffraction analysis

Samples of pure alumina and alumina containing 5% and 10% starch were analyzed using X-ray diffraction. The analyses were performed on a D2 Phaser Bruker diffractometer. The X-ray diffractograms were obtained between 20º to 80° in 2θ with 0.03°/s steps and 0.2-mm slit.

2.3 Thermal analysis

Samples of pure alumina and alumina containing 5% and 10% starch were submitted to thermogravimetric analysis (Shimadzu TGA-51H Thermogravimetric Analyzer). The samples were heated to 800 °C, with a heating rate of 10 ºC/min and a flow of synthetic air carrier gas of 20 mL/min.

2.4 Sintering of samples

Before sintering, the samples were pressed (SKAY 30-Ton uniaxial hydraulic press) with 2-ton pressure to produce the specimens in two different shapes (rectangular and cylindrical formats). The samples were then sintering in a Nabertherm LHT 02/17 LB Speed furnace according to the curve shown in Figure 1.

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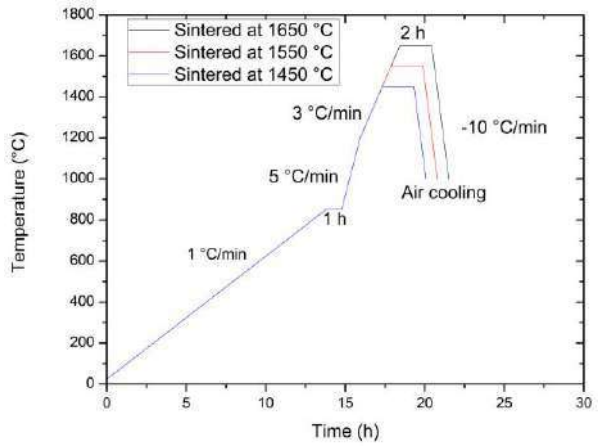

Fig. 1 – Sintering curve of the alumina sample.

2.5 Dilatometry

The samples were pressed and placed in a dilatometer (Netzsch DIL 402 dilatometer). The measurement was performed with the same sintering curve as shown in Figure 1 (1450 ºC and 1550 ºC) for samples of pure alumina, alumina with 5% starch and 10% starch. The sintering curve with temperature at 1650 ºC could not be performed due to the equipment operating at temperatures up to 1600 ºC.

2.6 Scanning electron microscope

Rectangular samples were broken and the fractured surface was analyzed at SEM FEI quanta 200. To allow responses from the microscope surface, the surfaces were sputtered with gold particles (*sputtering/coating* Bal-Tec SCD-050 device). Only the rectangular samples were analyzed under magnifications of 42x, 600x, 2400x, 10000x, and 30000x.

*Table 1 – Bone properties and their possible implant substitutes (*Ti-6Al-4V alloy recovered - post-heat treatment).*

	Density (kg/m³)	Tensile strength limit (MPa)	Young's Module (GPa)
Cranium (bone)	1728	92.72	8
PEEK (implant)	1300	-	3.2
HAP (pure)	2500	-	0.75
HAP with bone (implant)	2224	20.5	1.25
Titanium (pure)	4510	240	103
Titanium (alloys)	-	900-1172	53-113
Alumina (90-98% purity)	3600-3900	104-551	275-380

Adapted de [11, 9]

2.7 Diametral compression

The cylindrical samples were subjected to the diametrical compression test on a universal testing machine (Shijin WDW100E Testing Machine). The cylindrical samples were subjected to compression until fracturing. The stress (σ) is calculated considering the diameter (D) and thickness of the cylinder (h), in addition to the force (P) applied to the specimen (Equation 1) (Marion & Johnstone, 1975).

$$\sigma = \frac{2P}{\pi Dh} \qquad \text{Equation 1}$$

2.8 Mercury porosimetry

Mercury porosimetry was performed only on rectangular samples using a Micromeritics Autopore™ IV porosimeter. Mercury intrusion was performed from low (50 µmHg) to high pressure (4.45 psi). Each pressure point had a 300-second equilibrium time.

2.9 Bupivacaine absorption and release

The drug absorption test was performed with the rectangular shape alumina specimens (previously weighed) from three different samples: pure alumina, alumina 5% starch, and alumina 10 % starch (all of them sintered). The specimens were immersed in 5-mL Bupivacaine hydrochloride (BUP) (3.00 mg/mL) for 24 h under agitation. After this period, the alumina samples were removed from the drug solution and weighed.

For the absorbed BUP release study, the BUP/alumina specimens were immersed in 30-mL phosphate buffer solution, 7.4 pH (0.2 M). Buffer solution aliquots (2 mL) were removed at regular intervals: 0.5h; 1h; 2h, 3.5h; 5h; 7.5h; 26.5h; 28h; 51h; 172h; 197h; 268h; 315h; 338h; and 482h. The release tests for the different samples (pure alumina, alumina 5% starch, and alumina 10% starch) were performed in triplicates. The aliquots were analyzed in UV_{vis} (Biochrom Libra) spectrophotometer to determine the BUP content released from the alumina. After analysis, samples were returned to the flask containing the phosphate buffer solution.

A BUP calibration curve was performed in advance using standard solutions with concentrations ranging from 0.5 to 3 mM (BUP absorption at 263 nm).

III. RESULTS AND DISCUTIONS

Alumina samples containing starch were prepared under the same conditions. The amount of starch used was 5% and 10%. Two specimen shapes were prepared: rectangular and cylindrical. Three sintering temperatures were used: 1450, 1550, and 1650 ºC.

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X-ray diffraction analysis was performed to verify the phase of the acquired alumina, as well as any possible contamination. According to the RRUFF website, the alumina is used in the corundum phase (website catalog: R040096.2) (Figure 2) indicating that there is only the presence of the alumina phase.

A pure starch sample was submitted to thermogravimetric analysis in order to define the starch degradation, as well as adjusting the sintering heating curve (Figure 3). Starch degradation occurs in 3 stages: up to 120 ºC water and other small molecules are lost; between 280 and 390 ºC series reactions occur, such as depolymerization (breaking of polysaccharide chains) and decomposition of amylopectin/amylase; and between 390 and 625 ºC carbonization reactions take place, which leads to the formation of amorphous carbon structures [17].

The sintering test was carried out with initial heating at a slow rate until reaching the temperature of 800 ºC for one hour (Figure 1) [18]. This slow heating (1 ºC/min) is intended to completely degrade the starch. The heating process from that point until reaching the temperature of 1200 ºC was fast (5 ºC/min).

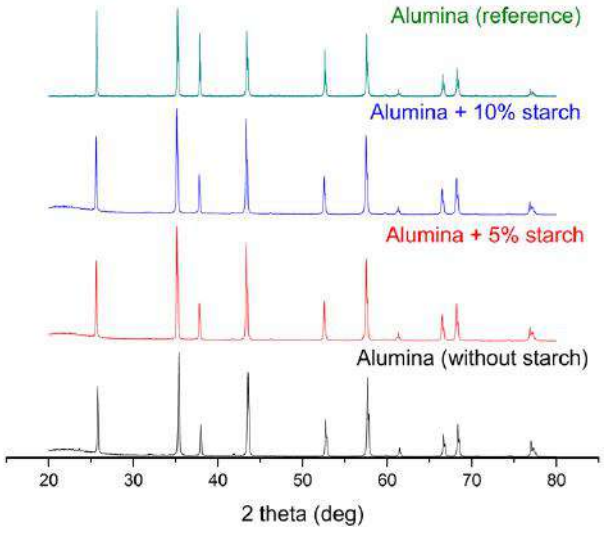

Fig. 2 – X-ray diffractometry for pure alumina (without starch); 5% starch alumina; 10% starch alumina; and alumina reference.

From 1200 ºC, the heating was moderate (3 ºC/min) until reaching the sample sintering temperature, where the temperature was maintained for two hours. The sintering process was carried out by varying the temperature from 1450, 1550, and 1650 °C. In this case, it is assumed that these temperatures result in partial samples sintering and therefore, differences in alumina properties must also be presented. The samples were cooled in a controlled manner (10 ºC/min) up to 1000 ºC to avoid cracks in the alumina.

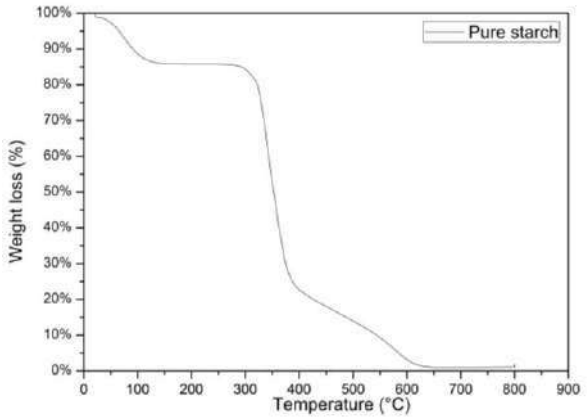

Fig. 3 – Thermogravimetric analysis of pure starch in an oxidizing atmosphere

The samples were then submitted to a dilatometry test, with the objective of verifying the contraction process of the samples during sintering. The analysis compares the contraction of samples in relation to their starch content and sintering temperature. The dilatometry analysis was performed reproducing the thermal ramps of 1450 ºC and 1550ºC (Figure 4).

Figure 4 shows an almost-constant expansion in the samples with the increase in temperature (obeying the increase in heating rate). The sintering temperature starts at approximately 900 ºC, with the process of contraction of samples. The samples burned at 1450 ºC presented less contraction than those burned at 1550 ºC, precisely because the sintering process is more effective at higher temperatures.

Another important analysis is the influence of porosity in the shrinking process. The greater porosity interferes in the proximity between the particles, making the sintering process and consequent shrinkage difficult. Thus, it was expected that samples presenting 5% starch presented greater retraction than those with 10% starch content. However, at a temperature of 1450 ºC, an inversion in the results can be observed, that is, a greater retraction was observed in the 10% starch samples. This can be explained by the fact that at this temperature the sintering process is in the intermediate phase in which the amount of pores is still moving, and depending on the size, it influences the contraction, thus being an obstacle during the sintering process. At 1550 ºC, the temperature at the final sintering phase, the contraction was practically the same for all samples, regardless of the amount of pores in them.

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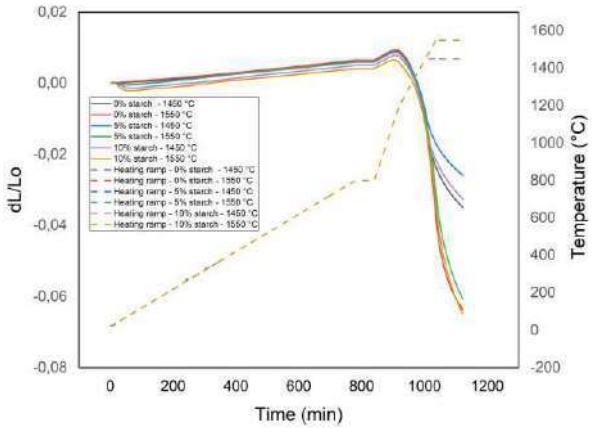

Fig. 4 - Dilatometry performed on alumina samples.

After the heat treatment, the samples were submitted to scanning electron microscopy (SEM) analysis to check the alumina porosity. It is possible to observe in the SEM images (Figure 5) that with the increase in the sintering temperature, the pure samples became more spherical and with rounded corners [19]. Besides that, the increase in sintering temperature induces a decrease in space between particles, an increase in particle size, and an apparent reduction in porosity and pore size. At 1650 ºC sintering temperature, there is little porosity, and thus, it would not be considered a temperature of interest to obtain pores. The difference in terms of porosity is not noticeable when comparing the starch percentages (5 and 10%) since they are relatively low content levels. Li et al. (2013) found noticeable results due to the use of samples showing a large variation (10 to 40%) of starch.

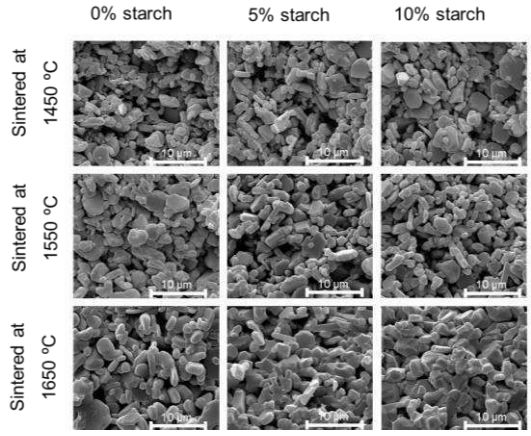

Fig. 5 - SEM microphotograph of fracture surface of pure alumina; alumina starch (5 and 10%) at temperature 1450 ºC, 1550 ºC, and 1650 ºC.

The porosity index related to the starch percentage and sintering temperature was checked using mercury porosimetry test (Table 2). Regarding the sintering temperature, it can be observed that porosity decreased with the increase in sintering temperature. At the temperature of 1450 ºC, an increase in porosity could be observed in samples with an increase in the starch percentage. At the sintering temperature of 1550 ºC, a small decrease in porosity could be observed when compared to samples at the temperature of 1450 ºC. The highest value was observed for 10% starch samples at 1550 ºC. At the sintering temperature of 1650 ºC, the sample without starch and with 10% starch presented similar porosity values. However, for the sample with 5% starch, a higher porosity index could be observed (Table 2). All porosity values at 1650 ºC are lower than at other sintered temperatures, which corroborates with the concept that an increase in the sintering temperature decreases the porosity.

The result of the three analysis (dilatometry, SEM, and porosimetry) related to the pore formation indicates low efficiency in the mixture between starch and alumina, and at 1650 ºC sintering temperatures the amount of starch used (5 and 10%) is not sufficient to form porosity.

The development of sintered alumina with pores for drug delivery systems has been successfully carried out. The presence of pores may reduce the mechanical resistance of the material, and therefore, it is important to check its properties. Diametrical compression tests were performed (Table 3) with samples of pure alumina and alumina samples containing 5 and 10% starch at different sintering temperatures.

Table 2 – Mercury porosimetry analysis for samples with rectangular shape.

Samples	Porosity (%)
1450 ºC / 0 % starch	29.7752
1450 ºC / 5 % starch	31.1073
1450 ºC / 10 % starch	34.9708
1550 ºC / 0 % starch	25.8941
1550 ºC / 5 % starch	24.7535
1550 ºC / 10 % starch	31.8249
1650 ºC / 0 % starch	15.6107
1650 ºC / 5 % starch	21.4169
1650 ºC / 10 % starch	14.9683

The tests were performed with 5 replicates for each sample to reduce the standard deviation and allow greater statistical validation of the values. It is important to emphasize that the elevated standard deviation can be explained due to the greater amount of pores, distribution defects, and small quantity of samples.

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By analyzing the samples submitted to the 1650 ºC sintering temperature, it can be observed that the values regarding tensile strength limit and Young's Modulus are much higher when compared with the samples with starch percentage (Table 3). However, the results at other sintering temperatures did not present significant variation when comparing the pure sample and starch samples. This indicates that at 1650 ºC the alumina is possibly near the final sintering phase.

Table 3 – Diametrical compression test results.

	Tensile strength limit (diametrical compression) (MPa)	Total deformation (%)	Young's modulus (approximate)(GPa)
1450 ºC / 0 % starch	7.13 ± 2.65	0.66 ± 0.30	49.19 ± 4.19
1450 ºC / 5 % starch	7.48 ±1.98	0.65 ± 0.51	71.67 ± 40.74
1450 ºC / 10 % starch	6.37 ± 1.54	0.67 ± 0.86	54.75 ± 2.75
1550 ºC / 0 % starch	20.18 ± 5.73	1.02 ± 0.43	134.01 ± 64.33
1550 ºC / 5 % starch	18.24 ± 6.78	0.87 ± 0.13	133.86 ± 32.14
1550 ºC / 10 % starch	17.73 ± 2.69	1.02 ± 0.20	119.05 ± 15.98
1650 ºC / 0 % starch	69.30 ± 17.05	1.55 ± 0.27	278.20 ± 48.27
1650 ºC / 5 % starch	32.82 ± 10.30	1.21 ± 0.56	151.74 ± 44.07
1650 ºC / 10 % starch	33.95 ± 11.63	1.54 ± 0.20	1.14 ± 55.42

When comparing the values obtained from literature regarding alumina (Table 1), it can be noted that the tensile strength limit for alumina samples sintered at 1650 ºC was below that found in literature. In addition to the use of an indirect method for obtaining the tensile strength, which can influence the values, the study used one of the simplest pressing/burning methods. Young's modulus was close to that found in the literature for alumina with 90% purity at temperature 1650 ºC.

When compared to the value of Young's modulus for the cranial bone present in Table 1, the Young's modulus value for the analyzed samples was much higher, which indicates greater rigidity. In relation to the titanium alloys, the values for Young's modulus at 1450 ºC are close, while those burning at 1550 ºC and 1650ºC exceeded the limits.

Regarding the tensile strength limit, for samples burning at 1450 ºC, the values were close to those of HAP with bone sample. Samples burning at 1550 ºC and 1650 ºC exceeded the value obtained for HAP with bone, but did not reach the bone tensile strength limit, and are much lower than the limit value for pure titanium (and in the case of titanium alloys, this value can be 5-fold greater than the tensile strength limit for pure titanium).

The tensile strength limit is a property that must be improved in these samples. The polymers and metals currently used have a high tensile strength limit, and the bone itself has a higher tensile strength limit than the analyzed samples. However, HAP with bone, which is currently used in implants, presents a lower tensile strength limit than most tested samples, and thus, porous alumina can be considered a possible alternative for use in cranial implants, considering the strength limit traction.

3.1 Bupivacaine absorption and release test

The absorption and release of BUP in the alumina was measured through the determination of the maximum absorbance wavelengths of BUP in the UV_{vis} (λ = 263 nm), and a calibration curve for the BUP concentration ranging from 0.5 to 3.5 mM produced a regression equation (r^2 = 0.9844):

$$y = 2.305x - 0.0654 \qquad \text{Equation 2}$$

In the drug absorption assay, the alumina was immersed in a BUP solution for a period of 24 h. The alumina sample was weighed before and after immersion in the BUP solution (Table 4). Table 4 indicates that the increase in the sintering temperature resulted in a lower absorption of the BUP. This can be explained by the decrease in porosity with the increase in the sintering temperature. Regarding the starch content at temperatures of 1450 ºC and 1550 ºC, it could be observed that samples of pure alumina (0% starch) showed less absorption due to their lower porosity. Regarding the temperature of 1550 ºC, the absorption values were relatively similar, but higher than that of pure alumina and below those for 1450 ºC. This drug absorption equality indicates that the porosity reached for alumina with 5% starch and 10% starch did not differ, despite doubling the amount of starch.

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For the BUP release test, the alumina samples containing BUP were immersed in 30-mL phosphate buffer solution under constant agitation. Aliquots were removed at specific times and analyzed under UV_{vis}. The aliquots were returned to the release test reaction medium. It was assumed that the maximum concentration of BUP absorbed by alumina was estimated as the final BUP concentration of the absorbed solution minus the initial BUP concentration of the solution in the absorption test. The results were compared in percentage terms in relation to its maximum BUP concentration value.

Figure 6 presents the results of the release tests as a percentage of BUP released in relation to time. A similar release profile could be observed for all samples, with the highest release intensity in the first 100 h. Low release rates were also observed at a temperature of 1650 °C.

These results can be explained by the low BUP concentration absorption at high sintering temperatures (1650 ° C) due to the low level of porosity.

The BUP release from alumina samples with 10% starch showed the highest release values for the sample sintered at 1450 ºC, followed by the ones sintering at 1550 ºC and 1650 ºC, respectively. These results are expected due to the greater amount of starch used to form the pores and the greater number of pores at 1450 °C (approximately 80% release). At 1550 °C, the release value was approximately 60%.

Table 4 - Sample absorption (water and BUP) in alumina in relation to sample weight.

1450 ºC / 0 % starch	11.00%
1450 ºC / 5 % starch	15.84%
1450 ºC / 10 % starch	15.84%
1550 ºC / 0 % starch	11.22%
1550 ºC / 5 % starch	12.40%
1550 ºC / 10 % starch	12.25%
1650 ºC / 0 % starch	3.05%
1650 ºC / 5 % starch	5.53%
1650 ºC / 10 % starch	7.47%

In general, when comparing the samples in the three different sintering temperatures, it can be concluded that at 1450 ºC more drugs were released, followed by 1550, and finally 1650 ºC. Regarding the starch contents, the release increased for samples with 10% starch due to the greater formation of pores and greater absorption of BUP.

An exception was a sample of pure alumina sintered at 1450 ºC, which showed greater release when compared to the sample with 5% starch. This may be due to the high surface porosity on the pure alumina due to processing.

IV. CONCLUSIONS

It was possible to prepare the samples with 5 and 10% starch, as expected. However, the amount of starch released during sintering was lower than the initially added, as shown in the thermogravimetry tests, indicating that it is likely that the starch was not fully distributed during incorporation into the alumina, or that the distribution of starch in the alumina was not homogeneous due to the use of uncontrolled drying.

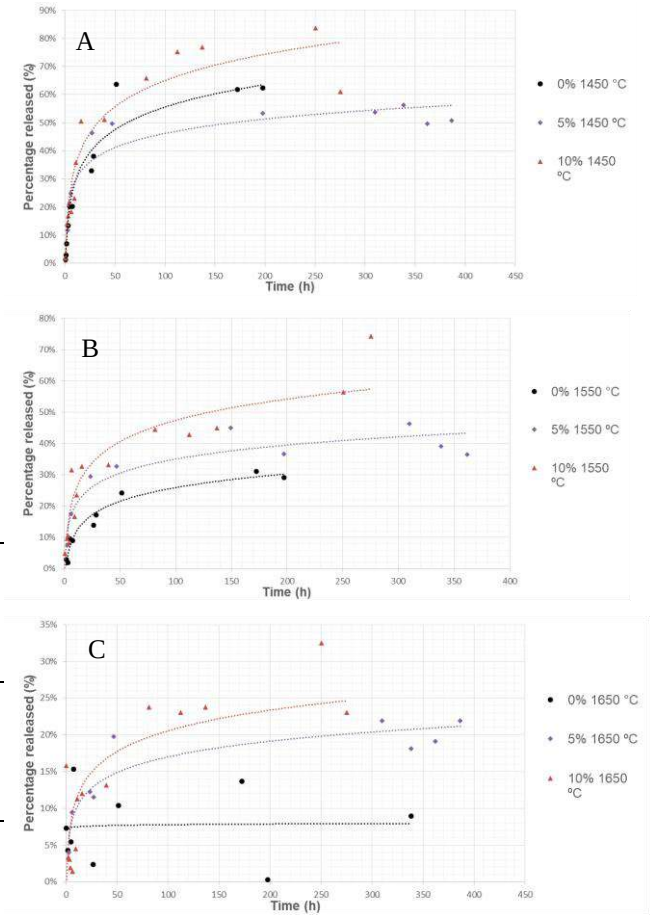

Fig. 6 - Percentage of BUP release as a function of time (hours). A) sintering temperature of 1450 ºC; B) sintering temperature of 1550 ºC; and C) sintering temperature of 1650 ºC.

Scanning electron microscopy determined the particle morphology of the samples in addition to observing the differences in porosity in the samples.

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As for dilatometry, it was possible to observe that the samples sintered at 1550 ºC presented greater contraction than those sintered at 1450 ºC, thus resulting in greater porosity at lower temperatures. It was also possible to observe that the starch content did not influence the temperature at the beginning of sintering.

It was possible to verify that the loss of mechanical properties occurs at temperatures of 1450 and 1550 °C for all samples, possibly due to the complete sintering of the samples rather than the incorporation of starch. At a temperature of 1650 °C, it is possible to notice that the porosity generated by the starch reduces the mechanical properties in almost 50%. However, both samples with starch contents presented similar properties. This means that possibly the influence of the addition of a greater amount of starch did not impair the mechanical properties. Nevertheless, further studies must be developed in order to confirm this behavior at higher starch levels.

Regarding the porosity analyzed by the mercury porosimetry, it can be inferred that a decrease in porosity could be observed with the increase in sintering temperature. Considering the temperature of 1450 ºC, the increase in the starch content resulted in an increase in porosity. However, at the sintering temperatures of 1550 ºC and 1650 ºC, the same could not be observed, that is, the variation in the percentage of starch may have been different from the expected and with the increase in the sintering temperature, a reduction in porosity was observed.

The weighing of the samples before and after immersion allowed to infer which samples presented greater absorption of the diluted drug in relation to their initial mass. It was noted that the increase in the sintering temperature in samples with the same starch content resulted in a decrease in the absorbed percentage. The absorption percentages were lower for samples of pure alumina and equivalent for samples containing 5 and 10% starch.

Regarding controlled release, considering the released concentrations between the two samples with starch, samples with 10% starch were the ones presenting the greatest release of drugs. Considering the three sintering temperatures, the samples with the lowest sintering temperature (1450 ºC) were the ones that released most drugs due to their higher porosity.

The addition of pores in the alumina resulted in a greater controlled release, but a decrease in the mechanical properties. The samples sintered at 1550 ºC were the ones that released most drugs in relation to the initially absorbed amount. At this temperature, some of its mechanical properties are compared to that of PAH, which is frequently used for this type of implant. However, since it was the first formulation of the samples, future changes in the process for obtaining the samples can be made, which could result in samples with greater mechanical strength than the current ones. For the results obtained in this study, the samples with 5 and 10% of starch sintered at 1550 ºC could be chosen for use in this type of application.

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An Immense Review on Comparative Analysis between Regular and Irregular Multistoried Building under Seismic Loading

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Abstract**—** *With growing Use of Multistoried buildings in India has become common, it has been in necessity of human beings to acquire particular space for their residential living in this type of freely environment. To make it more fascinate use of irregular shaped structures has modernized. The technical reason behind this modernization is that minimize effects of torsion on building and also to make the structure more ecofriendly and economical. The plan of the research in the present article has been obtained depending on previous studies on irregular building with shapes such as H-shaped, L-shaped, T-shaped, V-shaped, U-shaped etc., with different parameters being studied and compared on the structures having regular frame. The further study can be done by taking irregularity in the buildings by making floor in different directions such as east, west, North and south etc. and also by changing the grades of concrete.*

Keywords**— Concrete Grade, Dual system, Irregular Building, Lateral load capacity, Shear Wall.**

I. INTRODUCTION

The natural calamities are very unwanted and disrupting and earthquake is one of them. From this, it is most difficult to save the structural properties and life. To surmount these calamities we are required to calculate the behavior of the build atmosphere on seismic zone by enhancing development of different analytical methodologies, which gives security to the buildings to survive during several insignificant earthquakes and also gives a sufficient suitable warning at the time of major earthquake calamities. The seismic behavior of a building is based on various factors such as stiffness, sufficient lateral strength, ductility, configuration etc. During an earthquake, In contrast to irregular configurations structures with regular shape and UDL and stiffness in both elevation along with the plan undergo much less damage Most of engineers & architects prefer to build irregular plan structures and mostly it is impossible for them to keep this idea ascertain.

II. REVIEW OF LITERATURE

In this paper analysis & Modelling of a wind tunnel is done and pressure due to wind is determined on several faces of typical plan shape structures. The closed circuit of tunnel of a wind having flow of boundary layer is used to examine models having similar region and height. The preparation of models is done on the perplex sheets with a geometrical scale of about measurement of 1:500. The comprehensive range of angle of wind direction from 00 to 1800 at an interval of 150 is done by using geometry of model by variating pressure distribution at the surface. Change in pressure along the height and also along width of faces of the buildings models is examined to be huge. The value of peak pressure coefficient also differs significantly with direction of the wind in both position as well as magnitude (J.A. Amin, A.K Ahuja, 2008).

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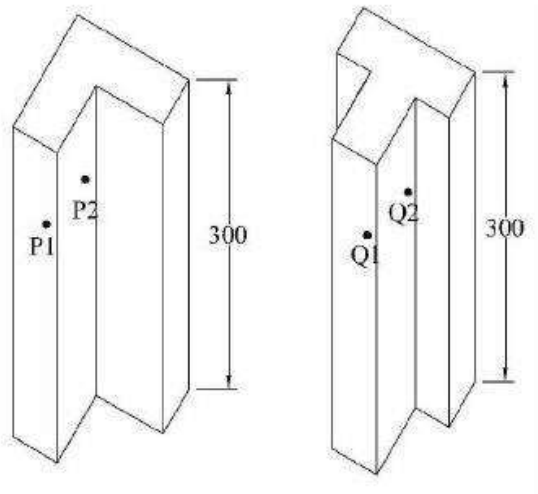

Fig.1: Plan of Building model of L-shaped building & T-shaped building respectively (J.A. Amin, A.K Ahuja, 2008)

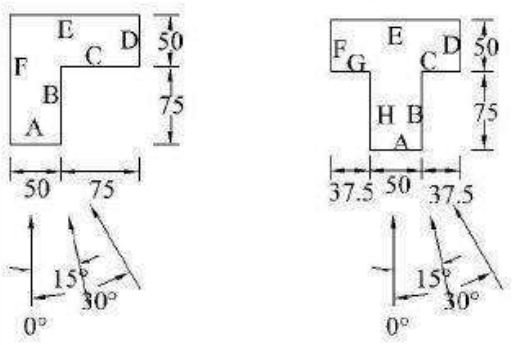

Fig.2: Isometric view of Building model of L-shaped building & T-shaped building respectively (J.A. Amin, A.K Ahuja, 2008)

The object of study included the effect of torsion along with that behavior of asymmetric building is analyzed by modeling a 14 storey building with software Tabs as per IS code 1893:2002 (part-I). During occurrence of an earthquake in building, torsion arise due to various reasons along the height of building. Most common is unsymmetrical distribution of stiffness and mass. In this paper dynamic analysis method (i.e., Response spectrum method) is adopted in which two types building are considered, one is square building 25m x 25m and other one is L shape building for determining the vibration, storey drift and displacement on each floor. In Irregular building (L Shape) displacement and storey drift is high. Frequencies vibration results as low in regular building and values of Torsion are less in irregular building. (Shaik munner hussain, Dr. Sunil kumar tengli, 2018)

The objective of this research is to analyze the seismic effect of the building of geometrical plan configurations and compare the analysis on various parameters i.e. axial forces, displacement, base shear, bending moment, shear force, etc. For this analysis response spectrum method has been used and it is analyzed by using STAAD Pro software. In this analysis a regular square shape building in plan is analyzed and the same is compared with H-shape plan building. Also, all the data being used for this analysis are same i.e. size of column, beam, height of floors, etc. The results of this analysis have been compared using graphs and by graphical illustration of displacement of both the buildings, axial forces, stress distribution through the height of the building etc. This study has been carried out to examine the effect on the stability of the building under seismic analysis and to make an easiness in the selection of the shape of the building in the seismic zone. (Mohd. Shadab khan, 2018)

Skyscrapers, parking garages, steel & concrete structures, low and high rise structures, and portal frame structures are usually analyzed by the software ETABS. In this article in this article the analysis of the cases includes the behavior of structures with multistorey during earthquake for several irregular plan such as Rectangular, C-shape, L-shape and I-shape. The analysis of a G+14 storey RCC framed building structure is done in the software ETABS. The maximum shear forces, bending moments, and maximum storey displacement are determined after analyzing the building structure and then calculated for all the modelled cases. (Abhay Guleria, 2014)

It is an attempt to determine the effect of Irregular plan configuration for multistoried reinforced concrete building model. This paper mainly gives importance to analysis of a multi-storey building (G+24) which is irregular both in plan and elevation. Modelling of 25 storied building structure with RCC frame is done on the ETABS v13.2.0 software. After analysis of the structure such as Maximum Storey Displacement, Base Shear, Storey Drift, Maximum base reactions, Torsion and Over-turning moments are determined, evaluated and then all the cases values are being compared. (N Mohan Reddy, Dr. E. Arunakanthi, 2015)

In this paper the T-shaped irregular plan tall structure is analyzed using wind load and the parameters are obtained such as base shear(FX),Overturning moment (MY) and Torsional moment (MZ) for the isolated as well as conditions for interference. Wind incidence angles. & effect of interference were measured for isolated condition, the interfering model has same shape and dimensions as that of the instrumented model. Placing of models were done side by side and also as random plan along with it spacing was varied... It was observed that the presence of a neighboring building greatly affects the wind flow pattern

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around a building which causes change in the wind loading on the building. The effects of the interference may be either give benefits or it will be adverse that will depend on the position of the interference building structure. . (Ravindra ahlawat, ashok K. ahuja, 2015)

In recent times current architecture describes one of the nice abstract with irregular geometry. Everybody desire to make aesthetical design of attractive as well as structures such as compound type and with shortage of land it is modern requirement to increase the height of the structure & making it as tall structure. But as long as we move towards vertical height of tall structure the wind pressure is exerted with level of extent., which can be very hazardous to life., so it is necessary to examine and recognize such pressures by controlling them .The wind analysis is done for irregular geometry such as T-shape, L-shape and parameters are checked at various heights . The building with 15, 25 and 30 storey is analyzed for both regular and irregular models and it is observed that coefficient of parameter increases with the height of building. . Also path of wind plays extremely necessary part in performance of structure. (Bhumika Pashine, et.al, 2016)

The structural analysis of RCC Multistoried building structures is very complex. The IS code of earthquake load i.e. IS-1893-2002 with its latest version suggests to analyses RCC building in 3-D Systems. The irregularities in plan and elevation of building structures is the main reason behind analysis of 3-D Systems. It has been observed that irregularity leads to unfavorable performance or behavior or the effectiveness during earthquake and IS-codes for earthquake load differentiate between both regular and irregular structures. The behavior of RCC framed buildings is proposed, discussed and highlighted during an earthquake for different cases in the present article. The seismic analysis is done for RCC framed models with different cases such as without shear wall, with shear wall at Centre, with shear wall in X-direction, with shear wall in Y-direction, lastly shear wall in both direction i.e. X & Y. (C.M. Ravi Kumar, et.al, 2013)

This analysis presented the method for seismic assessment of vertically mass irregular RC frame structures depending on an idea of the response spectrum method. When the earlier modern earthquakes in various parts of India and world are concerned, this discloses the matter regarding the vulnerability of existing structures. The existing building structures which were designed and constructed in accordance with earlier Codal provisions do not satisfy condition of present seismic code and design practice. Many RC buildings in urban areas lying in active seismic zone may undergo moderate to severe damages for the period of future ground motion. Therefore it is necessary to diminish improper danger to property and life of inhabitant. 12-storied building model is used as irregular building in this analysis in 3D-system. The full project is carried out under the software ETABS. The influence of masses is considered in the building at several floors such as 4th floor, 8th floor and 12th floor respectively. The parametric comparison is done for structures with regular frame being compared with irregular frame. The different method used in the analysis is the Equivalent static method and Response spectrum method. Md. Kashif Ansari, Prof. H.S Vidhyadhar, 2016)

There has been usually irregularity in buildings plan and it is found very less in elevation of the building. This enhances a hazardous influence on behavior of structure during earthquake. The comparative analysis is done in between regular and irregular structures with vertical irregularities. The equivalent method is used for the analysis for building with five storey in regular shape during earthquake load acting on it. The seismic analysis is done by using UBC code 1997. There are nine setbacks being made from the regular buildings and analysis is done for each model in which stories are excluded at several heights. The time history analysis and Response spectrum analysis being nonlinear dynamic analysis is used which is carried out by the using software ETABS. The parameter such as storey displacement, base shear, Storey drift, shear force, bending moment are calculated using ETABS by modeling irregular buildings with setbacks. (Qaiser uz Zaman Khan, et. al, 2013)

The seismic behavior of building or a structure is based significantly on its shape, size and geometry taken as a whole. During seismic calamities various buildings with regular shape were executed very well but in comparison to irregular buildings it is observed to be more harmful with damage to property. The response spectrum method is used to analyses the regular plan buildings in the present paper with the latest code of earthquake load namely IS-1893-2002 part-1, along with this method are taken into account to analyses the situation of seismic behavior. The analysis is carried out by various effect of different shapes of the already constructed building being situated in the same region of seismic zone in this article by response spectrum method, with vital importance given to the plan of building being analyzed by response spectrum method, due to various criteria that it gives an important detail for different facts of the world. (Rucha S. Banginwar, 2012).

The authors in this work put emphasis on the usage of wall belt supported system used in multistoried building. This work compares the various possibilities of the

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demand and supply of stability enhancement system, since review has done. The lateral load handling capacity has evolved as the main criteria in this work. They secretly revealed their upcoming work with total 14 cases with the usage of response spectrum analysis will be used under Zone 5 with zone factor 0.36 respectively. The Shear wall at corners with belt connecting over its periphery column members was the main idea of their research. After reviewing the various researchers they conclude that their main focus will be shear strip which was the modified part of the concrete wall system. After than their outline of the proposed work was pointed out. In this, they pointed out if the width and thickness were kept fixed and if the height at which the shear strip behaves effective will be their optimum case (Neeraj Patel et. al.).

The research work draws attention to again the stability enhancement system consists of outrigger and belt truss supported system. They have shown the results in technical point of view. The figure in their work shows the effective approach to the stability system applied over a multistoried building. They have performed a software approach with total seven cases created and abbreviated as Case S1 to Case S7 respectively. Fundamental Natural period for the structures were taken as 1.2978 seconds with subjected to the structure rest over hard soil with importance factor is equal to 1. Response spectrum method was used in this approach of earthquake analysis. Their tabular representation was really good since in each of the tables, worst case has shown subjected to the maximum values of the parametric case. After the results performed and showed as per various objectives, conclusions have been drawn. They conclude Case S4 shows the least values among all the seven cases and should be recommend the same (Archit Dangi et. al.).

Research revealed that the interaction of shear wall in connection with the multistoried building under seismic loading was the main criteria of the research. They have described the various possibilities of the location of the shear wall along with the criteria of shear wall type. This increases the stability of the structure with only shear wall at a particular location. The research done with the aim of taking G+9, G+18, G+27 and G+36 storied models conducted over a software approach. They have selected 20m x 20m plan area just to perform the analysis with frames abbreviated as Frame 1 to Frame 12 in each storey. Firstly they showed that what is the meaning of shear wall with its types. Total 48 frames have been constructed and all the structures are supposed to be rested over medium soil at earthquake zone V. After the analysis, conclusions have been drawn. The result proves that the frame 10 i.e. + shaped shear wall at center with flab slab proves to be the best of all (Sagar Jamle et. al.).

Researchers in this research work points out the reviewed approach on the effect of the different concrete grade in outrigger and wall belt supported dual structural system. Since same grade approach has been a major part of the work now a days but this kind of approach have been proved the numerous possibilities of the research work in different grades of concrete. Firstly they have shown the concept of multistoried buildings in the urban areas. Then they described the value of outrigger system and after than the belt supported system and the combined effective approach to the general building as per stability point of view. They have conducted numerous literature review related to the same topic and after than conclusions have drawn. The conclusion part has combined with an approach to the outline of the proposed work. They proposed that grade change in outrigger and wall belt supported system will become the major technical part of their study and will going to be major research work (Mohammad Bilal Rasheed et. al.).

This particular work brings out the review effort drafted on shear wall opening criteria of a multistoried building. In introduction, the author described the criteria's to fulfill the earthquake requirements is to make a dual system building which was considered in Indian Standardization too. Shear wall description with its types have also been discussed. The main emphasize has done to classify the core type shear wall viz. single core shear wall and dual core shear wall. Then he clearly described the types of opening in shear wall provided with figuratively approach. After then the numerous reviews on the shear wall usage, its importance and the opening criteria of shear wall was discussed. Lastly, they draw the conclusions and outline of the proposed work, that there should be a criterion describing the percentage deduction of the shear wall area and the percentage usage of the wall area. Their technical work will show the percentage elimination of the same (Gagan Yadav et. al.).

The Exposure of extra load beyond the calculated load over the multistoried building under seismic loading was the worst case taken in their analysis. The authors suggested the optimum location of rooftop telecommunication tower along with its various fixtures and attachments. In introduction, they have suggested the importance of rooftop telecommunication tower in urban areas. Since the working approach was technical findings, they have discussed and set an aim by the various objectives consist of Base shear, axial forces, shear forces, moments and displacements. These parameters selected for both X and Z direction. Then they have described the

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methodology adopted for seismic analysis. After than the structure modeling has performed with total 5 cases selected and abbreviated as CASE A to CASE E with different telecommunication tower location. G+ 12 storied residential apartments have selected and all the structures have rested over medium soil at seismic zone 4. After the results, conclusions have been drawn suggested that on comparing all the cases, case D shows optimum amongst all (Suyash Malviya et. al.).

The paper highlights the insight of concrete which can cure itself where the shortage of the water in such areas. The agent used in their research work was polyethylene glycol abbreviated as PEG 400. This particular chemical was replaced by the percentage of cement in their research by 0%, 0.8%, 1.5%, 2.4% and 3.2%. The grade of concrete chosen was M20 and M25 grade of concrete. Both compressive and flexural strength test have been performed since this research work has done first in lab then the results were computed in tabular form and represented by graphical form. The work specially emphasize on 28 days curing results. Total 5 types of replacement mixed have made by replacement of cement and abbreviated as Mix-1 to Mix-5. They have concluded that For M25, 1.6% PEG Mix is efficient and for M20 Grade, 2.4% PEG Mix suited the best (Prakash Mandiwal et. al.).

This particular work give emphasis to the analytical approach of multistorey building wen shear wall is used at different locations and also for different heights. Authors in this work firstly show why we have to implant the structural stability feature when different height of the structure used. UBC analysis was also described in it. Also, they described the importance of providing the shear walls with stiffness and aspect ratios. Advantages of shear wall have also discussed. In methodology section, they provided various input parameters that were used in their work. There were basically three structures viz. G+10, G+20 and G+26 structures rested over medium soil for the analysis. Finite element approach in calculation of stresses of only shear wall have discussed in their approach. Different approached were found out and finally future scope has provided (Priyanka Soni et. al.).

III. CONCLUSIONS AND OUTLINE OF PROPOSED WORK

As per above review of the different papers we found the following objective to study concluded as below:-

1. The irregular shape used in the different papers includes only shapes such as H-shaped, L-shaped, T-shaped, V-shaped, U-shaped, I-shaped, etc. as a whole building structure.
2. The papers only study about effects of parameters such as torsion, shear force, bending moment, Storey drift, etc.
3. The irregularity in the buildings can be done by making floor in different directions such as east, west, North and south etc.
4. The Comparative study can also be done by changing the grades of concrete in multistorey building.

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Connection of Stress and Job Satisfaction to Successful Organizational Stress Management: A Literature Review

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Abstract**—** *Various empirical research results prove that stress directly negatively affects job satisfaction. This proves that employee work stress determines an employee's job satisfaction level because work stress is a condition of tension that creates a physical and psychic imbalance that affects an employee's emotions, and thinking process; excessive stress can threaten an employee's ability to deal with their work environment and will ultimately interfere with the performance of employees duties. Work stress can be seen as a depressing feeling or feeling depressed that employees experience in the face of their work; overall excessive work stress will lower employee job satisfaction levels.*

Keywords**— Stress, Job Satisfaction, Organization.**

I. INTRODUCTION

Job satisfaction has become a pillar on which employee performance depends. The most important goal of an organization is to explore all possibilities to get the best employee performance in achieving a set of goals. The organization leader's understanding of an employee's job satisfaction level is very important because an employee's job satisfaction will result in certain behaviors and attitudes that may indicate the employee's performance and work performance. In this case, job satisfaction management is needed to achieve the company's goals. According to Mathis and Jackson, in its most basic sense, job satisfaction is a positive emotional state resulting from evaluating work experience (Mathis, Robert L. & Jackson, John H., 2010:158). From that sense can be interpreted as job satisfaction related to a person's feelings towards the work he or she does. One's satisfaction or dissatisfaction with their work has a profound effect on productivity and effectiveness of work.

On the other hand, work stress related to job satisfaction arises among others when the employee is unable to meet what their work demands, feels unclear what employees work responsibilities are, the tasks given to each other, the lack of time to complete the task they are charged, the absence of support and facilities are sufficient from the company to run and complete the work, and so on. Stress reactions can lead to increased absenteeism due to pain, concentration and low creativity at work. In companies that do not invest heavily in their employees, employee downsizing can occur due to voluntary turnover, resulting in vital human resource capital being lost (Robbins, Stephen P. & Coulter, Mary, 2012:495). Work stress has a direct impact on employee job satisfaction, the statement is in accordance with the results of research conducted by Putri Cahya Kusuma, et.al. in 2015 on 100 non-medical employees of Ibn Sina Gresik Hospital with data analysis techniques using descriptive statistical and Partial Least Square (PLS), the study concluded that work stress has a negative and significant effect on job satisfaction. How important employee stress management in an organization or company is also shown in the results of research conducted by Gyamfi in 2014, in his research that analyzed the effect of stress on job satisfaction on service unit employees in Ghana police using multiple regression analysis, shows that there is a negative relationship between work stress factor which is role

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overload to job satisfaction. Still dealing with work stress, Abdul Salam Munir Abu-Helalah, et.al., from his research of 626 healthcare professionals in Saudi Arabia revealed factors related to stress including working at weekends, the absence of time off compensation, being depressed by deadlines, being a Saudi, the amount of off-work activities that make them stressed throughout the year. While Panagiotis Trivellas, et.al., in his research on 271 nurses at the hospital concluded that work stress caused by conflict and high workload. negatively significant impact with several dimensions of job satisfaction, namely, physical environment, career opportunities, job enrichment management style, reward and job security. However, a study conducted by Muttie ur Rehman, et.al., in his research at a private college in Pakistan that examined the effect of stress on job satisfaction using multiple regression analysis techniques gave results that contradicted previous studies, they concluded that there is a significant positive relationship between stress factors, namely workload to job satisfaction.

II. THEORETICAL FRAME

Work stress is the main focus of this discussion. Hellriegel and Slocum in his book explain the concept of stress as follows, "Stress is the excitement, feeling of anxiety, and/or physical tension that occurs when the demands or stressors placed on an individual are thought to exceed the person's ability to cope". Hellriegel and Slocum explain that stress is a feeling of anxiety, and or physical tension that occurs when a person's demands or pressures are considered to exceed a person's ability to cope (Hellriegel, D. & Slocum, Jr., John W., 2011:221). Stress according to Dyer, K.A. (2006), "Stress is defined by psychologists as the body's reaction to a change that requires a physical, mental, or emotional adjustment or response" (Talya, Bauer & Erdogan, Berrin, 2009:297). Robbins and Coulter further explained the definition of stress in his book adopted from the UK National Work-Stress Network, "Stress is the adverse reaction people have to excessive pressure placed on them from extraordinary demands, constraints, or opportunities" (Robbins, Stephen P. & Coulter, Mary, 2012:161). Robbins and Coulter explain that stress is an adverse reaction that a person has inflicted by excessive pressure on them stemming from tremendous demands, urges, or opportunities. Robbins and Coutler further explain that stress can be caused by personal factors and job related factors or so-called stressors. Clearly, any change in either personal or work has the potential to cause stress due to. this may involve demands, urges, or opportunities. Meanwhile, Ross and Altmaie (1994) in Yatna Nayaputera mention that work stress is an accumulation of a number of stress sources that are work situations that are considered stressful for most people. It is further mentioned that work stress is an interaction between a number of work conditions and the characteristics that workers have where the demands of the job exceed the ability of the worker. Gibson, et.al. in his book describes stress as the following response, "Using a response definition, we will define stress as an adaptive response, mediated by individual differences, that is a consequence of any action, situation, or event that places special demands on a person" Gibson, et.al. defines stress as an adaptive response, mediated by individual differences, which is a consequence of an action, situation, or event that places special demands on a person (Gibson, James L., 2012:195).

According to Kondalkar, sources of work stress that are slightly different from Robbins's opinion above, namely: 1) Environmental factors. There are many environmental factors that cause work stress in employees. According to Kondalkar, Ivancevich and Matterson (1982) have identified social, economic, financial, cultural, family and technological factors that have a tremendous influence on employee mental health, 2) Organizational factors. Included in the organizational factors are mission statements, strategies, policies, organizational structure and design, reporting channels, communications, organizational processes and systems and working conditions. The organization's mission and ongoing work unit targets have a long-term impact on employees. The organization's overly ambitious goals will make it difficult for employees to keep up. Good company policies, procedures, regulations, and regulations will keep employees in high spirits. On the contrary, inadequate compensation, regulations rigid, ambiguous organizational policies and incorrect job design will cause great stress on employees, 3) Group factors. Studies from Hawthorne (1924) have found many influences of group complexion, group norms and the importance of group goals to achieve organizational goals. A lack of compace in the group will create conflict. Employees should be given the opportunity to develop themselves and join social groups. Group social activities and other group activities should be organized regularly. Managers must form groups, which are not based on rank and position. Employee morale should be maintained so that there is no group stress, 4) Individual Factors. His personal life and the events he experienced were inseparable, marriage, divorce, death in the family had an impact on his work situation. The difficulties of life are very stressful for a person. The things included in the individual factors are, job security, relocation, change in life structure, stress and behaviour (Kondalkar, 2007:179-

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182). Schermerhorn, et.al. in his book mentions the sources of stressor are: 1) Work related stressor which includes task demands, role ambiguity, role conflict, ethical dilemma, interpersonal problems, career development, and physical setting, 2) Personal stress factors (non-work and personal stressor) such as family events (e.g. child birth), economic difficulties (e.g. investment losses), and personal affairs (e.g. family divorce). Because it is often difficult to completely separate work and personal life, stress stemming from personal life can affect behavior in the workplace. Individual needs, abilities and personality factors are also included in personal stress factors (Schermerhorn, Jr., John R., et.al., 2002:165-166). Further Schermerhorn, et.al. explaining that stress does not always have a negative impact on life, stress has both positive and negative sides. Constructive stress (eustress) acts in a positive way, a level of stress that will encourage performance improvement, stimulate creativity, and encourage greater perseverance while destructive stress (distress) is individual or organizational dysfunction, excessive stress burden will make a person's physical and mental overload and will experience breakdown resulting in absenteeism, employee turnover, error, work accident, job dissatisfaction, decreased work performance, unethical behavior, and even sick to someone. Robbins and Judge (2013) divide employee reactions in the face of stress into five variables or commonly referred to as individual perceptions, namely: 1) Perception, is a process that individuals take to organize and interpret their senses to give meaning to their environment. Which is where employees react to respond to their perception of reality instead of reality itself. Therefore the perception will soften the relationship between a potential stress condition and an employee's reaction to the condition. 2) Work experience, can also be an excellent aspect of stress reduction. Work experience tends to be negatively related to work stress. Employees who work longer in the organization are those with more stress-resistant traits or who are more resistant to the stress characteristics of their organization, 3) Social support, where social support as a reliever reduces the negative effects of high stressful jobs. Collegial relationships with colleagues or supervisors can reduce the impact of stress. In addition, social support can be found outside of work such as family, friends and communities that can provide support even more for those with high social needs that are not acquired in the workplace and this can make work stressors more tolerated, 4) The position of self-control, is a "locus of control". A person with an internal position of control believes that they are in control of their own goals, whereas individuals with external positions of control believe that their lives are controlled by outside forces. This shows that internal people perceive that their work is less stressful and they participate actively in achieving results their work even though they face stressful situations in their work. Meanwhile, external people are more likely to be exposed to stress. 5) Self-confidence, is a belief in the ability of one self to be able to lower the level of stress in person. Some studies have shown how important it is to manage stress both individual stress and stress factors in the workplace, such as a study conducted on Mississippi Cooperative Extension employees conducted by Graham (1982) quoted in Robert P. Vecchio's book mentioning that Mississippi Cooperative Extension personnel feel a decrease in work stress levels if they see their boss show more leadership traits at work and show their concern for various subordinate needs (Vecchio, Robert P., 2007:12-13). Various techniques can help individuals manage their stress. Among them are basic strategies that help a person to stay healthy such as exercising regularly, resting enough, and eating healthy food. While one can look for their own stress management strategies, today's top companies are supporting healthy living habits programs by helping employees manage their stress and become more productive. The impact of stress costs billions of dollars a year resulting from employee absence, low productivity, staff turnover, job accidents, and higher health insurance costs and worker compensation costs. Managing employees has become a business and ethics priority. In the UK, employers are required to meet certain minimum conditions to cope with work stress, such as ensuring that employees are not protected from a poor physical work environment, have the necessary skills and training to meet their work requirements, and are given the opportunity to provide input on how their work is done (Daft, Richard L., 2010:398).

On the other hand, Michael Armstrong explains the concept of job satisfaction in his book, "The term of 'job satisfaction' refers to the attitudes and feelings people have about their work. Positive and favourable attitudes towards the job indicate job satisfaction. Negative and unfavourable attitudes towards the job indicate job dissatisfaction". According to Armstrong, job satisfaction refers to the attitudes and feelings a person has about the work they have. A positive and good attitude towards work indicates job satisfaction. Negative and un kind attitudes towards work indicate job dissatisfaction. Armstrong further explained that job satisfaction levels are influenced by intrinsic and extrinsic motivating factors, quality of supervision, social relationships with work groups and individual success and failure rates in his work. Research conducted by Purcell, et.al. (2003) in Armstrong found the

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main factors that affect job satisfaction are, career opportunities, work influence, teamwork and job challenges (Armstrong, Michael, 2006:264). Priyono in his book titled "Human Resource Management" explains the concept of job satisfaction as follows, "Job satisfaction is a pleasant emotional attitude and loves his work. This attitude is reflected by work morale, discipline and work performance. Job satisfaction can also be expressed as an emotional state of employees where there is a meeting point between the value of work remuneration severance with the company and the level of remuneration recompiance desired by employees both financially and non-financially" (Priyono, 2010:115). Priyono further added that job satisfaction is not always a strong motivational factor for achievement, because employees who are satisfied in work are not necessarily improving their work performance. But at least the issue of job satisfaction needs to be taken seriously by the organization's managers. The standard or benchmark of absolute satisfaction level does not exist, because in general every employee different standards of satisfaction. But at least there are indicators that can be used to see the absence of job satisfaction, including discipline, employee morale and low turnover. Also, Priyono explained that employee job satisfaction is influenced by several factors including: 1) Fair and decent remuneration, 2) Proper placement in accordance with expertise, 3) Light weight of work, 4) The atmosphere and environment of the job, 5) Supporting equipment in the implementation of the work, 6) The attitude of the leader and his leadership, 7) The nature of the job (monotonous or not). Milton in Soehardi Sigit (2003) quoted by Priyono, mentions the dimensions of job satisfaction obtained from various study and research references, as follows: 1) Work, including intrinsic interests, variations, opportunities to learn, difficulties, many activities, opportunities for success, and mastery of Iangkah and methods. Less challenging work will create boredom, but being too challenging will create frustration and a feeling of failure. In these conditions the challenges are ongoing, will provide pleasure and satisfaction for most employees, 2) Pay, amount of pay, eligibility or fairness, and payment methods. Where pay is seen as fair based on job demands, skill level, will most likely result in satisfaction, 3) Promotion, opportunity for promotion, honesty, and basis for promotion, 4) Recognition, praise for implementation, appreciation for completion of work, and criticism, 5) Work conditions, working hours, rest time, work equipment, temperature, ventilation, humidity, location, and physical layout, 6) Co-worker , ability, love of help, and hospitality. Therefore it is not surprising to have a friendly and supportive co-worker will deliver to increased job satisfaction. Employer behavior is also the main determinant of job satisfaction. Studies generally find that employee satisfaction will increase when supervisors or supervisors are friendly and can understand, give praise for good performance, listen to employees' opinions, and show a personal interest in them, 7) Company and management (company and management), how it cares about employees, pay, and policies (Priyono, 2010:172-173). Wagner and Hollenbeck also explain the concept of job satisfaction as follows, "Job satisfaction is a pleasurable feeling that results from the perception that one's job fulfills or allows for the fulfillment of one's important job values".

Wagner and Hollenbeck explain that job satisfaction is a pleasant feeling resulting from a perception that a work has fulfilled or achieved the fulfillment of the essential value of the work itself (Wagner, John A. & Hollenbeck, John R., 2010:106). Further explained by Wagner and Hollenbeck, that the definition includes 3 components namely value, importance and perception. Job satisfaction is a function of value, that is, what a person consciously or subconsciously wants to obtain from a person work. Value is not the same as the objective need required by the body to survive such as oxygen and water but value is a subjective need that is in one's mind. The second component of job satisfaction is how important those values are to a person. A person's difference is not only because of the value they hold, but also in how much weight they give to that value and that difference will critically affect their job satisfaction level. An employee may value job security above all else, but other employees may be just concerned about getting the chance to travel on business, some people may be interested in doing a fun job or that can help others. Although the first employee is satisfied with a long-term job, the other two may find little satisfaction in a fixed working relationship. The final component of Wagner and Hollenbeck's definition of job satisfaction is perception. Satisfaction reflects our perception of the current situation and our values, it is worth remembering that perception may not be entirely an accurate reflection of objective reality. In his book, Luthans describes Locke's comprehensive definition of job satisfaction as follows, "Locke gives a comprehensive definition of job satisfaction as involving cognitive, affective, and evaluative reactions or attitudes and states it is a pleasurable or positive emotional state resulting from the appraisal of one's job or job experience" (Luthans, Fred, 2011:141). According to Locke, such job satisfaction involves reactions or attitudes, cognitive, affective and evaluative and states that it is a pleasant or positive emotional state resulting from an assessment of a person's

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work or work experience. Luthans further explained that job satisfaction depends on employees' perceptions of how able their work is to meet various aspects that they consider important. This is generally recognized in the field of organizational behavior where job satisfaction is the most important and often studied employee attitude. Over the years five dimensions of employment have been identified to represent the characteristics of a job that is most affected by workers or employees, namely: 1) The work itself, 2) Pay, 3) Promotion opportunities, 4) Supervision, and 5) Coworkers. Robbins and Judge present the following concepts of job satisfaction, "Job satisfaction—a positive feeling about a job resulting from an evaluation of its characteristics" (Robbin, Stephen P. & Judge, Timothy A., 2013:79). Explained by Robbins and Judge that job satisfaction as a positive feeling about a job as a result of evaluating the characteristics of the work. Work is more than just organizing administrative documents, creating and stringing programming codes, waiting for customers, or driving a transport truck. Work also requires interaction with colleagues and employers, following organizational rules and policies, meeting performance standards set by the company, living with less than ideal working conditions, and so on. An employee's assessment of their job satisfaction is a complex summation of many discrete elements. Indradevi in his research cites what definitions of job satisfaction are as follows, "Job satisfaction is defined as the feelings a person has about her or her job" (Balzer, et.al., 1997; Spector, P.E 1997). Described by Balzer et.al. that job satisfaction as a person's feelings about him or her work. Other definitions are, "Job satisfaction is the degree to which an individual feels positively or negatively about the various aspects of the job" (Schermerhorn, J.R., 1996). According to Schermerhorn, job satisfaction is the level at which a person feels positive or negative about various aspects of his work. It describes a person's comfort zone with his or her work. Someone who is happier with his work, they are said to be more satisfied. Further outlined other definitions of job satisfaction by Indradevi, "The assumption of the definition is that people can balance their specific satisfactions and dissatisfactions to arrive at a general degree of satisfaction with their job" (Loscocco, K.A. & Roschelle, A.R., 1991). According to Loscocco, K.A. and Roschelle, A.R., the assumption of the definition of job satisfaction is that people can balance their particular satisfaction and dissatisfaction to get to the general satisfaction level of their work. Naveed Ahmad, et.al. citing the results of Choo & Bowley's research (2007) as follows, "Satisfaction and employee performance are interconnected with each other and satisfaction is the resultant of job performance". (Ahmad, Naveed, et.al., 2014:86). Choo & Bowley's results indicate that employee satisfaction and performance are related to each other and job satisfaction is the result of performance. In his research, Nur Insan, et al. quoted Herzberg (2003) as follows, "Two-factor motivation theory explains that there are intrinsic factors leading to job satisfaction and extrinsic factors leading to work dissatisfaction" (Nur Insan, A., et al., 2013:136). The two-factor motivation theory explains that there are intrinsic factors that cause job satisfaction and extrinsic factors that lead to work dissatisfaction. Intrinsic factors come from within and influence the minds of employees, and ultimately determine their attitudes and behaviors. Extrinsic factors originate in the outside or surrounding environment, including salary, work environment, organizational policies, and other work-related items such as rewards, promotions, or structural positions. Gamage Dinoka Nimali Perera, et.al., in their research quoting mosser and gakais statements (2007), "Moser and Galais highlighted that employee's ability and opportunities aid to improve their satisfaction of the job level" (Perera, Gamage D.N., et.al., 2014:97). Moser and Galais highlight the skills and opportunities an employee has to help improve their satisfaction from the job level.

III. CONNECTIONS BETWEEN STRESS AND JOB SATISFACTION

According to Kasraie, et.al. there are four main reasons why organizations pay attention to work stress, namely general attention to employee health, financial impact on employee health care, organizational effectiveness, and legal compliance with worker compensation programs. Today organizations have become more concerned than just pursuing financial gain. Employee satisfaction, health, job accidents, employee turnover, absence, and productivity have been included in the evaluation of the organization's success and return on investment in a more Spacious (Kasraie, Shokoufeh, et.al., 2014:78). While Wexley and Yulk in Hendra Indy and Seger Handoyo, described job satisfaction as "Is the way an employee feels about his or her job" or the way the employee feels about himself or his work, then job satisfaction is a supportive feeling or not in the employee who is related to his work or with his condition (Indy, Hendra & Handoyo, Seger, 2013:101-102). In line with the above opinion, Felanny and Sukma Rani Moerkardjono in their research on the relationship of work stress with job satisfaction to 103 respondents of company employees, found a significant link between job satisfaction and negative work stress. The research was conducted correlational method with data analysis using Pearson Product Moment and snowball

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sampling technique. Research conducted by Hui Xiang, Suzanne Coleman, Mark Johannsson and Ronal Bates in 2014 on 42 Biology development professionals with regression model analysis tools showed consistent results from previous studies that work stress had a negative and significant effect on job satisfaction. In the study, data collection was conducted through cross sectional surveys, and Monte Carlo simulations to predict job satisfaction outcomes. Furthermore, I Gede Putro Wibowo, et al. in his research concluded that work stress negatively affects and affects job satisfaction. The study was an associative study conducted on 66 UD employee respondents. Ulam Sari Denpasar with data analysis technique using Partial Least Square (PLS) using variance based approach.

Based on the study of theories and the results of the above studies, the authors can thus conclude that the higher the stress that an employee has, the lower their job satisfaction, so it is very important for the company to be able to manage the stress of its employees due to the negative impact of stress on the company's output due to decreased employee job satisfaction.

IV. RESULT AND DISCUSSION

The increased stress that occurs among employees will decrease their job satisfaction, and conversely the decrease in stress that occurs in employees will increase their job satisfaction. In an effort to lower employee stress levels, organization top level management can make various efforts to reduce sources of stress for employees including workload or task demands. Work stress arises due to overly heavy workloads, companies must be able to measure the workload that will be given to their employees in each line of work in order for them to work optimally to the level of capability they have. Variety of work can also provide refresh and reduce work saturation that leads to work stress, managers can occasionally provide variations of tasks outside of the daily tasks of their subordinates that may already be felt monotonous. The difficulty level of tasks that employees provide should not exceed their abilities even though sometimes a leader occasionally needs to present challenges to a group of employees who are considered potential. The difficulty of a task that exceeds a person's ability will directly cause stress and ultimately the ineffectiveness of the work occurs because they will do their job by force. Roles given to employees need to be reviewed and adjusted so that each employee has a clear role within the organization, stress often occurs due to the obscurity of the role given by the company to their employees. Executive level management can clarify the role of employees by providing clear work targets, to whom employees should report and be responsible for their work, what authority they have, and clarifying job descriptions as clearly as possible.

Less harmonious inter-personal relationships in the workplace can be a significant source of work stress. The anticipation that management can do to create relationships between employees is to create a division of tasks that can reduce the potential for competition between unhealthy employees. To create harmonious relationships between employees, managers can create informal employee meetings in each of their work units periodically to discuss work issues and things outside of work so that they can socialize and get to know each other better. This will create harmonious relationships between employees and exemplary group work required by the organization.

A source of stress that is no less important is organizational structure and leadership. A long range of controls will result in long work decision-making and bureaucratic, it can cause stress on employees. Too short a range of controls is also a source of stress as it can provide excessive workload, so a review of organizational structure is needed to create a work system that can minimize employee stress levels. Leadership factors are quite dominant in increasing employee stress, including excessive supervision, authoritarian and arrogant leaders and leaders who are closed to subordinate input and criticism. In this case the company can strive to create a culture of democratic leadership from the supreme leader to the bottom line of leadership.

Some approaches can also be done by management in reducing employee stress levels, namely by taking several approaches namely, 1) Social approach, this can be done with various activities aimed at providing social satisfaction to employees, such as outing, outbound or other forms of joint recreation, 2) Biofeedback approach, this can be done by the company by facilitating employees with medical guidance i.e. through doctor guidance, psychiatrists, and psychologists, this aims to allow employees to manage their stress, 3) Preventive approach, this is a preventive approach before the onse of stress in employees. In this case, the company can facilitate employees to regularly check their health and do sports activities together regularly.

Further increasing job satisfaction will lower employee turnover rates. One dimension of achieving job satisfaction is employee earnings, in which case management can reward employees financially with good compensation and this should be a priority as part of good business practice. Executive level management should not get caught up in inappropriate austerity programs that would run the risk of

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employee benefit cuts, loss of bonuses, and even termination of employment.

Employees will be satisfied while doing work that suits their competencies, so they will feel comfortable in doing so. Companies can review the types of work given to all employees by requesting feedback from them in the early stages about their expectations of the type of work they want or can do according to their own passions. Knowing their expectations, management will understand the psychological composition in carrying out work placements. Of course not all employees will be accommodation in the field of work they expect but this will put more employees where they think they want and will ultimately be more likely to increase job satisfaction.

A fair and competency-appropriate promotion system is also an element that can improve employee job satisfaction which becomes executive level management homework. It is appropriate that the company does not practice discrimination in promoting positions, and only refers to competence as a basis for promoting, so that employees will be passionate in providing their best work for the company. Healthy competition will arise among employees and will increase their job satisfaction.

Employee job satisfaction is also related to the supervision given by the leadership. Excessive oversight will make employees feel unrealed in completing their tasks, in which case the company needs to create effective and efficient oversight and reporting mechanisms including determining the extent of flexibility for employees in taking task completion steps. Comprehensive assistants for task completion including the completion of work barriers also need to be implemented management so that employees' work remains targeted and productive, and moreover it will improve their job satisfaction.

Job satisfaction indicators that play a role in employee job satisfaction levels are co-workers. Colleagues who are in tune and healthy in terms of personal and competence can improve the performance of the group and will ultimately improve the work satisfaction of each group member. The Company needs to consider the placement of employees in the field of work duties or work groups with consideration of individual suitability, this can be obtained by receiving input from all employees about who the individually suitable personnel are to cooperate with them, then leadership is expected to make placements based on suitability and suitability between personnel. This certainly does not guarantee that all employees will get a suitable partner for them but at least there will be work optimization within the group, work unit or wider organizational scope. Colleagues who do not have conformity and cannot fill each other and are unable to cooperate will result in inequality is even confrontational in the work and can result in decreased job satisfaction and not achieving the organization's overall goals.

Management can also adapt the Ivancevich model, et.al. (2014) which in his book introduces a model that links between stressors, stressors themselves and the consequences resulting from such stress (outcomes). The model can be seen in Figure 1 as follows,

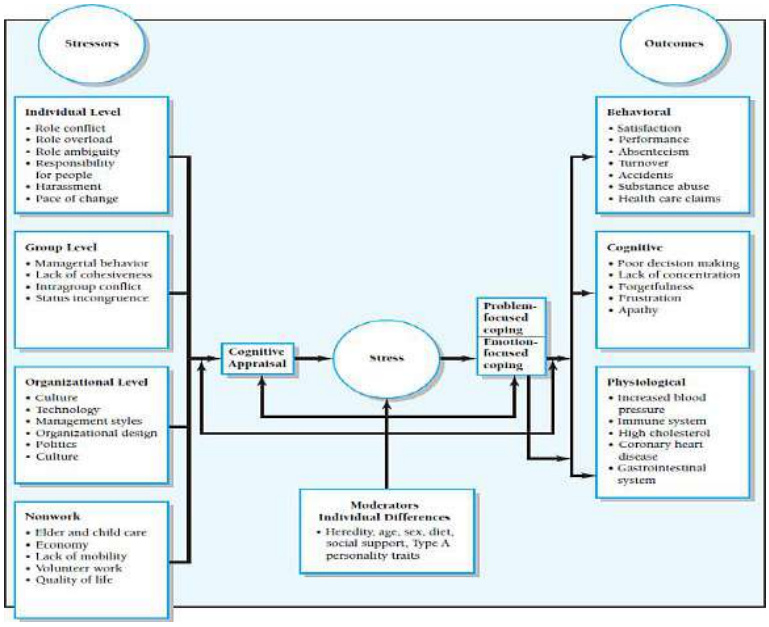

Fig.1: Model Stressor, Stress and Outcome

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The stress model provides a framework for organization decision makers in HRD to be able to think and identify about employee stress that occurs in their workplace. As a consequence of this, corporate intervention may be necessary in avoiding or managing the various negative impacts of work stress on employees. Prevention and management of stress in the workplace can be initiated by individual employees or organizations collectively (Ivancevich, John M., et.al., 2014:235).

V. CONCLUSION

Referring to the concept of stress and job satisfaction above, it is concluded that stress is a condition of inconsistencies between a person's expectations or desires and those obtained, and there is a gap between the demands of the environment and the ability of the individual to meet them that is judged to be potentially harmful, threatening, disruptive and uncontrollable or exceeding the individual's ability. In this case specifically stress measurements refer to indicators: the workload provided by the leader, the clarity of the role in carrying out the work, the demands of inter-personal relationships in the workplace, the influence of organizational structure in work, and the style and culture of leadership applied by the employer. While job satisfaction is summed up as the pleasure or disconsentness of a person related to the experience in carrying out his work. In this case specifically the measurement of job satisfaction refers to indicators: fair and decent remuneratia, suitability of the work done, application of the job promotion system, system of supervision by the leadership, and the behavior and condition of colleagues. It is also true that the stress that occurs in organization employees directly negatively affects their job satisfaction;

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The Spousal Violence on Women in Cabanatuan City

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Abstract— *One of the prominent domestic crimes committed today is spousal violence, according to National Statistics Authority based on the preliminary results from the 2017 National Demographic and Health Survey (NDHS) one in four (26%) ever-married women aged 15 to 49 has ever experienced physical, sexual, or emotional violence by their husband or partner. Hence, this study aimed at determining the spousal violence on women in Cabanatuan City. Police Officers assigned to Women and Children Protection Desk and Social Workers from the Department of Social Welfare and Development in Cabanatuan City were the respondents of the study. The study is Descriptive in nature. Registration Method was used in data gathering. For the Data treatment and analysis, frequency count, percentages and ranking were utilized. The results of the study from data gathered from both the Police officers and social workers revealed that, the spousal violence on women in Cabanatuan City is primarily economic violence and the least is sexual violence.*

Keywords— ***Spousal violence, Implications, Safety and Security, Women Empowerment, and Human Rights.***

I. INTRODUCTION

Violence against women have increased significantly within recent years, mostly spousal violence in nature. According to National Statistics Authority based on the preliminary results from the 2017 National Demographic and Health Survey (NDHS) one in four (26%) ever-married women aged 15 to 49 has ever experienced physical, sexual, or emotional violence by their husband or partner. Most of Filipino women believe and perceive their experiences as normal and part of being married or being in a romantic relationship since it is rooted in our Filipino culture. Women as wife, mother and home maker should be someone who is submissive, caring, loving, understanding, and forgiving. Higher rates of violence are expected to be more prevalent in cultures that encourage objectification of women, thus making them appear inferior to men. (Ramiro, et.al, 2016) Men on the other hand as heads of the family, breadwinners, and decision makers are accepted by society as someone that should be followed, served and have the last say on everything especially regarding domestic issues and concerns. The comparative advantage of men in the public arena translates to their greater power in the household, the ability to contribute to household income is the key to household balance of power. Contribution is measured in terms of monetary units. Non-monetary contribution like doing the household chores does not advance one's position in the household power structure. (Alcantara, 2014). Patriarchy is still much evident in the Philippine Culture.

Culture dictates the definition, perception and acceptability of one's role in the society. Culture acceptability often made practices and actions a non-violation of one's rights. Women in developing countries experience higher rates of violence than those in developed countries. Violence against women is perceived as a symptom of the historically unequal power relationship between men and women, and this imbalance has led to pervasive cultural stereotypes and attitudes that perpetuate a cycle of violence.

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Spousal Violence is viewed and accepted as an intimate partner violence (IPV) (HIndin & Adair, 2012) thus making women believe that it is part of being in a relationship and is normal.

II. OBJECTIVES OF THE STUDY

The research study aimed to determine the spousal violence experienced by women in Cabanatuan City as reported in the Department of Social Welfare and Development and Police Station-Women and Children Protection Desk in Cabanatuan City for the period of January 2018 to November 2019. The nature of spousal violence was also determined and used as a basis in proposing support activities and programs to improve women situation and somehow empower them.

III. RESEARCH METHODOLOGY

The study is descriptive in nature since its focus was determining the spousal violence experienced by women in Cabanatuan City and its nature. The instrument utilized was the Registration method since the data came from the Police Officers assigned to Women and Children Protection Desk and Social Workers from the Department of Social Welfare and Development in Cabanatuan City which showed that there were 53 cases of spousal violence. The above mentioned sources of data were the respondents of the study. For the Data treatment and analysis, frequency count, percentages and ranking were used.

IV. CONCEPTUAL FRAMEWORK

The basis of the study was the 2017 National Demographic and Health Survey (NDHS) from National Statistics Authority as stated, spousal violence may be in the forms of: physical violence; sexual violence; emotional violence; and economic violence.

As stated also in Republic Act. 9262 Section 2, Violence against Women and Children:

It is hereby declared that the State values the dignity of women and children and guarantees full respect for human rights. The State also recognizes the need to protect the family and its members particularly women and children, from violence and threats to their personal safety and security. Towards this end, the State shall exert efforts to address violence committed against women and children in keeping with the fundamental freedoms guaranteed under the Constitution and the Provisions of the Universal Declaration of Human Rights, the convention on the Elimination of all forms of discrimination Against Women, Convention on the Rights of the Child and other international human rights instruments of which the Philippines is a party.

Thus, the study focused on the recorded spousal violence on women and its nature based on how the Police Officers assigned to Women and Children Protection Desk and Social Workers from the Department of Social Welfare and Development in Cabanatuan City assessed and categorized the reported cases. The result of the study was used as a basis in proposing support activities and programs to improve women situation and somehow empower them.

V. RESULTS AND DISCUSSION

The reported spousal violence in Cabanatuan City as reported in the Police Officers assigned to Women and Children Protection Desk and Social Workers from the Department of Social Welfare and Development in Cabanatuan City is presented as follows:

Table.1: Spousal Violence

ITEM	f	%	Ranking
Physical Violence	**16**	**30.19%**	**2**
Sexual Violence	**1**	**1.89%**	**4**
Psychological Violence	**10**	**18.87%**	**3**
Economic Violence	**26**	**49.05%**	**1**
	53	**100.00%**	

The result shows that spousal violence are reported in the Police Department and the Department of Social Welfare and Development, majority of the reported cases were categorized as Economic violence in which it ranked first with a percentage of 49.05% and the least reported category of spousal violence was sexual abuse with a percentage of 1.89%.

This means that, majority of the victims experienced economic violence for majority of the cases concern with child custody, child support, adoption and the like. Most of the victims felt that they are financially dependent with their aggressors and on the other hand the aggressors also believe and made them believe that the

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victims' fate are on their hands. This is also the reason why they often took advantage of this and used it against their victims.

Based on the Gender Statistics on Labor and Employment conducted by the Philippine Statistics Office year 2017, there is a gender employment gap of 28.6% in which men employment is 76.4% compared to women employment which is only 47.8%.

As stated also from the above source, in terms of Labor Force Participation Rate by Region and Sex, in the Philippines, in region III, there are 2,922,000 employed men which is 75.7% and 1,626,000 employed women which is 41.8%., this shows that there is also a gender employment gap of 33.9% which is much higher than the overall gender gap.

The statistics also shows that in terms of employed, married, and head of the family, there are 14,085,000 men and 787,000 women, which means that men employed, married and head of the family is 13,298,000 higher than women employed, married, and head of the family.

These only show that more women are financially dependent on men with regards to family financial standing since men has greater earning and economic capability than women which make them more superior in the relationship and somehow make the situation inferior to women and to their vulnerability to abuse especially regarding financial support which is economic abuse.

According to Kaur & Garg, (2007) Economic dependence has been found to be the central reason. Without the ability to sustain themselves economically women are forced to stay in abusive relationships and are not able to be free from violence.

When victims start to have realization of their situation, their married or intimate relationship often reached the brink of break up, and most of the time it is when the economic abuse become highest. The aggressors used it to threaten the victim so, the victim will stay in the relationship or when the aggressors feel that it's too late, they just use it to get even with the victim. Men can use family law and child support processes as a way of directly or indirectly controlling their former partner and undermining her financial security and self-reliance. (Natalier, 2015)

Separation now a days is so common which made the situation also vulnerable for economic abuse. Conflict in separating and divorcing couples is common especially during property and child custody negotiations (Walker, 2004).

In totality, men's economic superiority give them a sense of entitlement over women.

VI. CONCLUSION

As viewed on the above mentioned results of the study, the following conclusions were drawn:

1. There were 53 reported spousal violence in Cabanatuan City; and
2. Economic Violence is the most reported spousal violence.

VII. RECOMMENDATIONS

Proposed Support Activities and Program

Based on the Results of the study the following Support Activities may be proposed:

Initiating Community Extension Activities and tapping Departments which are competent to provide the assistance needed, such as:

a. Development and dissemination of printed materials, and audio-visual campaign messages which highlight positive image of women, and relationships;

b. Creation of support groups for battered women which will help them build self efficacy, and livelihood skills;

c. Offer free Para legal consultation and recommendations; and

d. Establishing a tangible support and family-centered responses to enhance socio-economic equality.

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Oral rehabilitation of a patient with dental agenesis using osseointegrable implant

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Abstract**—** *Dental agenesis is one of the most common anomalies in numbers, affecting mainly women, occurs in both primary and permanent teeth, but more frequently in permanent teeth. Can be classified as hypodontia is the absence of one or more teeth, oligodontics of six or more teeth and anadontia total absence of tooth development. Its diagnosis can be made through radiographs and clinical examination, when performed early, they can assist in a broad treatment plan with the aim of solving this problem. Among the main treatment options that can be performed such as prostheses, implants and orthodontics depending on each case. The treatment plan of choice obtained with the patient was the osseointegrated implant with the aid of orthodontic treatment to open the ideal space. Thus, the objective of this review article is to examine the etiology, clinical properties and treatment of dental agenesis using an osseointegrable implant. This literature review sought a sample in the literature in the PubMed and Science Direct databases. The inclusion criteria were articles published between 2015 and 2020 in Portuguese and English. The following query terms were used: agenesis, oligondotia, hypodontia, agenesis, oligondotia and hypodontia. The results show that dental agenesis is one of the most common genetic abnormalities among humans. In most of the study results that in the case of agenesis, the osseointegrated implant approach has proven to be a reliable and predictable treatment for restoring function and aesthetics.*

Keywords**— *Agenesis, Orthodontics, Dental implants.***

I. INTRODUCTION

Dental agenesis is a common developmental anomaly that affects approximately 20% of the population and results in a reduction in the number of teeth present in the oral cavity. It is classified according to the number of teeth involved, divided into hypodontia, oligodontia and complete anodontia. Thus, hypodontia is defined as the congenital absence of less than six permanent teeth, oligodontics as the congenital absence of more than 6 teeth and complete anodontia as the absence of all permanent teeth (BARBOSA et al., 2016; FERNANDES, OLIVEIRA; COSTA , 2015).

Dental agenesis is the result of disturbances in the initiation and proliferation stages during tooth formation. Its etiology is associated with environmental factors such as infections, trauma, chemotherapy, radiotherapy and genetic causes (ANDERSSON et al., 2017).

The most used method for the diagnosis of dental anomalies is the clinical examination accompanied by the imaging exam. Periapical and panoramic radiographs are generally used for the radiographic diagnosis of dental agenesis (RETROUVEY et al., 2019).

There are several treatment options for adult and young patients with agenesis, although there are few studies demonstrating treatment in pediatric patients. A specialist with the patient must make the decision about the treatment, as it is based not only on the lack of teeth, but also on the length of the arch, the position of the incisors and lips and the aesthetic profile. Early diagnosis and treatment are important to improve masticatory function,

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speech and self-appearance to reduce psychosocial impact (EIMAR et al., 2016).

In cases with congenital missing teeth, missing teeth occur very early in life, in contrast to many other patients who have lost teeth due to caries or periodontitis in later stages. The starting point has an advantage that young patients are generally well adapted to defects. However, prosthetic treatments are usually needed already in childhood (ATTIA et al., 2019; FAUZI et al., 2018).

In childhood and adolescence, prosthetic treatments can be complicated, because teeth should not be ground as crown pillars due to the large pulp cavity, and prostheses may not be suitable if the jaws are still growing. It is also questionable whether dental implants can be placed before the end of growth due to the well-known problems of secondary infraocclusion due to the ankylotic cure of osseointegrated implants and for other biological reasons (EIMAR et al., 2016).

In addition, children and their young parents and families often have a cost problem because, unlike other groups of patients with implants, dental defects appear in the early stages of life, when income is low or is needed for other purposes (ANDERSSON et al., 2017).

Thus, the objective of this integrative review article is to examine the etiology, clinical properties and treatment of dental agenesis using an osseointegrable implant.

II. HELITERATURE REVIEW

2.1 CLASSIFICATION OF CONGENITAL DENTAL AGENESIA

Disorders in the early stages of dental formation can cause developmental problems or congenital absence of one or more teeth. The congenital absence of at least one tooth is a common dental anomaly. This definition refers to the word "hypodontia" in medical terminology that originates from the Greek, with "hypo" means less and "odious" means tooth. The etiology of congenital dental agenesis is not fully understood, but it is believed to be multifactorial, where the roles of many genetic and environmental factors contribute. In addition, several syndromes, cleft lip and palate, congenital deformities and some systemic diseases have been reported in the literature that could lead to dental agenesis. The congenital type requires a multidisciplinary approach to treatment, in which orthodontists, pediatricians, protodontists, oral and maxillofacial surgeons, laboratory technicians, clinical geneticists, dermatologists, speech therapists work as a team (ATTIA et al., 2019).

There are many different classifications for congenital tooth absence in the literature. Some researchers classify according to hereditary form, some according to the number of missing teeth and some classify according to severity. Generally, permanent third molars are not taken into account when assessing the presence and severity of dental agenesis. Consequently, the absence in the development of one or more teeth, excluding the third molars, is defined as "hypodontia". Some other researchers have suggested that the absence of one to six teeth should be called "hypodontia" and the absence of more than six teeth should be called "oligodontia" (RAKHSHAN, 2015; TAMBURINI et al., 2020).

To reflect the genetic or morphological differences in terminology, it was suggested the use of subsections such as isolated hypodontia or isolated oligodontia for non-syndromic cases and syndromic hypodontia or syndromic oligodontia for cases related to syndromes (DURE-MOLA et al., 2019; LU et al., 2016).

Some researchers have assessed the severity of congenital tooth absence to help with diagnostic classification. Consequently, the absence of 1-2 teeth is mild, that of 3-5 teeth is moderate and 6 or more teeth are noted as severe hypodontia (ATTIA et al., 2019; LIMA et al., 2019).

2.2 ETIOLOGY OF CONGENITAL DENTAL AGENESIA

The etiology of congenital dental agenesis is classified as general and local factors. The general factors are several genetic conditions, such as Down syndrome, cleft lip and palate, ectodermal dysplasia. Local factors are conditions such as trauma to the tooth germ in the early stages of development, hormonal conditions, radiation, infectious diseases and unintentional removal of the tooth germ. Diseases such as syphilis, birth injuries and diseases that the mother has during pregnancy are also contributing factors (SANTOS and SILVA, 2018).

In addition to the familiar nature of hypodontia, it is believed that this condition may occur as a result of a genetic mutation without a family history. It is not surprising to see problems resulting in dental agenesis in the complex process of dental formation that is defined as odontogenesis (LIANG et al., 2016).

During odontogenesis, the epithelial-mesenchymal signal at the molecular level is under the control of the family members of the wingless protein (Wnt) gene, fibroblast growth factor and bone morphogenic proteins. Defects observed in any of these pathways can cause problems with dental morphology (tooth size or shape),

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dental mineralization and number of teeth (hypodontia or supernumerary teeth) (TAMBURINI et al., 2020).

Studies have shown that the interactions of mutations in the MSX1 and PAX9 homeobox genes during odontogenesis are associated with dental agenesis in mice and may be associated with hypodontia in humans. The PAX9 gene is expressed in mesenchymal elements of tooth germ development and is necessary in the subsequent stages of dental development. It was observed that tooth growth stagnated in the budding stage in mice with the mutant PAX9 gene (LU et al., 2016; TAMBURINI et al., 2020).

Mutations in the MSX1, PAX9, EDA1, WNT10A and EDARDD genes are proven to be responsible for isolated cases of hypodontia. It is also shown that hypodontia is associated with the Gene AXIN2, responsible for the increased risk of colorectal cancer. The specific mutations of four genes (EDA1, EDARADD, EDAR and WNT10A) that are effective in 90% of cases of ectodermal dysplasia are demonstrated in the etiology of oligodontics and hypodontia (ATTIA et al., 2019).

Tooth germ infections, trauma or traumatic removal of primary teeth are the main environmental factors for dental agenesis. It is also reported that exposure to some systemic diseases such as syphilis, scarlet fever, rickets during pregnancy and childhood are influential in dental agenesis. Smoking during pregnancy or exposure to radiation at a young age can cause problems in the formation of some glands and teeth. Chemotherapy and, mainly, radiotherapy affect teeth irreversibly (EIMAR et al., 2016).

Some syndromes are seen as one of the properties of hypodontia and many genetic defects have been shown in these syndromes. Syndromes such as Rieger's syndrome, Down's syndrome, facial clefts, cleft lip and palate and ectodermal dysplasia are associated with hypodontia (TAMBURINI et al., 2020).

2.3 PREVALENCE OF DENTAL AGENESIA

Dental agenesis is rarely seen in primary dentition, although there is a relationship between hypodontia in primary and permanent teeth. Children who show absence in primary teeth are reported to be absent in permanent teeth, replacing those teeth. In one study, hypodontia in primary dentition showed a prevalence of less than 1% in Caucasians, while a much higher prevalence was reported in the Japanese population. The central lateral and lower maxillary primary incisors represent 90% of the affected primary teeth (SIRIANNI and GONÇALVES, 2019).

The absence of anterior teeth in mild hypodontia is the dominant pattern, whereas severe hypodontia is characterized by the absence of posterior teeth. Bilateral agenesis is most often seen in the upper lateral incisors. The most frequent unilateral agenesis is seen in the lower second premolars. The most frequent patterns of tooth absence in the population are upper lateral incisors, lower second premolars and lower central incisors (BORALI et al., 2019).

2.4 SKELETAL AND DENTAL ANOMALIES OBSERVED IN HYPODONTICS

Severe hypodontia has been reported to cause a decrease in quality of life associated with oral health. Unfavorable aesthetics is the most common complaint in patients with hypodontia. The aesthetic problems caused by hypodontia depend on the number of missing teeth, the size and shape of the remaining teeth, the size of the jaws and the position of the toothless spaces. Despite being a less common complaint presented by patients with hypodontia, the lack of teeth can also cause difficulties in chewing and speaking (ATTIA et al., 2019).

There are several reasons for a possible relationship between congenital absence of teeth and facial skeletal pattern. Neural crest cells play a critical role in the formation of dentoeskeletal structures in the facial area. Therefore, the skeletal pattern may develop differently in patients with congenital missing teeth. In addition, according to Moss's concept of functional matrix, bone grows by responding to the functional relationships created by functional units. The teeth serve as a functional unit in the jaw growth process. Therefore, the absence of dental germs can cause deficiencies in the development of the apical bone. The dentofacial structure exhibits functional compensation, showing a different growth pattern in individuals with severe hypodontia (ATTIA et al., 2019; TAMBURINI et al., 2020).

The cephalometric values of patients with congenital missing teeth show a significant difference in anteroposterior dimensions compared to the norms. It is observed that the jaws are in a slightly posterior position in patients with hypodontia. Therefore, patients with missing teeth have reduced vertical facial dimensions, with a flat and retrognathic profile in general. The upper and lower incisor teeth are significantly more retroclined compared to the control groups in patients with congenital missing teeth. This situation is more serious in people with 10 or more missing permanent teeth. This dentofacial structure caused by hypodontia is perceived to be much more unsightly, since a broader profile has recently been perceived as aesthetic (BORALI et al., 2019).

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2.5 ANOMALIES OF TOOTH SIZE AND SHAPE IN HYPODONTICS

Microdontia is a condition characterized by smaller than normal teeth and is a widely reported feature of hypodontia. In addition to small sizes, the affected teeth usually have abnormally contoured crowns. The roots of these teeth are almost shrunk and abnormalities in root formation can be seen in addition. Ectopic eruption of permanent teeth is common in cases of hypodontia. One study showed a significant relationship between the lack of upper lateral incisors and the position of other permanent teeth. A similar relationship is also found between the superior lateral microdontia and the palatinal positioning of the canines or the distal angulation of the lower secondary premolars (LU et al., 2016).

Root resorption of a deciduous tooth is usually delayed if there is no permanent bud under it. Persistent deciduous teeth can provide satisfactory service for years, although significant amounts of root resorption are observed. However, they often remain in infraocclusion due to the localized insufficiency of alveolar development and the relatively excessive eruption of adjacent teeth. As a result, persistent deciduous teeth generally become ankylated (TAMBURINI et al., 2020).

Another characteristic of hypodontia is the delayed tooth eruption. Children with mild to moderate hypodontia showed a significant delay of 0.3 years in dental development in both sexes. There was no correlation between dental and chronological age or the severity of hypodontia (BORALI et al., 2019).

2.6 TREATMENT OPTIONS IN DENTAL AGENESIA

Comprehensive treatment, covering a long period of time, must be planned in cases of hypodontia to achieve the best results for a lifetime. A treatment plan can be prepared depending on the patient's age, complaints and dental development.

2.6.1 Space closure with eruption orientation

The rash orientation described by Hotz can be applied in the congenital absence of the teeth of the upper incisor during the initial stage of mixed dentition in children with a tendency to increase overjet, open bite, protruding incisors and crowding. This method makes it possible to spontaneously close cracks belonging to teeth with congenital defects due to the eruption of upper canines instead of upper lateral incisors and obtaining a class II occlusion. The enamel reduction should be applied to the 1st and 2nd upper deciduous molars on the mesial and distal sides for this purpose. In the case of absence of a congenital mandibular 2nd bicuspid, the first deciduous molars must be reduced on the distal side and the 2nd deciduous molars must be reduced on the mesial and distal sides, if the intention is to close the missing teeth spaces with orientation of eruption. Alternatively, the eruption can be guided by the early removal of the 1st and 2nd deciduous upper and lower molars (ANDERSSON et al., 2017; DIAZ et al., 2020; TAMBURINI et al., 2020).

The purpose of arrangements in toothless spaces with orthodontic mechanics is to create an ideal size area for prosthetic prostheses, implants or microdontic tooth restorations. Fixed orthodontic appliances that allow parallel movement are more preferable for this purpose and an adequate root parallelism is guaranteed (BARBOSA et al., 2016; BORALI et al., 2019).

Congenital lateral absence is one of the most common dental agenesis. One of the treatment alternatives is the opening of spaces and the application of prosthetic restorations. The other option is the closure of spaces with orthodontics, followed by the retelling of canines and premolars. It is suggested that the age of the patients, the type of skeletal and dental malocclusion in the sagittal and vertical dimensions, the crowding in the dental arches and in the facial profile should be analyzed before choosing the best treatment alternative. Overjet, overbite and posterior occlusion should be carefully evaluated when deciding to open or close the spaces of the congenital absent teeth in the alveolar bone. It is best to open the spaces if there is a favorable molar relationship, a decent overlap or a deep bite. In addition, when a tooth is planned to replace another tooth, parameters such as size, shape, color and eruption level need to be assessed (COSTA, 2015; SILVA et al. 2019).

2.6.2 Opening the orthodontic space followed by prosthetic treatment

If the treatment plan involves opening spaces for missing teeth, these spaces can be replaced by fixed partial prosthetic restorations bonded by resin, conventional fixed partial prosthetic restorations, implant supported prosthetic restorations or modified partial adhesive prosthetic restorations (ANDERSSON et al., 2017).

There are three ways to determine the proper space for missing lateral incisors. They are using the golden ratio, Bolton analysis or the mesiodistal size of the contralateral lateral incisor tooth. The golden ratio or Bolton's analysis can be used to measure toothless spaces in patients with unilateral or bilateral upper lateral incisors in congenital absence (BORALI et al., 2019).

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2.6.3 Fixed partial dentures bonded with resin

Fixed partial dentures bonded with resin can be used to replace only a few missing teeth. The most conservative approach to prosthetic treatment supported by teeth is a fixed partial denture attached to the resin, because the adjacent teeth remain almost untouched. The thickness and translucency of the supporting teeth have an important effect on the design of fixed partial dentures bonded with resin. If the metal retaining unit is positioned too incisally, it may cause gray reflection through adjacent highly translucent teeth in the incisal third (TAMBURINI et al., 2020).

2.6.4 Conventional fixed partial dentures

One type of restoration supported by a less conservative tooth is a conventional fixed partial denture. The main disadvantage of these prostheses is the necessary preparation of the adjacent teeth. Fixed partial dentures are not the best treatment options for young patients who have congenitally absent upper lateral incisors due to the need for preparation. It is reported that patients with fixed partial dentures supported by teeth have unfavorable periodontal conditions compared to patients who have only natural teeth after orthodontic treatment with space closure (MANGANO et al., 2016; TAMBURINI et al., 2020).

Important issues when planning these restorations are the alignment and leveling of the adjacent teeth. The orthodontist must carefully evaluate the inclination and angulation of the central incisor and canine teeth during the alignment process.

2.6.5 Prostheses supported by implants

The spaces in the anterior and posterior regions can be replaced by implants supported by implants, after the teeth adjacent to the edentulous spaces are leveled with orthodontic treatment. Dental implants can remain by infra-occlusion after completion of growth, if they are placed in growing patients. For this reason, treatments with dental implants must be postponed after completion of growth (ZARONE et al., 2016; BARBOSA et al., 2016).

A frequent feature in hypodontic patients is that the thickness of the alveolar crest is not adequate in edentulous areas. If the crest width is unsuitable for a dental implant, the use of small diameter implants or surgical procedures to enlarge the alveolar crest can be applied. Alternatively, alveolar distraction osteogenesis techniques can be applied if there is sufficient patient cooperation or bone augmentation procedures, if necessary. Autogenic bone grafts are the gold standard in these situations. On the other hand, replacing lost teeth with dental implants has some disadvantages, such as accumulation of dental plaque, gingival inflammation and increased treatment costs (ANDERSSON et al., 2017).

III. METHODOLOGY

This integrative literature review followed the following steps:

1st - elaboration of the guiding question (identification of the theme and selection of the hypothesis or research question for the elaboration of the integrative review);

2nd - literature search or sampling (establishment of criteria for inclusion and exclusion of studies / sampling or literature search) in the PubMed and Science Direct databases. The inclusion criteria were articles published between 2015 and 2020 in Portuguese and English. The following query terms were used: agenesis, oligondotia, hypodontia, agenesis, oligondotia and hypodontia. The query terms were combined by the Boolean operator 'OR' to request a comprehensive search of the available literature. All other samples were immediately excluded. The exclusion criteria were: duplicate studies, available only in the abstract or with the presentation of only the topic, with the content unavailable and paid articles.

3rd - data collection (definition of information to be extracted from selected studies / categorization of studies);

4th - critical analysis of the included studies (evaluation of the studies included in the integrative review);

5th - discussion and interpretation of results and;

6th - presentation of the integrative review, that is, presentation of the review / synthesis of knowledge)

The screening was carried out independently by the three authors. Disagreements regarding inclusion during the first and second stages of study selection were resolved by discussion.

The items recovered were selected based on a three-step selection process, which later considered titles, abstracts and full texts. In stage 1, a list of titles was obtained from the databases and titles that clearly did not refer to the theme. In stage 2, the abstracts of the selected titles were selected and, if it was clear from the abstract text that the article did not deal with the theme, it was excluded from the review. In step 3, full-text articles were read carefully and it was verified whether the studies were relevant to the review objectives.

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IV. RESULTS AND DISCUSSION

In the first stage of the study, 342 articles were found, which referred to the etiology, clinical properties and treatment of dental agenesis using an osseointegrated implant. Then, an attentive and systematic reading of the titles of the selected articles was carried out according to the theme addressed in the research, and 64 articles were selected. Subsequently to reading the abstracts, only 47 studies were chosen to be included in a more detailed analysis, of a critical and integral character. At the end of these verification and analysis steps, 15 studies remained that met the inclusion criteria. It was found that the most significant portion of articles was found in the SCIELO database, followed by the periodicals PUBMED and LILACS, as shown in Figure 1.

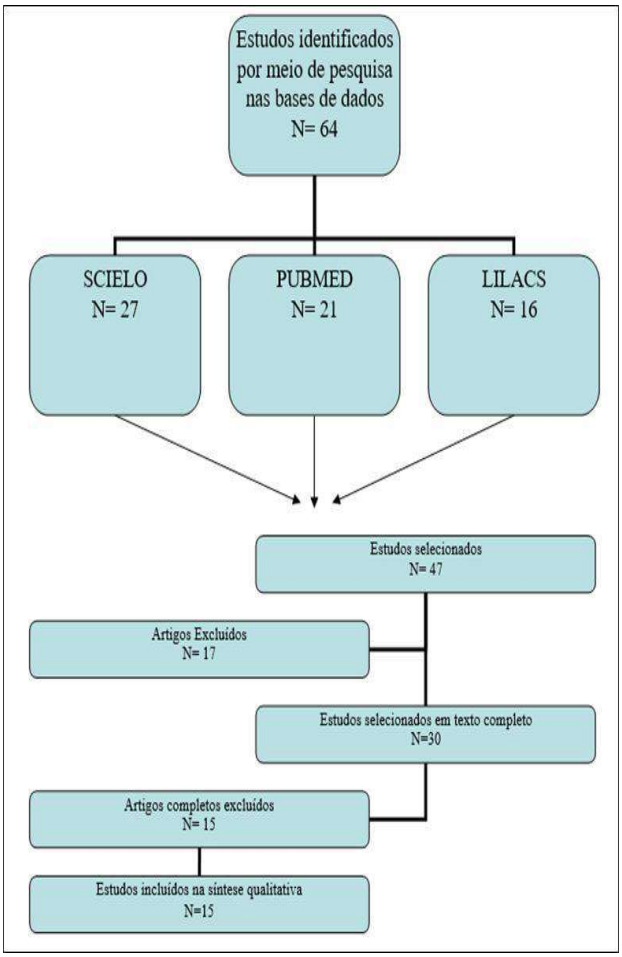

Fig. 1: Selection of studies for review.

In view of the research carried out, it was found that this is a topic of great relevance to the academic and scientific scope, however, it has a great shortage of literature, especially in national journals.

Of the 15 selected studies, six were published in a national journal and nine were published in American journals, shown in Table 1.

This review consists of 15 articles published between 2015 and 2020. Of the selected sample, six were case studies, one was a literature review, three were retrospective studies, four cross-sectional studies and a clinical study, distributed as shown in the table 1.

Table.1: References used in this review.

Autores	**Título**	**Ano**	**Periódico**	**Metodologia**
Ferreira; Oliveira; Costa	Retratamento ortodôntico em paciente com agenesia de incisivo lateral superior.	2015	Revista UNINGÁ Review	Case study
Rakhshan	Congenitally missing teeth (hypodontia): A review of the literature concerning the etiology, prevalence, risk factors, patterns and treatment	2015	Dental research journal	Literature review
Barbosa et al.	Agenesias múltiplas, planejamento e hereditariedade	2016	Revista Faipe	Case study
Citak et al.	Dental anomalies in an orthodontic patient population with maxillary lateral incisor agenesis	2016	Dental Press Journal of Orthodontics	Retrospective study
Anderssón et al.	Mutations in COL1A1 and COL1A2 and dental aberrations in children and adolescents with	2017	PLoS One .	Clinical study

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	osteogenesis imperfecta ± A retrospective cohort study			
Redua; Redua	Hypodontia of mandibular incisors: considerations on the orthodontic treatment.	2018	Dental Press Journal of Orthodontics	Case study
Santos; Silva	Reabilitação protética em paciente portadora de agenesia dentária: relato de caso	2018	RvAcBO	Case study
Attia et al.	Oral Rehabilitation of Hypodontia Patients Using an Endosseous Dental Implant: Functional and Aesthetic Results	2019	Journal of Clinical Medicine	Retrospective study
Borali et al.	Association between agenesis and root morphology of anterior teeth	2019	Revista de Odontologia da UNESP	Cross-sectional study
Martins et al.	Digital smile designing, pressing and stratifying ceramic lithium disilicate veneers to rehabilitate dental agenesis: a clinical report	2019	RGO - Revista Gaúcha de Odontologia	Case study
Moreno et al.	Third Molar Agenesis an Anomaly or Just a Sign of Variation?	2019	International journal of morphology	Cross-sectional study
	Prevalence and Manner of Presentation of this Condition in a Sample from the Metropolitan Region of Chile.			
Sirianni; Gonçalves	Avaliação da prevalência de agenesia de segundos pré-molares dos pacientes do curso de Odontologia do Centro Universitário da Serra Gaúcha	2019	Journal of Oral Investigations	Cross-sectional study
Yu et al.	Genetic analysis: Wnt and other pathways in nonsyndromic tooth agenesis.	2019	Oral Diseases	Retrospective study
Zeng et al.	KDF1 is a novel candidate gene of non-syndromic tooth agenesis.	2019	Archives of Oral Biology	Case study
Tamburini et al.	Dental anomalies in the deciduous dentition of non-syndromic oral clefts patients.	2020	Revista Brasileira de Saúde Materno Infantil	Cross-sectional study

Orthodontics is a specialty that gathers knowledge about biological, mechanical and artistic factors. Some conditions require maximum interaction and use of this extensive knowledge. Some examples of this are the cases of missing teeth that need to be replaced in the anterior region, in the aesthetic zone. These teeth can be replaced by different techniques, such as orthodontic movement of other teeth, autotransplantation, and the use of fixed or

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implant-supported prostheses. Various aesthetic factors, such as symmetry, morphology, shade, width, length, angulation, thickness and gingival architecture of the replaced teeth, must be considered in the treatment planning (SIRIANNI and GONÇALVES, 2019; TAMBURINI et al., 2020).

Dental agenesis is one of the most frequent dental anomalies. Dental agenesis is clinically apparent due to the lack of one or more teeth: that is why such alteration is one of the best candidates for implant-prosthetic rehabilitation. The literature reports that lateral incisors are affected by agenesis in 2.2% of cases (SANTOS and SILVA, 2018; BORALI et al., 2019; TAMBURINI et al., 2020).

When agenesis reaches the lateral incisors, in addition to functional issues, the greatest discomfort is represented by aesthetic reasons. The most adequate solution for these clinical conditions is, obviously, an implant-prosthetic rehabilitation, but this surgical approach is not always viable (LIANG et al., 2016; SIRIANNI and GONÇALVES, 2019).

The ideal proportion of a tooth can be calculated as the width-length ratio. An upper central incisor (ICS) has an acceptable proportion when its width is 75% -85% of its length. Another fundamental factor is the visibility of the teeth in a frontal view of the smile (SANTOS and SILVA, 2018; BORALI et al., 2019).

When a tooth needs to be replaced, some considerations should be included in the treatment planning, such as: patient's age and skeletal maturation at the time the agenesis was diagnosed or the tooth was lost, the amount of time from orthodontic treatment to definitive restoration and stability or longevity of results (SIRIANNI and GONÇALVES, 2019; TAMBURINI et al., 2020).

The relatively common agenesis with upper lateral incisors (ILS), one of the most frequent types of agenesis in the permanent dentition, as well as other atypical morphological changes, substantially compromises the smile's aesthetics. Its frequency varies according to the characteristics of the population studied and the sex of the participants, and the values vary from 0.8% to 4.25% in the permanent dentition, with a slight predominance in the female sex. Individuals with agenesis who most seek treatment are those whose anterior teeth, especially the lateral ones, are absent (ZARONE et al., 2016; SANTOS and SILVA, 2018).

The absence of the lateral incisor is usually diagnosed early, during mixed dentition, or even during adolescence, when parents seek treatment for their children for aesthetic reasons. There are three options for replacing the ILS: replacement with an orthodontically moved and remodeled canine; dental implants; or tooth supported restorations. The challenge here is to develop a comprehensive treatment plan according to the diagnosis, age and needs of each patient (ANDERSSON et al., 2017; MARTINS et al., 2019).

The replacement of an absent ILS with osseointegrated implants has some frequent complications. The growth of the alveolar process, more intense during the patient's growth, but continuous throughout life, does not cease with the patient's aging. Therefore, this type of treatment often presents unsatisfactory aesthetic results in the medium and long term. In addition, the verticalization of the incisors occurs as the patient ages and the implants appear to become more protrusive. However, implants in the aesthetic zone of patients with a high smile line are contraindicated due to the darkening of the gingival margin, reported in more than half of the patients after rehabilitation (MORENO et al., 2019; TAMBURINI et al., 2020).

An argument in favor of using orthodontic movement to close the space is that the possible complications of minimally invasive or non-invasive procedures are relatively easy to correct or repair, while implant treatments are difficult or impossible to change later. Despite the aesthetic complications observed in these cases, most patients with implants appear to be satisfied with the results of their treatment (CITAK et al., 2016; MORENO et al., 2019; ATTIA et al., 2019; TAMBURINI et al., 2020).

Authors report that the critical condition for good osseointegration is to have a quantity of at least 2 mm of healthy bone around the implant (RÉDUA et al., 2015; ZENG et al., 2019).

It is also necessary to guarantee a good dental emergency profile, in order to obtain a correct prosthetic rehabilitation from the aesthetic and functional point of view. These conditions are not always possible and the presence of a small bone thickness forces the surgeon to change the implant insertion axis, exposing the prosthetic restoration to the concrete risk of failure (ANDERSSON et al., 2017; ATTIA et al., 2019; ZENG et al., 2019).

Over the past few years, several methods have been offered to address the problem of sparse bone thickness in cases requiring prosthetic-implant rehabilitation. In fact, thanks to several Guided Bone Regeneration (GBR) strategies, the idea of placing implants where the amount of bone is abundant has become an inclined guided bone arrangement (RÉDUA and RÉDUA, 2018; YU et al., 2019).

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Many authors have proposed the use of bone grafts by taking samples of oral tissues (mandibular branch); others preferred extra-oral tissues (eg, iliac crest bone). These methods generally lead to good results, but are very aggressive and cannot exclude complications, such as additional surgical procedures. To find an alternative solution to increase the thickness of the crest, a crest approach was proposed, divided between the buccal and lingual cortical layers, in order to induce new bone formation in the internal region (BARBOSA et al., 2016; ANDERSSON et al ., 2017).

Studies have evaluated dental implants in patients with dental agenesis, focusing on the implant survival rate. The soft tissue parameters were not assessed in most of these studies, and the implant's success was assessed with self-defined parameters. Standard success criteria were not used in any of these studies (ANDERSSON et al., 2017; ATTIA et al., 2019).

V. CONCLUSION

The present literature review showed that dental agenesis is one of the most common genetic abnormalities among humans. In most of the study results that in the case of agenesis, the osseointegrated implant approach has proven to be a reliable and predictable treatment for restoring function and aesthetics.

It has been found that replacing a tooth with a congenital defect in the maxillary region with implants is often preferable to conventional supported dental restorations, such as bridges or an adhesive restoration, because this replacement technique avoids the preparation of an adjacent tooth substance intact and requires a time of relatively short treatment. Osseointegrated implants have shown great potential for issues related to agenesis. In addition, implants have broadened their indications and have become a reliable and widely accepted treatment modality in all fields of dentistry.

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Mobilities, climate change and rights of city

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Abstract— *This article analyzes the relationship between mobility, climate crisis and the right of city in Salvador, capital of the state of Bahia, Brazil. In addition to briefly describing the history of the city's mobility and its fundamental role in social relations, we demonstrate how it has been the subject of countless conflicts over the 19th and 20th centuries. Using bike sharing system data, we also demonstrate how active modes of transport are an important practice in central areas. Using the bicycle as a means of transportation can not only mean a reduction in the use of cars, but also a reduction in greenhouse gas emissions in the atmosphere. In the analysis of data on the movement of bicycles shared between April 2018 and April 2019 in the old center of Salvador, we noticed that the routes suggest routes and practices aligned with Transit-Oriented Development, a concept coined in the 90s and aimed at building democratic, sustainable and diverse cities.*

Keywords— ***Bike sharing, Climate change, Mobilities, Right of city, Salvador.***

I. INTRODUCTION

Since the new mobility paradigm was created [1], we can verify in field that the movement of people, ideas and things is able to explain our socio-cultural history. More than that, the world is being built on the relationship between mobility and people and, especially in the city, they are decisive in our lifestyle. In the Anthropocene era [2], mobilities have an important contribution to make and discussions about them become central, especially concerning climate change.

This article will show how mobility issues are important in Salvador, capital of the state of Bahia, Brazil, and how they are fundamental in understanding conflicts in urban space and the right of city [3]. On the other hand, mobility, especially the movements with the bicycle, can show us how to solve circulation problems in the city center, as well as indicate issues of climate change that should be considered in the near future.

We present the mobility data from the Tembici [4] bike sharing app in the years 2018-2019 and how they are marked by gender issues. We were also able to calculate the greenhouse gas amount that was not emitted in the old city center of Salvador (OCS). In addition, we realize that these paths are aligned with TOD - Transit-Oriented Development [5] in the context of active mobility.

II. SALVADOR: A MOVEMENT CITY

When the Portuguese started the colonization of the lands where is Salvador, they knew about the enormous challenge that awaited them. If the city had the advantage of placing itself in the fortification of high hills, which could protect the colonial project, they still needed search strategies to bring the upper and lower parts of the city together. Lisbon has presented the same mobility problems since its foundation. Over time, the two cities built solutions for accidental topography, first with enslaved human labor, then with elevators and other mechanical inventions.

It did not take long for the first conflicts to arise. The pioneering workers' strike involved issues related to mobility and enslaved black workers. Until the 19th century, they were one of the main labor forces in Salvador, moving things and people, and were known by the name of "ganhadores" (winners) [6]. For ten days, people were unable to go anywhere because the "cadeirinha de arruar" (street chair), perhaps the first shared transport service, performed mainly by freed slaves,

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was out of service. Food and other services provided by these workers also ceased in 1857.

This century was extremely important for thinking about mobility. Due to the influence of European modernity, a series of inventions such as electric trams, bicycles, steam powered cars by steam and then fossil fuel changed the customs, behaviors and lifestyles in the tropical city. Before the colonial presence, traditional forms of travel, such as hiking and sailing, were essential means of transportation. The boats called "igapebas" and "igaras" [7] have been used for centuries by the Tupinambás tribes that inhabit these lands surrounded by the sea.

The modernity not only changed the Salvador lifestyle, but also changed the urban space. Milton Santos [8] was the first researcher to observe this impact of transport engineering. Electric trams and asphalt with their cars allowed the growth of the city and, at the same time, contradictorily, the escape of the population and the economy. With the possibility of circulation, the city maintained its port, a speculative and colonial character that founded it in the 16th century. In addition, conflicts quickly began to occur between citizens, transportation companies and public authorities, mainly due to the elitist character that these technologies have had since their creation. In fact, today, who can use expensive and inefficient public transport in an underdeveloped country?

In 1930, we will be occupied with the first great mobility conflict of the 20th century: the "Quebra-Bonde" (1), a popular revolt that destroyed the electric tram system due to its inoperability and poor service, added to the political instability experienced in the country with the Revolution of Getúlio Vargas.

Fig. 1: "Quebra-Bonde", 1930.
Public Archive of the State of Bahia

Fig. 2: "Revolta do Buzu", 2003.
Photo by Marcelo de Trói

It was the first of other revolts. The public transportation inefficiency will be a reason for enormous riot throughout the 20th century. In 1983, "Quebra Quebra" destroyed 343 buses and another 10 were set on fire because of the high ticket price. In 2003, another revolt marked Salvador, the so-called "Revolta do Buzu" (Bus Uprising) (2), when the city was totally paralyzed by students who occupied the urban space, preventing the movement of people. The bus uprising was especially important because it was the origin of a social movement that sought to eliminate urban public transport fares and which would return with strength 10 years later: in 2013, a new demonstration initiated by the "Movimento Passe Livre" (Free Pass Movement) reached the entire Brazilian territory and was configured as one of the biggest urban turbulences in the recent history of the country with political impact until today [9].

These examples show how the transportation issue is central to understanding the right of city and the importance of mobilities for the urban population. Furthermore, these conflicts demonstrate a certain inability of governments to solve delicate problems for citizens and its other fields of life influences, such as housing, work and well-being.

III. TRANSIT-ORIENTED DEVELOPMENT

The 1980s were marked by the beginning of a new way of thinking about urban mobility issues, especially in the case of development habits, mobility and climate change, which would be accelerated from the 1990s onwards. If economies grow, it was evident that transport activities grow as much as human activities and urbanization. Actually, it is estimated that transport is responsible for 23% of the total related to energy consumed worldwide and 13% for global emissions [10].

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The concept of TOD - Transit-Oriented Development appears to help cities solve problems related to this. In this trend, institutes such as ITDP - Institute of Transport and Development Policies have emerged intending to thinking about these issues, which created models for analyzing standards on aspects involving mobility and development. Standards such as pedestrian mobility, active and collective modes of transport, connections and soil diversity are taken into account [11]. In this paper, we have no intention of making a thorough analysis of TOD in the old center of Salvador, but it is important to understand how this territory presents favorable conditions for the establishment of these standards: first for its plan topography, second for the diversity of the population and land-use diversity of this central area, and third for the various connections with bus stations, cultural, education and health facilities.

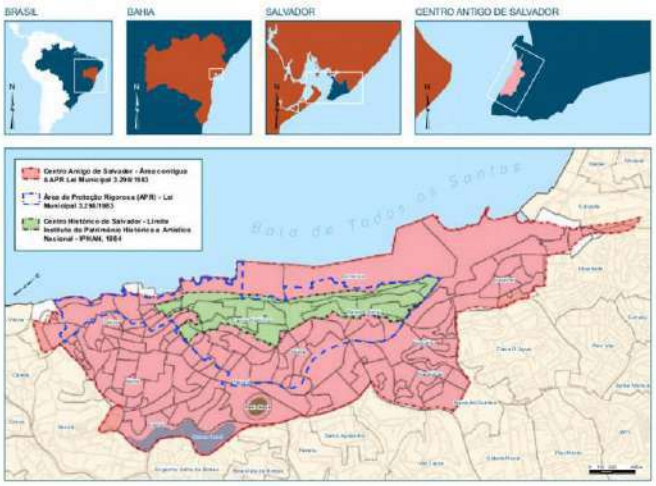

Fig. 3: OCS - Old Center of Salvador (Centro Antigo de Salvador) in the red selection, with the historical center (green area). Source: SEI, 2013 [12]

The old center of Salvador (OCS) is one of the most privileged area city (3). Besides the beautiful "Baía de Todos os Santos" (All Saints Bay) view in the south Atlantic Ocean, this territory is rich in identities, cultures and services access. The OCS has numerous symbolic values and is considered one of the places with the largest heritage site in Latin America, mainly in terms of colonial and baroque architecture.

Although there are people in a social vulnerable situation, the territory is occupied by a modest middle class, which means a monthly income of less than two minimum wages, the proportion of the poor being less than the rest of this city. About 77 thousand people live in this area, which corresponds to 2.9% of the total population of Salvador - almost 3 million inhabitants. It's important to highlight some demographic data such as 54.9% of women, 78% of black people and 73.6% of people have medium schooling. Concerning mobilities 79.8% don't own a car and 78% of the population take half an hour to get to work [12].

Recently, the hall city promoted a series of changes encouraged by new mobile practices due to the increased cyclist number besides to other policy guidelines in function of the new climate policy.

This means that the public administration should encourage projects related to reducing travel rates, non-automotive travel and pedestrians. The data we explore in this paper indicate that the bicycle sharing system Tembici has been used by students and workers who live in this area and this experience can inspire political transport to other regions of the city, especially those located in peripheral and suburban areas.

IV. BIKE SHARING SYSTEM AND SALVADOR

Begun in the 1960s in Amsterdam, the BSSs - Bicycle-sharing schemes is a reality in all major Western metropolises. Of the 1,600 bike sharing systems in operation, 95% of them have been in operation for over a decade. In 2015, there were approximately 1.2 million shared bicycles accessible to the public worldwide, which demonstrates the potential for this technology [13].

In Brazil, the initiatives on BSS started 10 years ago. In operation since 2011, Tembici (formerly called Bike Itaú) is one of the most known and nowadays it operates in the cities of São Paulo (state of São Paulo), Rio de Janeiro (state of Rio de Janeiro), Belo Horizonte (state of Minas Gerais), Recife, Olinda, Jaboatão dos Guararapes (state of Pernambuco) and Salvador. Since 2017, the system has started to offer aluminum bicycles produced by a Canadian company, with a rim 24 and roller brake system on two wheels. The new system was made available in Salvador in 2018, linked to the "Salvador Vai de Bike" Movement, a city hall program created as one of the responses of the city administration to the 2013 demonstrations, already mentioned in this article.

The application has a certain elitist character, first due to the distribution of stations, which does not reach the periphery of the city, second because the system requires the user to have a credit card to obtain one of the paid plans. The bicycle is released either from an application installed on the cell phone or directly on the totem pole for daily plans. Or the bicycle can be removed through the "Salvador Card" (after registration), a ticket for integrating

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municipal public transport, which was also implemented in 2014 as a claim of the 2013 demonstrations.

We analyzed the system's trips throughout the city of Salvador between April 2018 and April 2019. The data provided by the company Tembici contained information on bicycle pickup and delivery, the corresponding station with details of day, month, year and hours exact times of use, in addition to the user's age and gender. With some insistence, we managed the number of users in this period, estimated at 33,782 people.

Our methodology for analyzing and interpreting these data was to articulate the neighborhoods in the old center of Salvador (OCS) that contained the Tembici stations as transmitters and receivers of the system's trips. In other words, we were interested in all the trips in the city that had as their final destination the old center, as well as all the trips that left the central stations with any other destination.

Of the 50 stations of the Tembici system in operation during the studied period, 10 were within the studied area. We tried to select all trips that had the OCS stations as their final departure or destination. Therefore we came to some consolidated data regarding travel across the city and those restricted to the center. Of the total of 400,177 trips made in the city of Salvador in the analyzed period, 71,943 had their arrival or departure to the OCS region. In total, trips of this type accounted for 15 to 20% of trips across the city. In the analysis of the period of one year of trips made with the Tembici app, we account for trips that left or departed the old center of Salvador. The total kilometers traveled with bicycles reached a total of 194,852 kilometers.

Table.1: Tembici OCS/gender (April 2018-April 2019)

Gender	Total Trips	%
Male	53,592	74.49
Female	13,529	18.81
Not declared	4,822	6.70
Total	71,943	100%

The data above (1) demonstrated what the observational field research already signaled: the system is mostly used by male people. We consider this as a hypothesis, which is evident in the very history of bicycle creation. Although the women were instrumental in the creation of the modern and safe bicycle in the 19th century [13], which was previously restricted to the male world, they still do not feel fully confident in facing the brutality of traffic in the city. In 6.70% of the trips, it was not possible to determine the gender. In this case, we have three possible hypotheses: the person did not identify with the binarism attributed by the system's registration, the person did not want to identify himself or, more likely, the data were not consolidated by the system, which is common, especially with regard to the sex and age categories that rely on the user to put the information in the system.

Table.2: Tembici OCS/age (April 2018-April 2019)

Age groups	Total Trips	%
26 - 35	23,589	32.79
18 - 25	23,186	32.23
36 - 45	11,448	15.91
46 - 55	5,257	7.31
56 - 65	2,364	3.29
Less 18	1,736	2.41
+ 65	640	0.89
Not declared	3,723	5.17
Total	71,943	100

The age group of most users was between 18 and 45 years old, a category that concentrates more than 70% of the total trips. Surprisingly more than 10% of the trips were made by people between 46 and 65 years old. In the not declared data, corresponding to 3,723 trips, it was not possible to assign age to the user because the table with the data was missing or because it contained the year 2018 or 2019, which would give to a person with 01 year, presenting an error in filling out the form system (2).

The data analyzed in the period also showed that the system was used mostly on weekdays, which may indicate that bicycles were used less for leisure than for daily mobility in the OCS.

Table.3: Tembici OCS/distance in kilometers (April, 2019)

Distance	Total Trips	km
Up to 5 km	8,738	17,901.5

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Between 5.1 and 10 km	603	4,033
Between 10.1 and 20 km	60	694.1
More than 20 km	1	24.7
Total	9,402	22,653

Another important factor to be analyzed and which is directly related to the concept of TOD is the distance per trip (3). According to the concept of TOD, the ideal bicycle locomotion is 8 km for complete journeys and 3 to 5 km for complementary journeys (those that are performed with the combination of other modes). When analyzing only the April 2019 data, of the 9,402 trips that left or arrived at the OCS, less than 700 trips had routes between 5 km and 10 km, and only one trip was above 20 km (in January 2019 there were two trips greater than 20 km). In other words, 8,738 trips had routes of up to 5 km, which indicates that users traveled shorter distances, within the OCS itself, indicating interests and motivations in that space, reinforcing the utility use of the system. The hypothesis was reinforced through direct observation of the field without participation. For comparison, in January 2019 trips up to 5 km were the majority (9,055 trips), but routes between 5.1 and 10 km increased by 31 trips, perhaps due to school holidays

The analysis of these trajectories shows that active mobility policies intended to workers and students use can have excellent results and adherence, which means reducing the use of motorized modes in the central areas, increasing the interaction of people in the urban space, avoiding emissions of greenhouse gases, according to the simulation that we have also prepared from the total kilometers of trips in the OCS (194,852 km):

*Table.4: Tembici OCS - CO_2 / year compensation simulation (*exchange rate R$1 = US$ 5,63 in Oct. 26, 2020)*

Vehicle type/scenario	**tons / CO_2**	**number of trees**	**dollar US$***
A - Gasoline car 1.5 / 2.0	553.12	1,533	7,760
B - Biofuel car 1.5 / 2.0	214.65	595	3,011
C - Diesel bus	62.23	173	875

We used a CO_2 emission calculator to find out how many emissions would be emitted (4), if that mileage were achieved by motor vehicles with only one passenger. Thus, we simulated three possible scenarios: “A” - gasoline car with 1.5 / 2.0 engine; “B” - biofuel car with 1.5 / 2.0 engine and “C” - diesel collective bus. The amount of CO_2 is expressed in tons, the number of trees that must be planted to neutralize the emission of gases and the corresponding dollar value for planting them.

Among the three simulations, the gasoline car would be the most polluting and the trip with the collective transport to which it emits least *per capita*, considering 30 people transported in the bus.

Thus, it is suggested that an ethics based on climate policies, using public transport for commuting from the city would be the first option, followed by automobiles powered by biofuel. The simulation was done thinking about only one occupant per car and, not by chance, once in direct field observations, we noticed that most automobiles were and still are always with only one person. It is urgent to create concrete measures against the emission of greenhouse gases into the atmosphere and the automotive system has been the biggest villain in this respect [15].

V. CONCLUSION

The preliminary data shows the mobilities such a central question for urban studies in old center of Salvador.

Although the purpose of this investigation, which is still ongoing, is not to make a rigorous calculation regarding the study of trajectories and CO_2 compensation, we can see from these data that tons of CO_2 are no longer released into the atmosphere by the simple use of Bike Sharing System. A precarious and somewhat shy system with little access if we think about the population of OCS and the entire city of Salvador. Still it shows an enormous potential for dissemination as a practice of cycling, especially among workers and students.

Even if measures are taken to reduce greenhouse gas emissions, which means radically changing the form of global mobility, the effects of the current transport policy and its environmental impacts are already being felt.

High temperatures should be more frequent in Salvador until the end of the century, increasing the risk of illness and death, especially among the elderly, babies and people

with chronic medical conditions. The risks are even greater for the low-income population, the majority in the case of the capital of Bahia [9].

Emphasizing active modes, valuing human propulsion, especially for those in physical and structural conditions, is a way of relieving mobility systems and urban roads. Only new practices can modify urban structures and guarantee the right to the city.

This article dealt with specific issues in the old center of Salvador, a privileged area, but which has always been the scene of disputes and conflicts involving mobilities. Expanding this investigation to peripheral areas, for people with disabilities, is essential to have a broader and more representative view of the city of Salvador. This can help to guide society and its elected officials towards the construction of a better and more democratic city with regards to mobility.

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Situational analysis of exogenous intoxication in the state of Amapá, between 2015 and 2017

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Abstract— *Exogenous intoxication is a collection of noxious effects represented by laboratorial and clinical manifestations that disclose the organic disproportion produced by the interaction of one or more toxic agents with the biological system. The aim of this work is to perform a situational analysis of exogenous intoxication in the state of Amapá during the period of 2015 to 2017. The form of study is retrospective with quantitative approach. The data sources used were DATASUS and the Brazilian Institute of Geography and Statistics – IBGE. Papers published in journals, BIREME database, LILACS, SciELO and data from the Ministry of Health were an additional sources. The results showed that in the period from January 1, 2015 to December 31, 2017, the total number of reports of endogenous intoxication by municipality of residence was 60 cases, and Macapá was the municipality that contributed with maximum notifications which is 86.6%. The most prevalent age group for exposure to toxic agents is the group of young adults between 20 and 39 years of age, with an average of 50% of the total cases with a predominance of female representing 53%. Among the substances that mostly caused these type of poisonings are the use Raticide with 30% and the use of drugs with 18%. It is concluded that exogenous intoxications are a risk to the public health and need to be minimized with more effective public policies by reducing the exposure of groups of risks that lead to accidents or that favors suicides.*
***Keywords*— Exogenous intoxication, Suicide, Notifications.**

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I. INTRODUCTION

Exogenous intoxication is the set of harmful effects represented by clinical or laboratory manifestations that reveal the organic imbalance produced by the interaction of one or more toxic agents with the biological system. These acute intoxications can cause clinical and / or biochemical consequences of exposure to chemical substances found in the environment (water, food, poisonous or venomous animals) or isolated (pesticides, medicines, household products) (Schvartsman & Schvartsman, 1999).

Toxic agents are mostly of anthropogenic origin, capable of causing damage and can cause death depending on the concentration and time of exposure. Taking the clinical history, in the evaluation of intoxication, becomes a challenge to identify the substances used, the quantities and the time elapsed. Detailed and systematic physical examination is the best solution for diagnosis and treatment guidance (Oliveira & Menezes, 2003). Among the agents, rodenticides in poisoning by accident and suicide attempts stood out. These substances, however, have been improperly diverted for use in domestic environments, since its uses are exclusive in farming (Dantas et al., 2013).

Currently, it has been found that the use of these products is more present among intoxications, either by intentional use or by accident. In 2002, the World Health Organization (WHO) estimated that in the world there were about 350 thousand deaths due to poisoning, with 10% being in children under 15 years of age, prevailing between 15 and 44 years (Werneck & Hasselmann, 2009). Among intentional intoxications, the main cause is suicide attempt. The most used substances are medicines, alcohol and pesticides (Santos, Legay, &Lovisi, 2013). The use of rodenticide is accidentally associated, but most cases of deaths observed are due to intentional exposure. The Aldicarb rodenticide is more used for high intake, even though it is illegal to sell it in Brazil (Batista et al., 2017). In the country there is no production of this product, but the commercialization is great in the domestic environment, since its use is for agricultural purposes, and when involved in cases of intoxications, they inhibit the enzyme acetylcholinesterase and it stops acting in the degradation of acetylcholine, which can lead to mortality if diagnosis is late (Vieira, 2004). The conducts in the hospital network range from the description of toxic agents, amounts and time of exposure and the procedures must be started as soon as possible; vomiting, nasogastric tube, gastric lavage, urine alkalinization and activated carbon can be induced (Silva & Costa, 2018).

The agents related to the most serious cases of poisoning are pesticides, drugs and rodenticides. The highest prevalence in the number of notifications for medications and the age group most exposed to these products ranges from 1 to 4 years (22.06%) and from 20 to 29 years (17.72%) (Santos et al., 2014). This is because in Brazil several weaknesses facilitate the acquisition of products that contribute to intoxications, such as: deficient advertising of the risks of medicines, the acquisition of medicines without a medical prescription, fragility of packaging and abuse of drugs by the population (Silva & Costa, 2018).

It is worth mentioning that many of these notifications involve cases of suicide attempts. The World Health Organization (WHO) conceptualizes suicide as an intentional act of the individual to extinguish his own life (Schlichting & Moraes, 2018).

Suicide represents a public health problem for society, and is among the three main causes of death among adolescents and young adults and the identification of toxic agents can be a guide for the implementation of prevention measures (Vieira, Santana, &Suchara, 2015). For the World Health Organization (WHO), it is estimated that more than 1.5 million people by 2020 will commit suicide, being the most common practice for hanging, firearms and poisoning (Santos et al., 2014).

Thus, this work aimed to make a situational analysis of exogenous intoxication in the State of Amapá, from 2015 to 2017, addressing the age group; most prevalent sex; toxic agent and the circumstances of intoxication. Given the relevance of the topic to Public Health, it is essential to conduct a study that characterizes the population at risk, in order to direct health policies to minimize morbidity and mortality related to exogenous intoxications.

II. METHOD

A retrospective study was carried out, with a quantitative approach to the cases of exogenous intoxications reported in the State of Amapá in the period from 2015 to 2017.The data used was DATASUS and IBGE (Brazilian Institute of Geography and Statistics) 2010 census, considering all cases of exogenous intoxication notified from January 1, 2015 to December 31, 2017 residing in Amapá.For the analysis of this study, certain variables were adopted, being: municipality of residence, incidence rate, age group, sex, toxic agent and circumstances.

For the analysis of the statistical data, the programs Windows Word and Excel were used, the information was displayed in tables and for discussion the

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available literature on the topic was used, based on the data network BIREME (Regional Library of Medicine), LILACS (Literature Latin American and Caribbean Health Sciences), SCIELO (Scientific Electronic Library Online) and Ministry of Health.

III. RESULTS

During the studied period, the total number of notified cases of endogenous intoxication was 60 cases, according to table 01, the cases were reported by municipality of residence.Between the years 2015 and 2017, it was possible to see an increase in cases of exogenous intoxications in the state of Amapá, comparing 2015 in relation to 2016 this increase was 150% in the state, and when related the year 2015 with 2017, the increase observed was more than 100% of the reported cases, with Macapá being the municipality that most contributed to the notifications, with 52 (86.6%) cases in the analyzed period.

Table 1: Notified cases of exogenous poisoning, by municipality of residence, Amapá, 2015 to 2017

Municipality of Residence	Notificationyear		
	2015	2016	2017
1 Macapá	09	24	19
2 Laranjal do Jarí	-	-	04
3 Porto Grande	01	-	-
4 Ferreira Gomes	-	01	01
5Itaubal	-	-	01
Total	**10**	**25**	**25**

Source: Ministry of Health / SVS - Information System for Notifiable Diseases / DATASUS

Table 2 reveals the incidences of exogenous intoxication by municipality of residence, and Macapá showed an increase in incidence for every 100,000 inhabitants from 2.26 in 2015 to 6.03 in 2016. However, compared to other smaller municipalities, in 2017 its incidence it's smaller.

Table 2: Exogenous intoxication incidence rate for every 100,000 inhabitants per municipality, Amapá, 2015 to 2017

Municipality of Residence	Notificationyear		
	2015	2016	2017
1 Macapá	2,26	6,03	4,52
2 Laranjal do Jarí	-	-	5,02
3 Porto Grande	5,94	-	-
4 Ferreira Gomes	-	17,3	-
5Itaubal	-	-	23,4
Total	8,2	23,33	32,94

Source: Ministry of Health / SVS - Information System for Notifiable Diseases / DATASUS

Regarding the age group, observed in table 3, the group that most prevailed in terms of exposure to toxic agents comprises young adults between 20 and 39 years old, with an average of 50% of the total cases reported. The population under 15 had a drop in cases, with an increase in the remainder, making a total number of 25 notifications between 2016 and 2017.

Table 3: Distribution of notified cases of exogenous poisoning by age group, Amapá, 2015 to 2017

Age Group	Notificationyear		
	2015	2016	2017
<1 year	-	01	01
1-4	-	03	01
10-14	-	02	-
15-19	-	05	07
20-39	10	13	12
40-59	-	01	04
Total	**10**	**25**	**25**

Source: Ministry of Health / SVS - Information System for Notifiable Diseases / DATASUS

As for the distribution by sex, table 4 shows that there is a slight predominance of female cases, which represents 53% of the total of notified cases. In Macapá, the discrepancy is greater, with the female group accounting for approximately 58% of cases.

Table 4: Distribution of notified cases of exogenous intoxication by sex, in the municipalities of the State of Amapá, 2015 to 2017

Municipality of Residence	Sex	
	Male	Female
1 Ferreira Gomes	01	-
2 Laranjal do Jari	01	01
3 Macapá	22	30
4 Porto Grande	-	01
5Itaubal	01	-
Total	**28**	**32**

Source: Ministry of Health / SVS - Information System for Notifiable Diseases / DATASUS

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Among the substances that most caused these intoxications, it can be seen in Table 5 that the use of Rodenticides leads with 18 (30%) cases out of 60 in the state's municipalities, while IGN - Ignored / Blankrepresents 13 cases (22%) and the use of drugs with 11 (18%).

Table 5: Distribution of notified cases of exogenous toxicity by toxic agent, Amapá, 2015 to 2017

Toxic Agent	Notificationyear		
	2015	2016	2017
Medicines	-	06	05
Householdpesticides	-	01	01
Rodenticide	07	06	05
VeterinaryProduct	-	01	01
Home use product	-	02	01
Chemicalproduct	01	-	01
Metal	-	-	01
Foodand drink	-	-	02
Other	-	06	-
IGN - Ignored / Blank	02	03	08
Total	**10**	**25**	**25**

Source: Ministry of Health / SVS - Information System for Notifiable Diseases / DATASUS

Among the circumstances involved, table 6 shows a marked growth between 2015 and 2017 in the State of Amapá, among these events the suicide attempt is the most recurrent, making up 67% of the total; followed by accidental circumstances with 18% of the total. There is also the occurrence of 1 notification regarding homicide and violence in 2017.

Table 6: Distribution of notified cases of exogenous intoxication, according to circumstances, Amapá, 2015 to 2017

Circumstances	Notificationyear		
	2015	2016	2017
Accidental	01	07	03
Self-medication	-	01	-
Foodintake	-	-	02
Suicide attempt	09	15	16
IGN - Ignored / Blank	-	02	03
Violence / homicide	-	-	01
Total	**10**	**25**	**25**

Source: Ministry of Health / SVS - Information System for Notifiable Diseases / DATASUS

IV. DISCUSSION

Exogenous intoxications are a reality in Brazilian health units and this scenario is no different in the state of Amapá. Many complications are not reported, making infeasible, which favors underreporting in several municipalities. Among the main substances used in intercurrences are pesticides, with frequencies of up to 90% in developing countries, while the use of medicines reaches 60%. In Brazil, exogenous intoxication is responsible for approximately 70% of reported cases (Santos, Legay, &Lovisi, 2013).

The agents related to the most serious cases of poisoning are pesticides, drugs and rodenticides and the age group most exposed to these products is between 1 to 4 years (22.06%) and 20 to 29 years (17.72%) (Santos et al., 2014). This reality is no different from Amapá, given that the most exposed age is 15 to 39 years and the most evident toxic agents were drugs and rodenticides. This Brazilian scenario is due to weaknesses that perhaps facilitate the purchase of products that contribute to intoxications, such as: deficient advertising of the risks of medications, the acquisition of medications without medical prescription, fragility of packaging and the abuse of drugs by the population (Silva & Costa, 2018).

It is worth mentioning that many of these toxic agents, when used in an abusive or uncontrolled manner, can favor the exposure of groups of risks to accidents or to self-ingestion. According to the World Health Organization, suicide is one of the three main causes of death in the young population between 15 and 44 years old, present in developed and developing countries, and the global suicide rate is around 11.5 deaths per 100 thousand inhabitants(Veloso et al., 2017). It was also noticed that this reality in the state of Amapá remains in relation to the world and Brazilian scenario in relation to the attempted suicide circumstance. Among suicides due to exogenous intoxication, young people and young adults are the ones who commit the most and it is up to the health establishments to notify the competent public body of cases of attempted suicide, specifically in self-inflicted exogenous intoxications (Oliveira et al., 2015). In addition, women attempt suicide more than men by taking drugs and other toxic substances (Ribeiro et al., 2018).

V. CONCLUSION

Exogenous intoxications represent a risk to the public health scenario and need to be minimized with more effective public policies, reducing the exposure of groups of risks that lead to accidents or that favor suicide.

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Sustainable Energy Design Study in Esmeraldas, Ecuador

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Abstract**—** *Sustainable energy design is particularly challenging in equatorial climates with large tourist populations because of demands on fossil fuels for comfortable indoor temperatures. This study analyzed the relationship between windows buildings, design variables usage during hot tourist periods by life cycle analysis in buildings. A study was conducted in buildings of Esmeraldas, Ecuador. A database was used to reconstruct the local microclimatic variations in MERRA 2 coastal areas, on-site observations were made, and a life cycle analysis using SIMAPRO software was used to process the data. The results revealed that window size and exterior protections from solar energy were important features. These findings contribute to the study of buildings in hot coastal areas that require air conditioning, which could be reduced if bioclimatic designs were used on the exterior walls that are most exposed to solar radiation, implying an adverse internal heat gain. Effective bioclimatic design parameters could be used regarding unprotected buildings on beaches to reduce their energy consumption for air conditioning.*

Keywords**—Energy, sustainable design, Esmeraldas, Ecuador.**

I. INTRODUCTION

The energy consumption mostly is for artificial air conditioning, which contributes to air pollution and greenhouse gas (GHG) emissions, and much of the usage relates to the building's designs. To address these problems, it is necessary to investigate and quantitatively assess the environmental impacts of buildings in various climatic regions to provide designers with information they can apply to effect preventive measures. These measures are urgent for coastal cities that rely on tourism and for residents who might seriously be affected by rising sea levels and temperatures related to global climate change. The city of Esmeraldas, Ecuador, is an example of this global problem, and this study performed a comparative life cycle analysis (LCA) between modern and traditional designs in the Esmeraldas region.

The effects of climate change on buildings located in warm microclimates indicate the need to conduct research on sustainable energy design. Achieving energy sustainability in response to climate change might be most important in the world's coastal areas. Galindo, Samaniego, Alatorre, and Ferrer argued that Latin America could reduce its exposure to climate change and adaptation costs using a regional integration process by considering, for example, food and energy security issues in the regional context [1]. Economic Commission for Latin American and the Caribbean indicated that climate change demands adjustments in current production and consumption patterns and establishing a new style of sustainable development [2]. The International Panel on Climate Change issued a warning more than a decade ago about the negative effects of climate change on economies, population well-being, and ecosystems [3] According to Stern, the evidence in 2007 suggested that a temperature increase of 2º C and accompanying planetary impacts during the first half of the 21st century is practically was almost inevitable [4]. Others have warned us that Latin America needs to recognize the importance of adapting to new climatic conditions during this century if it hopes to reduce the effects of climate change, and the region should simultaneously seek a sustainable development path [1]. They highlighted the importance of implementing effective adaptive measures to reduce the negative impacts [1].

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Latin America and the Caribbean might be particularly sensitive to climate change because of their diverse geographical, social, economic, and environmental features [5]. Climate-sensitive activities, such as agriculture, livestock ranching, fisheries, tourism, population density in coastal and other vulnerable areas, high levels of biodiversity, and the historically hot temperatures point to the need to integrate climate change response measures into municipal and national policies [1]. According to climate indicators, energy use emissions comprise more than 40% of the total emissions by Latin America and the Caribbean [6]. Consequently, effective measures are needed to reduce energy consumption in residential areas and by various economic activities, such as tourism. The Ministry of Environment of Ecuador recently proposed measures to mitigate climate change effects caused by energy consumption, which included strengthening the implementation of existing measures to promote energy efficiency and sovereignty and a gradual transition in the energy consumption matrix to increase the proportion of renewable energy uses [7].

Because climate change implies consistent increases in average daily temperatures and greenhouse gas concentrations in the atmosphere, buildings will need more energy to control interior climates and more mechanical air conditioning systems to cool them. Many climate change response measures have eco-designs or green buildings designs that apply the principles of energy efficiency through bioclimatic designs based on efficient uses of resources and materials, as well as support human well-being and provide optimal indoor climatic comfort [8, 9]. Bioclimatic principles form the foundation of this sustainable energy design in architecture [10], and the microclimate and individual well-being define the comfortable conditions [11]. The negative effects i of climate change on equatorial microclimates and indoor temperature of buildings are numerous and complex. Some studies have described these implications [12], [13], [14], [15] [16].

The climate is arguably the most important factor in bioclimatic design because it encompasses temperature, structural type, and atmospheric factors, such as wind, relative humidity, urban weather factors, and vegetation factors. Implementing sustainable architecture criteria in cities should be economically beneficial for the real estate market because building performance, operating costs, and energy savings are enhanced [16].

A definition by the US Environmental Protection Agency (EPA) [17] is as follows: “Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction.” Indoor Air Quality refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants [17].

Green building certification for different types of buildings and some programs such as include the Building Research Establishment Environmental Assessment Methodology (BREEAM) [18]. and Leadership in Energy and Environmental Design (LEED) [19], are used in many countries. Green buildings are implemented by various programs and criteria around the world. The impact of ambient temperature on the total electricity consumption showed that the actual increase of the electricity demand per degree of temperature increase varies between 0.5% and 8.5%.They emphasize efficient use of energy and resources and, to lesser extent, healthy indoor air quality [20] [21].

Many studies have investigated the association between ventilation and energy design in buildings includes the effect of the design on the outdoor environment, [22], [23], [24], [25], and [26]. The relation between wind effects, wind comfort, wind danger and wind climate is outlined Air temperature surrounding the building significantly increases due to the multiple reflections of the radiation heat flux, leading to an increase in the cooling demand A number of studies have investigated the efficiency improvement of building cooling systems with the implementation of an air-side economizer. Applying energy storage building materials that can efficiently use thermal energy to a building can reduce the peak load of building energy use and reduce the heating and cooling load by efficient use of thermal energy and, furthermore, increase the thermal comfort time [26], [27], [28], [29], [30])

The global contribution from buildings towards energy consumption, both residential and commercial, has steadily increased reaching figures between 20% and 40% in developed countries [31], like Ecuador. Few studies have been done regarding other aspects of air distribution. Amongst existing types of ventilation systems, the performance of each ventilation methods varies from one case to another due to different usages of the ventilation system in different buildings [31], [32], especially on equatorial microclimate zoning, and temporary adjustments to zone temperature set points is one approach for implementing demand response measures during peak cooling periods [33].

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The coastal areas hot and dry characteristics usually require cooling of building interiors, which consumes large amounts of energy, and the energy conservation strategies based on bioclimatic and sustainable designs should be implemented there. Criteria for Assessing Sustainable Buildings in Developing Countries: The Case of Esmeraldas, reported on the studies on climate zoning in Ecuador [34]. It used geographic information systems to map the climatic zone extending from the southern Manabí coast to Ecuador's coastal provinces of Esmeraldas which have hot and extremely dry conditions with continuous airstreams from the sea [35], [36].

A bibliographic review was conducted on the life cycle analysis (LCA) applied to energy management in buildings [37], [38], [39], [40]. Life cycle analysis and multi-criteria decision-making techniques when used in combination within the same methodological framework have been shown to be the best tool for sustainable evaluation [39]. Time differentiation along the framework could have a significant impact on the LCA results and on decision support], [40].

II. MATERIALS AND METHODS

The current study collected primary data to reliably perform an LCA, which was conducted in accordance with the current international standards. Energy demands, GHG emissions, and environmental impact categories were assessed to obtain an integrated sustainability analysis for windows in building's façade with high level of energy consumer in Esmeraldas, Ecuador. A life cycle approach to design has the potential to reveal the balance between projected operational energy savings and inverted incorporated energy.

However, some authors [41], [42], [43] point out limitations in these methodologies but for the purposes of the present investigation if it is feasible to use for the windows of existing buildings and robust primary data measured [37], [38], [39], [40], in each place at different times have been collected.

2.1 Study Site.

Esmeraldas is the province of the northernmost Ecuadorian coast, that is, the one in the north of the country. The territory is flat, with small hills of a maximum of 30 meters above sea level. Small existing elevations. The climate of Esmeraldas varies from tropical subhumid, subtropical humid and subtropical very humid, with an average temperature of 23 ° C.

The Province of Esmeraldas is made up of 7 cantons, with their respective urban and rural parishes. According to the latest territorial ordinance, the province of Esmeraldas will belong to a region also included by the provinces of Carchi, Imbabura and Sucumbíos, although it is not officially formed, called North. Esmeraldas occupies a territory of about 14,893 km², being the seventh province of the country by extension. It limits to the east with Carchi and Imbabura, to the south with Santo Domingo de los Tsáchilas and Manabí, to the southeast with Pichincha, to the north with the Province of Tumaco-Barbacoas, of the department of Nariño belonging to Colombia, and to the west and north with the ocean Pacific along a maritime strip of about 230 kilometers. According to the demographic projection of the INEC for 2020, being the eighth most populated province in the country with 643,654 people live in the Emerald territory.

The province of Esmeraldas is known for its beautiful beaches, its exuberant landscapes and its hot and humid climate, for being traditionally the Afro-Ecuadorian territory par excellence. Its main attraction is its coasts - especially the beaches of the southern sector- as well as its ecological reserves -such as the Cayapas Mataje ecological reserve, to the north. All this makes the province one of the most visited tourist destinations in the country, with most of the provincial territory enjoying a favorable temperature throughout the year (21 and 25 ° C); [48], [49], [50], [51].

Esmeraldas has the mangrove forests that are among the highest in the world, the Majagual Mangroves, located in the Cayapas-Mataje Ecological Reserve, these are located in the north of the province (San Lorenzo) near the border with Colombia. Likewise, the Emerald jungles are the cradle of 3 of the 4 indigenous nationalities of the Litoral Region of Ecuador: the cayapas, the épera and the awá. The area of the province was the cradle of cultures such as the Atacames, Tolas, Cayapas, [52], [53], [54].

2.2 Study design

The study was conducted in three stages: data collection, analysis, and synthesis and discussion of results. First, the main design variables regarding solar influences on buildings were identified: window height, the projection of shadows with solar heat gain, and electricity consumption for cooling purposes.

The hypothesized: (1) more solar energy filtered into the buildings and more electricity was used for air conditioning by larger windows and (2) shadow projection negatively related to solar gain and electricity consumption for air conditioning.

The weather data files investigated are the experimental data from the reference station of Esmeraldas airport and other data were obtained from the global databases of the

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Modern-Era Retrospective Analysis for Research and Applications model, version 2 (MERRA-2), using the U. S. National Aeronautics and Space Administration documentation as a reference. MEERA-2 is a large database relevant to reconstructing variations of microclimates on any place on earth [20], particularly in coastal areas and small islands. MERRA-2 data were publicly available from the Data and Information Services Center of Goddard Earth Sciences [44], [45].

2.2 Analytical Methods

The following five variables were considered the most important to solar heat gain:

1. Relative solar heat gain (GCSRi), defined as the heat gained through opaque and transparent parts of a building's south facade.
2. Orientation of a building as facing south, measured by the solar radiation density of the south orientation because it occurs almost all year and all day.
3. Concrete block wall area on the south wall.
4. Aluminum profile, fixed transparency of four-mm thick glass window area of the south wall.
5. Width of the eaves that projected over the windows for solar protection (awnings).

The life cycle analysis (LCA) method was used to assess the influences of the architectural design variables on electricity consumption for comparison in case studies. LCA reveals the energy and resources consumed and the environmental impacts of a device during its useful life. By comparing these data, designers can theoretically identify aspects of a device that cause environmental damages LCA is believed to be particularly useful for comparing devices that perform the same function but have different initial and operating costs to select the one that maximizes net savings.

The development of the Eco-indicator 99 methodology started with the design of the weighting procedure [46]. This study used Eco-Indicator 99 and the Eco invent Version 7 database to perform the LCA on variables that mainly affected the admissible solar windows heat gain on the south walls of buildings [47].

However, we did not analyze relative solar heat gain, which involves variables that are relatively complex, such as the measured amount of heat transmitted through the glass under standardized conditions accounting for interior humidity and the direct and diffuse solar radiations [46].

III. RESULTS

Comparing the recorded temperatures to the historical temperatures (Table 1 above) indicates a 4° C increase in the low temperatures, suggesting evidence of climate change. The LCA evaluated energy performance during the buildings' operational phase with allowable solar heat gain per functional unit at the same time during the hottest days of that same month. Using Ecuadorean Construction Standards, we analyzed the design variables used for the buildings [55].

The permissible indoor heat gains due to thermal load (during the hot season) were considered constant for both case studies. The incoming heat caused by sunlight on the windows increased the ambient temperatures, which was undesirable in the hot areas because the indoor temperatures increased to the point of discomfort. Other building characteristics, such as structural components, which mainly were bricks and reinforced concrete, were not analyzed because of the high consumption of natural resources and energy and, further, their influences were inconvenient for visualizing the data of the variables under observation.

The comparison of the end environmental impacts in both case studies found high levels of fossil fuel energy consumption for air conditioning and its contribution to the adverse environmental impacts of climate change.

Table 2 compares the two cases. The differences between them were that the area of aluminum profile fixed glass three-mm thick windows was much smaller for Case 2, and, although the concrete block wall areas were similar, there was a one-m wide projecting eave (Case 2).

The environmental benefits included less solar heat in the interiors of the air-conditioned rooms, which thereby lowered the air conditioning and electricity consumption requirements during the life of the buildings. It was found that smaller windows on the south walls and those that were protected with one-m wide eaves annually used 50% less electricity for air conditioning, which is considered a significant energy saving.

In general, windows should have glass areas equal to or less than 25% of the total wall area for air-conditioned buildings designed to protect the interiors from direct solar radiation, and, when selecting materials and components, to account for the amount of energy used during the buildings' life cycles. The results found that, in most categories, the biggest influence related to electricity because of the extended period of use and the aggressiveness of the generation processes.

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The objective of the simulation was to ascertain the amount of electricity consumed by air conditioning. Two models were created in which the selected variables were combined. Both case studies of the rooms of the buildings were conducted during the operational stage, which is the most significant energy use period. The LCA's functional unit was one m2 of south-facing wall with an estimated area of 42 m2.

The correct design of windows in buildings, with comfortable indoor environments at the same time zeroing energy demand for heating, ventilation, and air-conditioning. The environmental impacts, energy consumption, and potential for contributing to global warming due to inefficient building designs in the within case studies were much higher than for other building designs, particularly for buildings with windows directly aligned with exposure to the maximum possible solar radiation.

The data revealed a correlation between the design of the window area with aluminum profiles and the fixed transparent four-mm thick glass covering one-half of the walls without solar protection eaves on the windows during the period of maximum sun exposure between noon and 3:00 PM (Case 1). In Case 2, significantly less fossil fuel energy consumption by air conditioning was observed because of its different window design with one-m wide eaves for solar protection on the southern windows (Figure 1).

IV. FIGURES AND TABLES

Table.1: Temperatures (Celsius) in Esmeraldas Ecuador compared to historical averages

	Temperature	***Timeframe***
	Case study 1	*Case study2*
Actual	*24°/10°*	*24°/14°*
Historical	*20°/8°*	*20°/8°*

Table 2. Comparison of the results of the LCA.

Variables	***Case 1***	***Case 2***
Orientation	*South*	*South*
Area	*18 m2*	*10 m2*
Width eaves	*0.30 m*	*0.90 m*
Concrete area	*42 m2*	*40 m2*
Solar heat	*0.25*	*0.38*

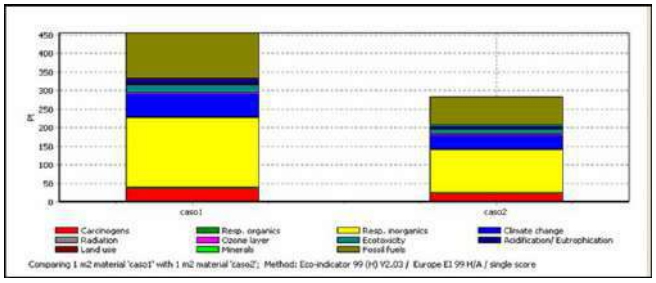

Fig.1: Comparison of environmental impacts of selected buildings.

V. CONCLUSION

This analysis concludes that the most important characteristics in the design are the size of the windows and the external protections of solar energy (awnings). The results obtained contribute to the study of buildings in hot coastal areas that require air conditioning, which could be reduced if bioclimatic designs were used on exterior walls that are more exposed to solar radiation, which have an adverse internal heat gain. Unprotected buildings on the beaches can reduce their energy consumption in air conditioning.

The research hypotheses were verified with the results of the analysis that determined that more solar energy was filtered inside the buildings and more electricity was used for air conditioning through larger windows.

The method for modeling the bioclimatic conditions that air-conditioned buildings' exterior designs should meet and revealed the strong influence of certain designs on the amount of energy consumed during the operational stage of air-conditioned buildings and the usefulness of employing LCA during the design phase

Buildings tend to consume large amounts of natural resources and generate environmental pollutants. Energy consumption is a major cause of these impacts, which aggravate the effects of climate change in coastal cities with dry hot climates, such as Esmeraldas, Ecuador. Building designers need updated tools to help them address energy management and sustainability criteria in their air-conditioned building designs and the results of this study contribute to their ability to develop designs and regulations for buildings in equatorial coastal cities that will minimize the negative impacts of energy consumption on the environment.

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"Bicycle" Model for Interdisciplinary approach in Parkinson's Disease

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Abstract— *Parkinson's disease is a multifaceted and symptomatically complex neurodegenerative condition, considered the second most prevalent neuroaging disease, compromising quality of life as the disease progresses. To improve the quality of life, some evidence points to a health model based on interdisciplinarity, however its real benefits are still limited in the literature, compared to the traditional monotherapeutic approach. The objective of this study was to develop a review containing a dynamic, comprehensive methodology, with a modern vision to address the main points of interest that are represented in the research model called "bicycle model". Based on this method involving the interdisciplinary approach on the determinants of health status in Parkinson's disease. The results present strategies to collect data from questions about morbidity, quality of life, health determinants (disease) and disease characteristics. The final considerations presented show that different perspectives result in a broad scope for the interdisciplinary approach, by different professionals within their expertise, with improvement in the quality of life of this research population.*

Keywords— ***Interdisciplinary; Quality of life; Parkinson's disease; Neurodegenerative disordens; Health care.***

I. INTRODUCTION

Parkinson's disease is a neuroaging disorder, with neurodegenerative and multisystemic morbidity, which leads to motor and non-motor disorders, among them: cognitive, psychiatric, sleep, metabolic, nutritional and sensory disorders, which play an important role in undermining functionality and quality of life (1-3).

Parkinson's disease does not respond to the simple formula (identification and elimination) "identify the cause and eliminate it" because its development is determined by multiple factors, thus resulting in limited possibilities for rapid interventions. Even when important risk factors are known, it seems difficult to intervene effectively. Due to the limitation of preventive interventions, changes in population distribution (a marked increase in the proportion of the elderly), and social changes, the prevalence of this disease has increased, and is expected to increase more in the near future (2-4).

Parkinson's disease is the second most common neurodegenerative disease and one of the most prevalent extrapyramidal neurodegenerative syndromes in motor losses. However, there are still no medications that can interrupt the course of the disease or prevent it (6-7).

Given the nature of multifactorial causes, the interdisciplinary approach can contribute to non-pharmacological treatment, without adverse effects, with a focus on maintaining quality of life and functional independence, a condition for performing day-to-day activities, with social interactions in professional and leisure activities (8-10).

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The current evidence points to a model of interrelated health behavior, but its real benefits are still limited in the literature, in face of the traditional therapeutic approach made in isolation (1,11). A better understanding of different models of health performance for Parkinsonians is a way to improve the quality of life, wellbeing and therapeutic resources for this population.

Therefore, the objective of this study was to develop a review containing a dynamic, comprehensive, interdisciplinary and modern approach to addressing the mutual influences of different factors related to Parkinson's disease.

II. METHOD

In this revision model based on interdisciplinary scientific contribution, the main points of interest are captured in the research model (figure 1), called "bicycle model" (12).

The "front wheel" concerns mainly concepts related to the patient, such as quality of life and neuropsychiatric disorders, among them: motor and non-motor. The current lines of research in this wheel focus on the course and consequences of the disease, aiming at an increase in knowledge about the relationships between participation, perceived autonomy and aspects related to the disease.

The "back wheel" focuses on health care, such as factors associated with motor and non-motor signs and symptoms. In this wheel occurs research on continuity and accessibility of care, for example, aiming at the care of patients. Another example of research that occurs in this part of the model concerns the evaluation and its effects on the quality and accessibility of care experienced by the elderly.

The "handlebars", containing determinants of the interdisciplinary approach, is a central concern from the point of view of health education. Research questions focus on motor and non-motor disorders and the associated risk factors.

The "ride" represents the health status in Parkinson's disease. Important issues in this approach concern the longitudinal relationship between health, health behavior and its determinants, with special attention to psychiatric and musculoskeletal complaints in order to be able to analyze the influence of health-related factors.

Another great look in this perspective is the combination with the "front wheel" that makes the axis in determinants of quality of life, under the longitudinal optics.

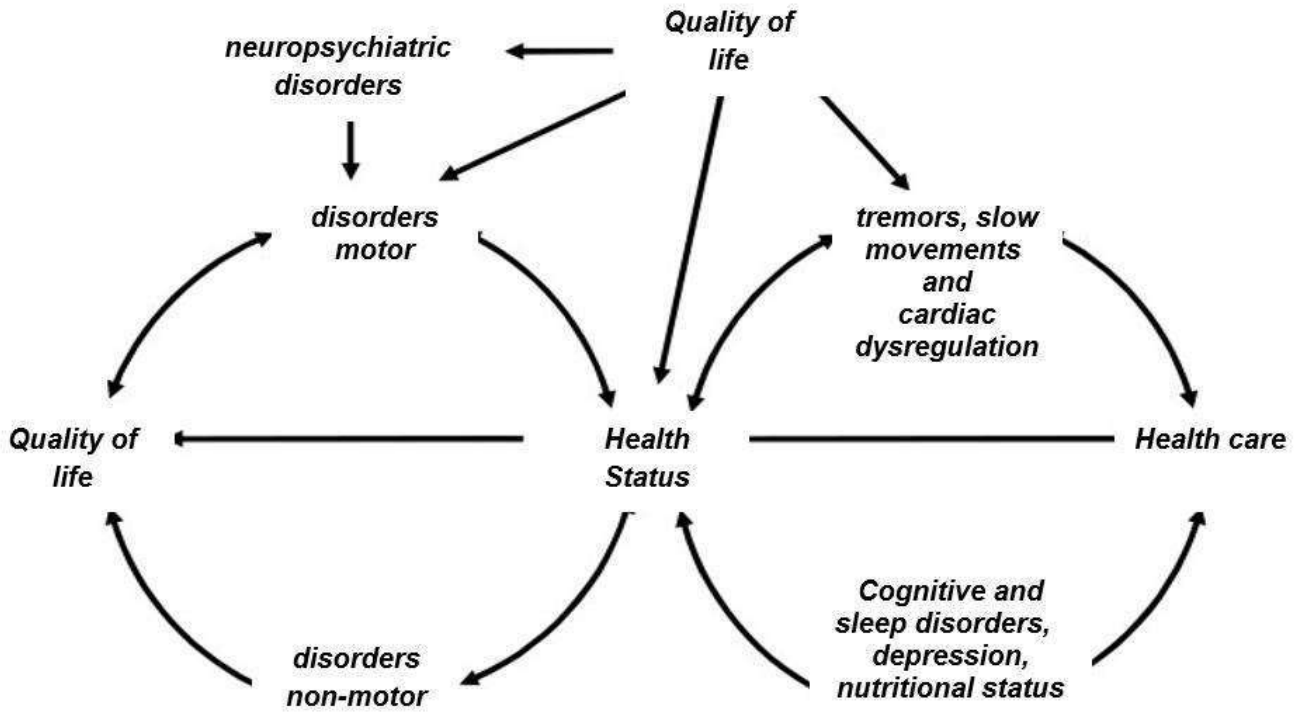

Fig.1: Adapted from the smile study the "Bicycle" Model for addressing the interdisciplinary method in Parkinson's disease.[12]

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Based on the "bicycle" method on the determinants of health status in Parkinson's disease, some strategies for search and selection with an interdisciplinary approach were carried out: PICO strategy, concept selection, goal determination (Table 1 and Table 2).

To search the articles we used online access to Medline/ Pubmed, Lilacs, SciELO databases, without filters, due to the scarcity of studies in the research area. The electronic search was carried out from October 10 to 28, 2020 and the descriptors controlled by the Virtual Health Library and Medical Subject Headings (MeSH) Validation were used, with the following keywords and Boolean operators: Parkinson OR Parkinson Disease AND Interdisciplinary OR Multidisciplinary approach AND Life of Quality.

Table 1: PICO Strategy

Itens	Abreviature	Question components
Pacient	**P**	Parkinson or Parkinson Disease
Intervention	**I**	Interdisciplinary or Multidisciplinar approach
Control	**C**	Not applicable
Outcome	**O**	Life of Quality

The collection of information and selection of articles took place as follows (Flowchart 1):

- ✓ 1st stage: Identification of the scientific production indexed in the databases by the cited descriptors, which were found to the total n= 28 articles.
- ✓ 2nd step: the articles were organized in a table, containing title, author, journal, volume, year of publication and pre-selected from the reading of the available abstract.
- ✓ 3rd step: the selection of articles was made by reading the abstracts, using as inclusion criteria publications in Portuguese and English with primary data performed in patients with Parkinson's disease in interdisciplinary or multidisciplinary treatment. However, the following were excluded: repeated studies in the different databases (n=7), after reading did not answer the question (n=6), and those that were not found in full (n=5).

At the end, n= 10 articles from national and international health committees were selected for this review.

Table 2: Interdisciplinary approach study in parkinson's disease

Author/Year	Study Type	Approach	Conclusion	Evidence
(30) Fründt, et al; 2018	Intervention study -16 months	169 individuals aged 39-88 years with Parkinson's disease	Treatment improved motor and non motors, cognition, sleep, pain, cardiovascular control disorders and quality of life. The patients positively evaluated the interdisciplinary approach.	A
(31) Taylor, et al; 2016	Literature reviews	Complications in Parkinson's disease and the role of themultidisciplinary team.	The authors emphasize how their multidisciplinary care model facilitates collaboration between psychiatrists and other mental health professionals.	C
(32) García ; 2016	Epidemiological reviews	Review to define public and private health resources to treatment People with Parkinson's disease and identify specialist	Spain estimated 300,000patients with Parkinson's disease and a new case and health professionals stillneed a long way to provide quality, efficient, multidisciplinary and universal health for patients with Parkinson's disease per 10,000 in habitants per year.	C
(33) Prizer, et al; 2012	Literature reviews	Review the effectiveness of multidisciplinary care in outpatient environments in individuals with Parkinson's disease.	The results indicated that multidisciplinary treatment improved the results of patients; however, they signal only short-term results.	C
(34) Eggers et al; 2018	Randomized Clinical Trial	300 individuals received an integrated model of	Patients with Parkinson's disease had a lower mortality rate than the general population, but there ar	A

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		end-of-life care.	e still failures in follow-up, signaling the need to urgently develop models of care for patients with Parkinson's disease.	
(35) Giladi , et al; 2014	Literature reviews	Emphasize the importance of the approach in the intervention of the interdisciplinary team in the treatment of Parkinson's Disease.	They discussed approaches and roles in different health professions, including a neurologist, a nurse, a speech therapist, a physiotherapist, a social worker, a psychiatrist, an occupational therapist, a sexologist and a nutritionist.	C
(36) Muñoz, et al; 2020	Observational Study	Document the experience of 90 individuals, among patients, caregivers and specialists.	The individuals interviewed 87.9% considered that the multidisciplinary activities improved their quality of life.	B
(37) Guo, et al; 2009	Randomized study	44 patients submitted to intervention with 45-minute lectures for 8 weeks.	Group education combined in a rehabilitation program has proven to be a beneficial and practical intervention, not only complementing medical treatment for Parkinson's patients, but also meeting the growing demand for long-term care.	B
(38) Trend, et al, 2002	Observational Study	118 individuals (patients and caregivers) were evaluated for mobility, quality of life.	Participants reported gains in knowledge and high levels of satisfaction with individual therapies and group activities.	B
(39)Tillman, et al; 2020	Non-randomized clinical trial	24 individuals participated for 12 weeks in samba classes and measures of depression, cognition, fatigue, sleep and severity of Parkinson's disease were assessed.	Interventions such as dancing had greater effects on non-motor symptoms, depending on the expected evolution of the disease. The scarcity of studies that use this approach in their analysis may explain the lack of evidence in this dance related symptomatology.	B

Flowchart 1- Stages of data collection

Identification of the scientific production indexed in the databases.

The articles were organized in a table - year of publication.

The selection of articles was made by reading the abstracts, using as inclusion criteria.

From the analysis, the data obtained were organized into tables, graphs, considering the year of publication, the type of research and the focus of the result of the article.

III. RESULTS

As a result, different perspectives have been explicitly incorporated to ensure the quality of the studies selected in a scope in the interdisciplinary approach.

From the analysis of the 10 articles found that were relevant to the subject, produced over these years (2002 to 2020), which reveals a need to carry out more studies on this subject, in addition to demonstrating the need to encourage and intensify scientific production to deepen the approach to this subject (Table 1).

As for the type of study, it demonstrated that 40% focus on theoretical studies and literature reviews, 20% observational studies, and 40% intervention studies (Graph 1).

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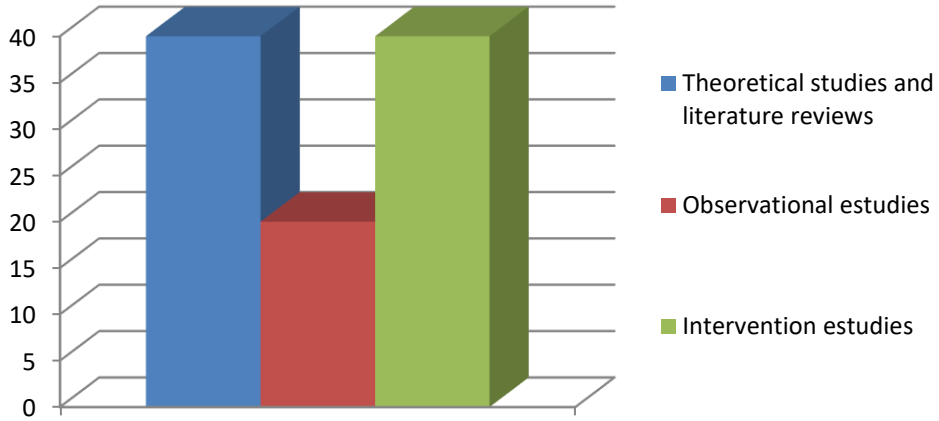
Graph 1- Distribution of different types of studies



The publications found are distributed in 10 journals. Although the studies are well distributed among the journals, it is possible to observe a predominance of production in international journals.

This predominance may be explained by the scientific advancement of researchers in financial resources and by the fact that they have large post-graduate centers and, therefore, knowledge generators.

IV. DISCUSSION

Therefore, this is the first review study that brings an interdisciplinary discussion with the method represented in the "bicycle" model adapted for Parkinson's Disease.

The two wheels of the bicycle are connected through the state of health represented by the "picture" that reinforces the need to broaden the interaction between the interdisciplinary works for functional advances in the quality of life of people with Parkinson's disease (1,3).

In relation to the "front wheel" which refers to the axis of neuropsychiatric determinants, among them: motor and non-motor signs in Parkinson's disease. In general, motor signals are related to tremors, stiffness in body limbs, muscles, and slowness of movement, in addition to extrapyramidal movements. In addition, the evidence shows dysfunctions in the balance between sympathetic and parasympathetic control of cardiac activity, which compromise cardiovascular regulation, hypotension, especially in orthostatic position (13-17).

Previous studies with Parkinson's patients, using tests of cardiovascular reflexes, demonstrated repressed responses of heart rate to different stimuli, such as normal and deep breathing and Valsalva maneuver. These findings describe autonomic responses, for only a limited period of time, with great individual variability, promoting a limited view of the autonomic mechanisms in the control of cardiac activity (8, 16-19).

Studies that used traditional measures of heart rate variability in the time domain and 24h spectral analysis concluded that the autonomic dysfunction was directly related to the duration and severity of the disease, age and drug use (15, 17- 20).

Regarding non-motor disorders in Parkinson's disease, represented by the "front wheel", the evidence indicates that 98.6% of patients had at least one of the non-motor symptoms, including most commonly psychiatric, sensory and sleep-related symptoms. On average, in this study, each patient presented about eight symptoms, a number that increased according to the time of evolution of the disease and its severity (21-23).

Therefore, understanding the course and stages of the disease, through the signs represented "in the back wheel" can be determinant for an interdisciplinary approach. Since some factors associated with the stages of Parkinson's disease do not yet present a clear relationship, such as forms of dysautonomia, depression and risk of falling (1, 22, 23).

Thus, the "guide" represented by the interdisciplinary approach can be evidenced in the recent randomized study that compared the assistance of the multidisciplinary team with the assistance of the neurologist. The variables investigated were quality of life, depression, psychosocial evaluation and overload of the caregiver. A total of 100 people participated and a significantly higher improvement was observed for the multidisciplinary group in the variables of quality of life, motor score, depression and psychosocial (24).

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Another study that compared individuals with Parkinson's disease who practice interdisciplinary activities with those who do not, showed a statistically lower dose of levodopa for individuals with greater severity of the disease, however, they practiced interdisciplinary activities (25).

The interdisciplinary approach is a challenge, but on the other hand it is the one that most favors the adherence of people with parkinson's disease, who seek pleasurable therapies for them, meeting individual demands (26,27).

The individual demands showed resolutiveness with the interdisciplinary actions in the study conducted with 179 individuals who used the Expanded Core of Family Health and Basic Care (NASF-AB). The main reasons that demanded multiprofessional care, predominated the elderly with osteomuscular diseases (back pain, osteoatrosis -30.7%), neurological diseases (parkinsonism, dementia -25.1%) and endocrine/nutritional diseases (diabetes I and II, overweight and obesity - 17.9%) (28, 29).

Certainly, the "saddle" represented by the longitudinal state of health in Parkinson's disease, brings relevant discussions, since further investigations on the interdisciplinary team in clinical management are still needed, with special attention to the costs and effectiveness of the team with intervention group control, as well as the description of therapeutic processes (30-39).

In the dynamics of understanding the "bicycle" model, several professionals from different areas of knowledge can compose the multiprofessional team of Parkinson's disease health care, and the most found studies in the literature for global health care are: dance (body perception), hydrotherapy and swimming (aquatic motor skills, learning to swim and cardiorespiratory conditioning), physiotherapy (functional motor skills on the ground), gymnastics (body practices aimed at gains in strength and physical conditioning), music therapy (relaxation), memory exercises (prevention of memory deficits), cognitive and behavioral therapy (social relationship), stretching (maintenance and gain of range of motion), pilates (stretching, resistance and muscle strength), phonoaudiology (attention to the process of speech and swallowing) and nutrition (attention to loss of lean mass and malnutrition) (22-25,29).

V. CONSIDERATIONS

We consider that scientific evidence is gradually beginning to report studies with an interdisciplinary approach, and the greater applicability in treatment programs for patients with Parkinson's disease with good results and improvement in quality of life is increasing.

The "bicycle" model has a broad scope, allowing a better understanding, between disease and therapy, advancing the strategies involved in the determinants of health status for an interdisciplinary approach to Parkinson's disease.

In summary, this review points to important gaps not yet described in the literature, contributing to new evidence in the interdisciplinary therapeutic approach to Parkinson's disease.

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Graphic waste management in PIM/AM

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Abstract— *This study aims to show the application of the management of graphic waste production providing suitability for the final disposal of solid waste from a company located in the Industrial Complex of Manaus/AM, segmentation of the printing industry showing the need to adopt procedures that bring environmental, economic and social benefits. The companies started to worry about actions that have the purpose of adapting, being ecologically correct and improving their image in the market as a company that is concerned with socio-environmental issues and sustainable development. The objective is to show the application of correct disposal management of solid waste produced by this company. However, the generation of solid waste is potentially harmful to the environment, the activity of industries can be performed in an environmentally friendly way, through this study, environmental aspects have been properly identified, evaluated and controlled. This shows that the company is committed, according to the National Policy for Solid Waste, playing an exemplary role regarding the proper disposal. Social and environmental responsibility practices, based on the company's economic performance, show the performance of responsibility practices, in the items that were considered in the analysis regarding the concern with the environment and the awareness about the waste generated by it, in its production process in the labour field. In this way, the company that demonstrates practices of responsibility and commitment to society and the environment.*

Keywords— ***Discard, Graphic Industry, Paperboard, Solid Waste.***

I. INTRODUCTION

This study aims to show the application of graphical waste production management providing suitability for the final disposal of waste, analyzing the need to adopt procedures that bring environmental, economic and social benefits, thus bringing a high quality image projection, including socio-environmental awareness and sensitivity.

One of the main milestones of technological evolution occurred during the period of the Industrial Revolution In order to meet the progress of this period, there was a search for new materials and consequently the demand for natural resources and manufactured products has risen causing damage to nature and an increase in the amount of waste generated [1].

Initially environmental impacts were not considered relevant to society and industry, because the production of waste was small and environmental assimilation was considered in a grand way. This concern became known after finding that one of the biggest polluters and generators of waste, in industries. From this concern, questions began to arise as to what could be done to alleviate this problem.

Industrial and technological development together with the population growth that has been made possible by this transition of the productive model, has triggered a number of impacts, whether social, cultural, economic or environmental, The latter deserves special attention because of its great interference in today's society [2].

In view of this, companies have started to worry about actions that have the purpose of adapting themselves, be ecologically correct and improve your image in the market as a company that is concerned with social and environmental issues and sustainable development. Environmental impact is a consequence of human action, so it is important that society is educated to behave responsibly, causing less aggressive impacts on the environment [3].

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Companies need to be seriously and ethically committed through management, so that industries can be required to have responsibility for the process of moving its production to its final destination for capturing value or proper disposal.

The problem of overproduction of solid waste contributes to its inadequate disposal in places not suitable for disposal, mainly when there is no adherence by industrial managers of reuse programmes and compliance with standards that establish guidelines for appropriate waste disposal [4].

In order to satisfy the demands of its clients and show its concern for socio-environmental issues, companies have shown a growing concern to highlight practices that make them recognized as socially and environmentally responsible [5].

To identify problems in the management of solid waste from industry the proposal of measures for its control prior knowledge of the characteristics and causes of waste generated is required.

II. METHODOLOGY

Therefore, the bibliographic and quantitative research has the objective of locating and consulting sources and information relevant to the subject, collecting useful data to support, complement and respond to a problem.

Quantitative research seeks to bring reality and aims to inform results according to indicators and other techniques, thus having a faster and more easily applicable result [6].

This study comprises a descriptive and exploratory bibliographic research together with data collected from a particular graphic segmentation company developed because of managing environmental, economic and social aspects in the management of the company with regard to the final disposal of solid waste left over from the company's production process.

The data collected is linked to a company that is located in the Industrial Complex of Manaus producer of paperboard packaging, with micro corrugated, special and technical literature manuals, the company now operates with a workforce of 120 founded in 2003 and located the southern part of Manaus. The company is certified with an Integrated Management System (IMS) by RINA BRASIL in ISO 14001-2015 and 9001:2015.

The details was obtained from the company's SGI sector which is responsible for collecting details related to waste from the company.

III. RESULT AND DISCUSSION

In the business area, sustainability is operationalized on a regular basis, from this it presents the three sustainable dimensions that are environmental, economic and social. In the environmental sphere, resources must be used in a way that does not harm future generations by reducing the impacts of production processes. From an economic point of view, it is necessary to take care of the profitability of the company and not to compromise its economic development. In the social sphere, the major objective is the evolution of a more just world, relating all stakeholders in the organization [7].

The legislation applied to companies is necessary given a commitment, with the rejects obtained by means of their production making it of great importance to know its specificities and possibilities of adequacy since there are specific means of treatment for each type of waste in which this study surveys the waste originated in the printing industry.

Development is the result of an extensive process of economic growth with increasing average productivity, productive diversification and employment, these processes cause intensification of industrialization where environmental issues are changed and there is a need for environmental issues to modernization the habits and customs of society [8]

The printing industry is very diverse performing graphic services as well as providing services for a specific field. The waste generated in graphics depends on the technology used, because the processes and inputs will also vary. The main raw materials used in the printing industry are various types of paper.

The problem of managing waste in the right way to obtain the correct disposal requires a large investment and that companies establish policies so that this process is aimed at helping, supporting and contributing to environmental issues, since most of the companies are only aiming at profitability and few want to join this programmer. However, management policies and measures are essential. Managers have several possibilities to adopt measures that can contribute significantly to promote industrial activities and maintain sustainability and minimize the effects of production processes.

The industry under study is active in the printing of packaging on paperboard and technical guide of technological products, more directly in the process of industrialization of customized products.

For the investigation of the waste generated in the printing company, showed the management of the waste

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from the production process of the company under study. Based on the types of waste, a sectorisation of the company has taken place.

Table 1. Waste generated by the company.

WASTE	GENERATING AREA	FINAL DISPOSAL	FINAL DESTINATION METHOD	FREQ. SHIPPING
White Paper	Production	In bulk	100% reused	Daily
Mixed Papel (coloured)	Production	In bulk	100% reused	Daily
Mixed Papel (coloured)	Production	In bulk	100% reused	Daily
Cardboard	Production	In bulk	100% reused	Daily
Cardboard tubes	Production	In bulk	100% reused	As needed.

Source: SGI,2020

The PNRS covers all the fundamental principles of the subject, seeking together coordination between production and conscious consumption, where each member of the production chain and government agencies have specific functions in the proper management and control of solid waste [9].

Various types of print jobs occur in production to meet market demand depending on the type of printing and finishing in the paper use process, differences were observed in the type of waste generated. Thus, having a destination for the waste center that meets the demand for waste that is generated by production, according to the data in table 1, shows that 100% of the final waste is reused after all, this procedure guarantees the improvement of the company's performance, taking care to minimize social and environmental impacts.

The conditioning takes place with collectors that are located in the waste center, which is on the side of the company, and for the disposal of the waste there is a specific collector and the removal of these scraps takes place on a daily basis depending on the quantity of material in the production waste.

With industrial growth, companies have gradually increased their production. As result, large quantities of the most diverse natural resources are removed from nature, as well as generating more waste, since they refer to the remains of raw materials and other products that are part of the production process [10].

Table 2. Survey of waste generated by the printing industry in the first half of 2020.

PRODUCT	JAN	FEB	MAR	APR	MAY	JUN
Mixed	39,67	53,50	66,97	103,68	64,69	42,73
Cardboard	0,76	5,07	12,48	12,91	1,69	1,01
Listing	3,48	11,02	13,16	14,22	0,00	7,29
Plastic	0,43	0,76	0,97	1,95	0,47	0,69
Total/ kg	**44,34**	**70,35**	**93,58**	**132,76**	**65,16**	**51,72**

Source: SGI,2020

The waste collected in the company is usually performed, through a third party company which carries out the withdrawal by means of its own transport with the help of officials of those companies of the temporary storage site, for the transport vehicle and then to the final destination, where the material is recycled.

Through the work of weighing the waste from the production sector and by means of the survey of proofs of waste disposal, data on the average quantity generated was determined form of packaging and responsibility for the final destination of the waste, as described in table 2.

It is noted that the economic development of the printing industries has been widely developed and are accompanied by changes to the environment, the economy and society. As direct result of these processes, there has been an increase in waste production.

The printing industries, with their daily segmentation, generate products from the production of printed materials. There are several printing segments there is a variety of papers shapes and sizes and despite attempts to reduce the

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volume generated, in this type of production, there will always be waste at the end of production.

In this company was invested mainly in the correct disposal in the production process because these materials have a different destination according to their specifications. The company has a selective collection system thus storing its waste generated in an appropriate manner until the companies responsible for their destination to carry out the collection when requested.

The waste paper is stored in the waste center until a significant amount is completed for collection, being collected at most one to three times a day. The company that collects this waste every fortnight carries out the quantitative survey received and weighed so that together with the company it makes a balance of waste generated and each month the outsourced company issues a certificate of destination to prove the destination of the waste generated in the printing industry.

Each year, the industry undergoes an audit to ascertain the disposition of the final product of its waste controlled by the SGI (Integrated Management System).

The main products are separated for disposal an analysis is carried out for the separation of this material regarding waste generation, aiming at pointing out and suggesting possible alternatives to improve the company's environmental performance.

However, the generation of solid waste is potentially harmful to the environment, the activity of the printing industries can be performed in an environmentally correct way as we see through this study in relation to the aspects duly identified, evaluated and controlled. This shows that the company is committed, according to the National Policy on Solid Waste, playing an exemplary role in the proper disposal.

The PNRS aims to reduce the negative impacts caused by the generation of waste being a joint action of powers between the government, companies and also consumers to establish a reverse supply chain to assist in the return of waste [11].

The company provides environmental education projects, through a partnership with the Environmental Court of the State of Amazonas develops the work on the importance of solid waste generated by the company, that is, through socio-environmental action and sustainable economic development a comprehensive measure of actions that bring benefits to the company and society.

Through these social and environmental measures the company, also works together with the community in relation to the planting of seedlings annual thus contributing to the preservation of the environment.

Therefore, the company is seeking values that correspond to the improvement of our environment, doing so through their work ensuring attributes that correspond to awareness, awareness and preservation.

IV. CONCLUSION

Through this it is possible to observe that companies are interested in seeking improvements in the management of waste generated in view of the fact that impacts can be mitigated through social and environmental awareness. However, the company aims to generate as little environmental impact as possible, because through the measures adopted, it can be seen that the company is linked to some measures, for its control.

However, socio-environmental responsibility practices, the economic performance of the company shows the performance of responsibility practices, the items that were considered in the analysis regarding the concern with the environment and the awareness about the waste generated by it, in its production process in the labour sphere. This way, the company that demonstrates practices of responsibility and commitment to society and the environment.

Economic development with the environment therefore provides an improvement in the company and for society as a whole. The solid waste produced is a reality in terms of a problem of extreme relevance, and the amount of waste generated, and by means of measures it is shown that this company is in favors of collaborating in this reflection of improvement in the aspect of generating less environmental impact social responsibility, because environment and society are part of the same context.

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Study on the effect of nitrogen content and cooling rate on the ferrite number of austenitic stainless steels

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Abstract**—** *In order to better understanding the effect of nitrogen content in shielding gases and different cooling rates on the volume fraction of δ ferrite in welded deposits through GTAW, the microstructures of four welded joints of austenitic stainless steel, were studied. The deposits were produced using the same welding electrode ER 316L2.4 mm and welding parameters, but different shielding gases from pure argon to mixture with N_2, and different cooling rates. One pair of the welding deposits was produced with 100% Ar and the other one with 98% Ar+2% N_2. The weld pads produced with the same shielding gas were submitted to different cooling rates, being cooled in air and water. The chemical compositions and the variation of the volume fractions of δ ferrite in the deposits were measured. It was observed pickup of nitrogen and, consequently, decreasing of the volume fraction of δ ferrite in the all weld metals produced with 98% Ar+2% N_2as the shielding gas. The weld pads cooled in water presented less δ ferrite when compared to those produced using the same shielding gas but cooled in air. The results confirm that nitrogen is a strong austenite stabilizer and that higher cooling rates reduce the δ ferrite volume fraction in austenitic stainless steels. Complementary techniques of microstructural analysis were used, such as optical emission spectrometry, optical microscopy and quantitative image analysis.*

Keywords**— Austenitic stainless steels; Cooling rate; Ferrite number; Nitrogen; Solidification mode.**

I. INTRODUCTION

In welding of high alloy steels, the δ ferrite content is normally estimated from the constitution diagrams such as the Schaeffler**[1]**, DeLong **[2]** and Kotechi**[3]**.

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).**[4]**

Table 1 shows the expressions of chromium and nickel equivalents proposed by Schaeffler **[1]**, DeLong **[2]** and Kotechi**[3]**.

Table 1 -Cr_{eq} and Ni_{eq} formulae used for estimating the delta-ferrite content from constitution diagrams[4-7]

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

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Most of the compositions of commercial stainless steels, are in the iron-rich side of the ternary Fe-Cr-Ni equilibrium diagram, between 50 and 70% of iron in weight. The initial solidifying phase is determined by the position of the alloy with respect to the liquidus surface, which under equilibrium conditions proceeds toward the eutectic and peritectic transformations, before solidification is complete. Figure 1 shows the pseudo-binary equilibrium diagram on the vertical section of Fe–Cr–Ni equilibrium diagram at a constant Fe content of 70% in weight. It is commonly used to identify the primary solidifying phases or solidification modes for various compositions of different stainless steels. **[4-17]**

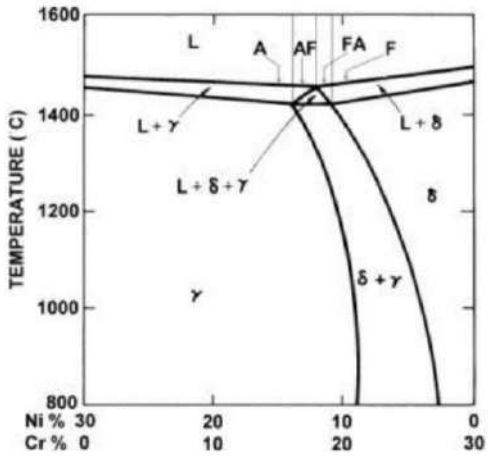

Fig.1: Pseudo-binary section of the Fe–Cr–Niternary diagram at 70% Fe, showing solidification modes; A - fully austenitic, AF - austenitic–ferritic, FA - ferritic–austenitic and F - fully ferritic.[8, 15]

According to Suutala's work**[18-22]**, the Cr_{eq}/Ni_{eq} ratio is fundamental in determining the solidification mode of austenitic stainless steels.

Considering the cooling rates ranges applicable in welding, 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). **[5-14, 18-22]**

The cooling rate is of fundamental importance for the microstructure resulting from the solidification of austenitic stainless steels.

Figure 2 shows the changes in the Schaeffler diagram proposed by Johnson, Grabaek, Johansen, Sarholt Kristensen and Wood **[23],** that shows an increase in the austenitic field for ultra-high cooling rates.

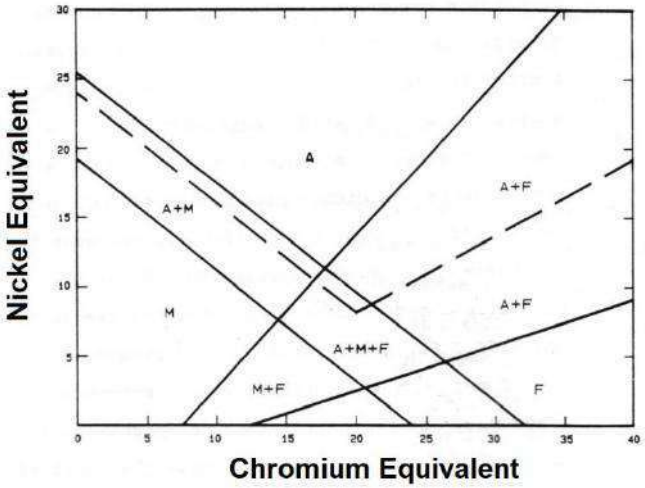

Fig.2: Modified Schaeffler diagrams for cooling rates of around 10^6 K/s.[5, 23]

O. Hammar and U. Svensson**[24]** showed that the addition of carbon and nitrogen decreases the volumetric fraction of ferrite in austenitic stainless steels.Taking as an example the austenitic stainless steel of type AISI 316, which usually solidifies through a ferritic-austenitic solidification mode. With the increasing of carbon and nitrogen contents as alloying elements, the solidification mode changes to austenitic-ferritic. There is, therefore, acarbon equivalent value that can change how this steel solidifies.

Ceq =% C + 0.65% N **(Equation 1)**

Figure 3 shows the change in the solidification mode of stainless steel of type AISI 316 as a function of carbon equivalent.

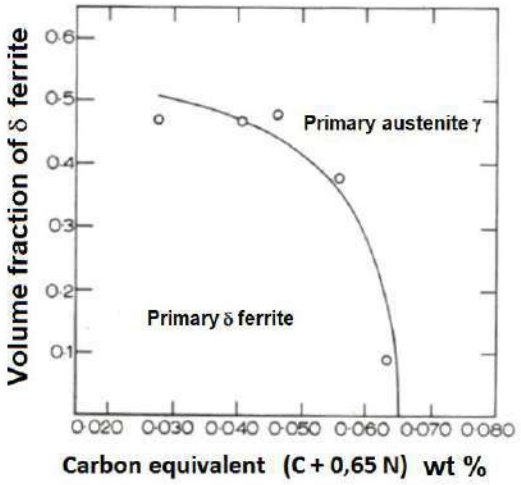

Fig.3: Change in the solidification mode of stainless steel of type AISI 316 as a function ofC_{eq}. [5,6,24]

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II. EXPERIMENTAL

Four welded joints of austenitic stainless steel produced using GTAW process with different shielding gases and different cooling rates were studied. The deposits were produced using the same welding electrode ER 316L 2.4 mm according to AWS 5.9 from the same heat. One pair of the welding deposits was produced with 100% Ar, and the other one with 98% Ar+2% N_2 as shielding gases. The weld pads produced with the same shielding gas were submitted to different cooling rates, being one cooled to100 °C in air and other one in water just after each welding bead. The GTAW welding machine was adjusted to allow a stable welding. All the weld pads were produced with the same travel speeds to have similar heat inputs for all the four samples. In order to minimize the effect of base metal chemical composition, 6 layers of 5 beads each were deposited. Overlapping passes were used, depositing approximately 25 mm on the base metal that was an AISI 304L type stainless steel. The weld pads were cut in longitudinal and transversal directions. Chemical analyzes were carried out in all samples at 20 mm from the base metal, by means of an optical emission spectrometer, according to ASTM E 1086-08. **[25]**

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, **[26]** using a 4X5 grid (20 points) with a magnification of 400X in 30 different regions per test piece.

III. RESULTS AND DISCUSSION

Table 2 presents the welding parameters used to weld the samples. It is important to emphasize that the deposits were produced using the welding electrode ER 316L 2.4 mm according to AWS 5.9 from the same heat, and similar welding parameters, but different shielding gases and different cooling rates. One pair of the welding deposits was produced with 100% Ar, and the other one with 98% Ar+2% N_2asshielding gases.The weld pads produced with the same shielding gas were submitted to different cooling rates, being one cooled to 100 °C in air and other one in water just after each welding bead.

Table 2–Welding parameters.

Welding wire (ER316L 2.4 mm)	Shielding gas	Flow (l/min)	Current (A)	Tension (V)	Travel Speed (mm/min)	Heat Input (kJ/mm)
Sample 1 (air)	Ar	18	215	19	185	1,32
Sample 2 (air)	98%Ar + 2%N_2	18	210	19	180	1,33
Sample 3 (water)	Ar	18	215	19	190	1,29
Sample 4 (water)	98%Ar + 2%N_2	18	210	19	185	1,29

Table 3 presents the chemical compositions and the calculations of C_{eq}, according to O. Hammar and U. Svensson**[24],** of four deposits.

The calculations of C_{eq} were done using **Equation 1**.

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

	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	N	Ceq
ER316L (FM)	0,010	0,40	1,76	0,025	0,011	18,91	12,33	2,55	0,26	0,028	0,028
Sample 1 (Ar - air)	0,008	0,33	1,73	0,025	0,011	18,60	12,20	2,51	0,25	0,042	0,035
Sample 2 (Ar+N_2 - air)	0,008	0,36	1,75	0,025	0,011	18,62	12,18	2,53	0,25	0,140	0,099

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Sample 3 (Ar - water)	0,008	0,35	1,72	0,025	0,011	18,63	12,22	2,53	0,25	0,043	0,036
Sample 4 (Ar+N_2 - water)	0,008	0,37	1,76	0,025	0,011	18,71	12,17	2,55	0,25	0,140	0,099

The results presented on table 3, show that the welded joints produced through GTAW present the least change in the chemical composition when compared to the filler wire, with the exception on the concentration of nitrogen.
Figure 4 shows the concentrations of nitrogen (% by weight) of the filler metal ER 316L and all weld metals.

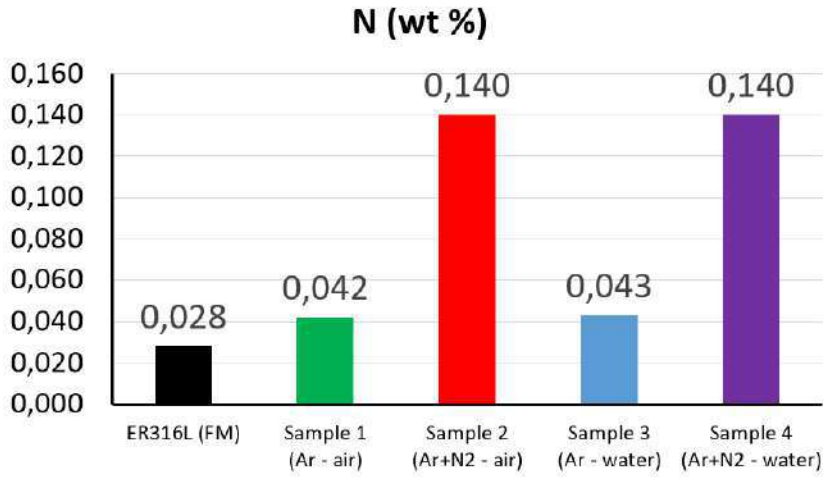
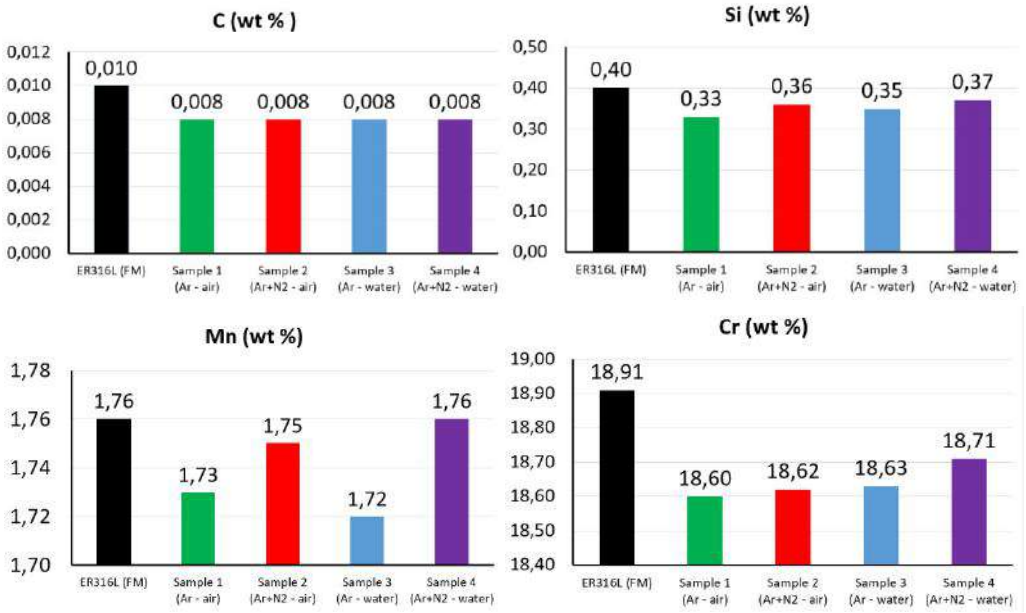


Fig.4: Concentrations of N (% by weight) of the filler metal ER 316L and all weld metals.

There is some loss of carbon, silicon, manganese, chromium and nickel. It is observed pick up of nitrogen for all the four weld pads when compared to the nitrogen content of the filler metal, from 150% when the shielding gas is pure argon, to 500% in the case of 98% Ar + 2% N_2.

Figure 5 shows the concentrations of C, Si, Mn Cr, Ni and Mo (% by weight) of the filler metal ER 316L and all weld metals.



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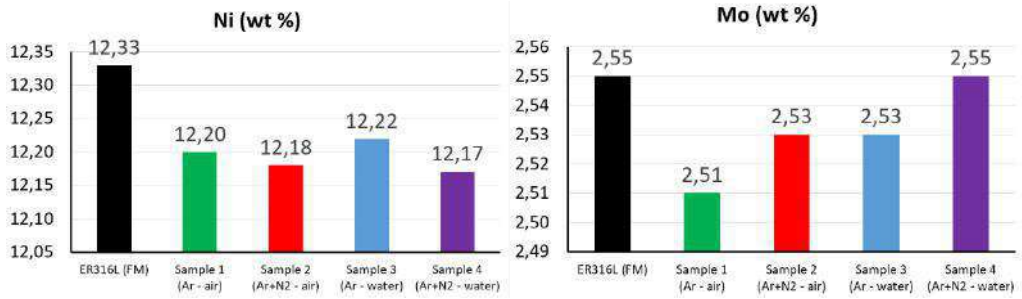


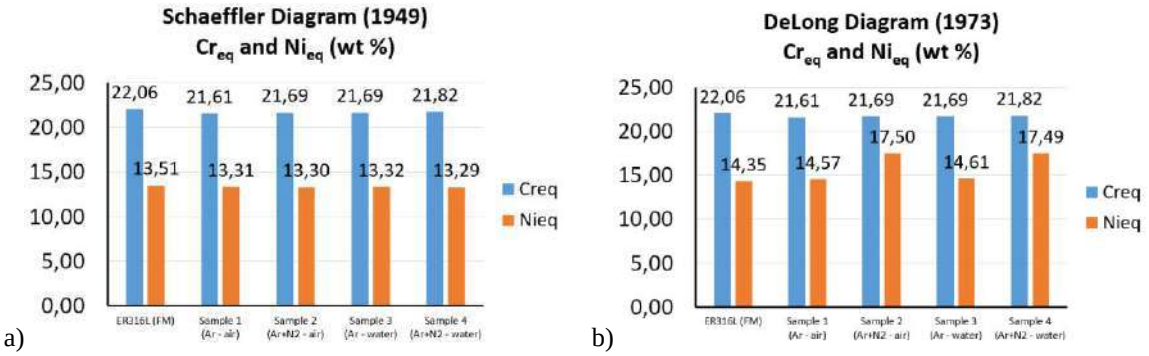
Fig.5: Concentrations of C, Si, Mn, Cr, Ni and Mo (% by weight) of the filler metal ER 316L and all weld metals.

Table 4 presents calculated values ofCr_{eq},Ni_{eq} and Cr_{eq}/Ni_{eq} ratio according to the expressions of chromium and nickel equivalent staken 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, De Long 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}**
ER316L (FM)	22,06	13,51	**1,63**	22,06	14,35	**1,54**	21,46	13,31	**1,61**
Sample 1 (Ar - air)	21,61	13,31	**1,62**	21,61	14,57	**1,48**	21,11	13,38	**1,58**
Sample 2 (Ar+N_2 - air)	21,69	13,30	**1,63**	21,69	17,50	**1,24**	21,15	15,32	**1,38**
Sample 3 (Ar - water)	21,69	13,32	**1,63**	21,69	14,61	**1,48**	21,16	13,42	**1,58**
Sample 4 (Ar+N_2 - water)	21,82	13,29	**1,64**	21,82	17,49	**1,25**	21,26	15,31	**1,39**

Figure 6 shows the variations of the Cr_{eq} and Ni_{eq} values (% by weight) of the filler metal ER 316L and all weld metals.



a) b)

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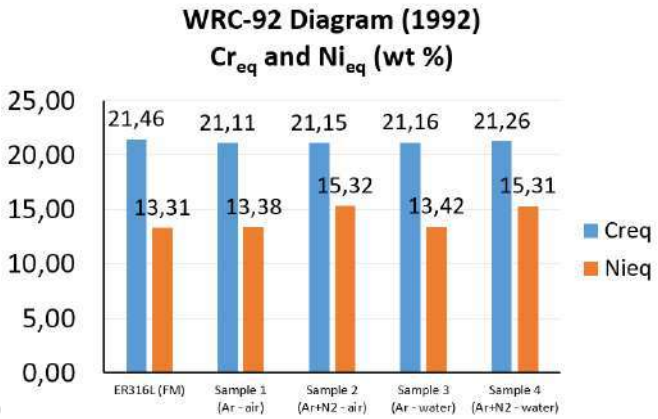
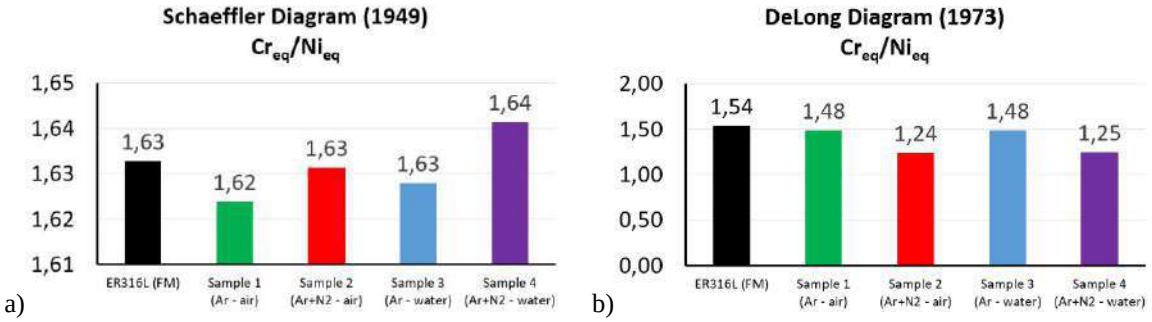


c)

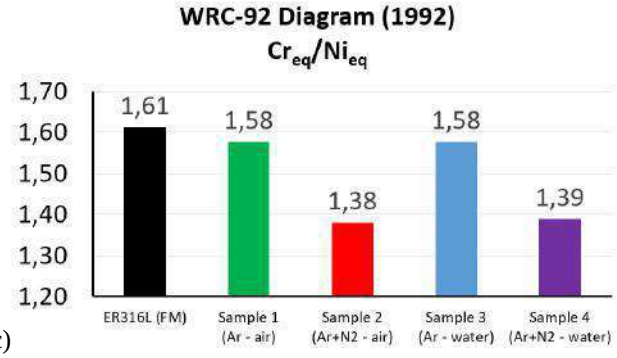
Fig.6: Cr_{eq} and Ni_{eq} values (% by weight) of the filler metal ER 316L and all weld metals, according to the expressions of chromium and nickel equivalents proposed by:
a) Schaeffler, b) DeLongand c) Kotechi.

Figure 7 shows the variations of the Cr_{eq}/Ni_{eq} ratio of the filler metal ER 316L and all weld metals.



a)

b)



c)

Fig.7: Cr_{eq}/Ni_{eq} ratio of the filler metal ER 316L and all weld metals, according to the expressions of chromium and nickel equivalents proposed by:a) Schaeffler, b) DeLongand 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
Sample 1(Ar - air)- Transversal	8.5	1.8	11.8
Sample 1(Ar - air)-Longitudinal	4.6	2.0	8.4

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Sample 1(Ar - air)- Average	**7.7**	**1.6**	**9.2**
Sample 2(Ar+N_2 - air) - Transversal	1.0	1.4	8.2
Sample 2(Ar+N_2 - air) - Longitudinal	0.3	1.2	7.1
Sample 2(Ar+N_2 - air) - Average	**0.5**	**1.3**	**7.4**
Sample 3(Ar - water) - Transversal	8.0	1.7	10.2
Sample 3(Ar - water) - Longitudinal	4.2	1.5	8.1
Sample 3(Ar - water) - Average	**6.8**	**1.8**	**8.7**
Sample 4(Ar+N_2 - water) - Transversal	0.3	1.5	8.6
Sample 4(Ar+N_2 - water) - Longitudinal	0.1	1.0	8.4
Sample 4(Ar+N_2 - water) - Average	**0.2**	**1.5**	**9.0**

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.

As discussed earlier, the results confirm that the nitrogen is a strong austenite former. The samples welded through GTAW using 98% Ar + 2% N_2as shielding gas, sample 2 and sample 4, presented lower volume fraction of δ ferrite.

The increasing in cooling rate results in reduction of the volume fraction of δ ferrite.

The sample welded through GTAW using 98% Ar + 2% N_2as shielding gas and cooled in water, sample 4, presented the lower volume fraction of δ ferrite.

IV. CONCLUSIONS

Nitrogen is a strong austenite former.

The shielding gas is of paramount importance on the ferrite number of the jointswelded through GTAW.The welded joints produced using 98% Ar + 2% N_2as shielding gas, presented lower volume fraction of δ ferrite.

The variations of Cr_{eq} and Ni_{eq}, and the Cr_{eq}/Ni_{eq} ratio of the welded joints suggest that welded joints produced using 98% Ar + 2% N_2as shielding gas, solidified through the austenitic-ferritic (mode II).

The increasing in cooling rate results in reduction of the volume fraction of δ ferrite.

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Environmental education in the school network in the municipality of Marabá, Brazil: A case study

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Abstract**—** *Currently, humanity has been concerned with the need to preserve the environment. Such urgency triggered the need to educate man to live with the environment. Thus, environmental education emerges as a possibility for new knowledge and methodologies in an interdisciplinary perspective, presenting itself as an essential instrument for the transformation of concepts and conduct towards the environment. To understand environmental "teaching" in the network of municipal schools in Maraba in the state of Pará - Brazil, SWOT analysis was used. We use two schools as study models located in the urban and rural areas. The research was experienced with the managers and educators who work in the schools through a questionnaire with questions regarding the internal and external areas of the schools (regarding school management). We found that there is an administrative effort to provide students with projects that raise environmental awareness in schools in the areas: urban and rural. Despite the insufficient support from the government (municipal, state or federal), the difficulty that the rural school has in this work is clear, both in relation to governmental visibility, as well as the resources to acquire materials to develop socio-environmental projects. In this way the SWOT analysis proves to be a promising tool to analyse the management of environmental education in the school network where it helps educators and managers in the teaching of Environmental Education and in decision making for the functioning of the school as a whole.*

Keywords**— Environmental management; Environment Rural school; Urban school; SWOT analysis.**

I. INTRODUCTION

The changes caused by humans to the environment have occurred since the beginning of our perception as a species, with: (1) hunting and extinction of the megafauna in the early civilization, (2) the beginning of low-intensity agriculture with the first settlements, (3) intensive agriculture, logging, forest fire and loss and fragmentation of modern-day habitats and (4) the intensification of land

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use, water, soil and air pollution coupled with the intensification of global climate change, together, human actions severely degrade natural ecosystems and leading to the global homogenization of biota (Lewis et al. 2015). One of the tools we can use to "brake" (a more subtle way, to educate) is through Environmental Education (Teixeira and Torales, 2014), whose principles are: (1) to move the individual about environmental problems, (2) to generate information about the composition of environments, (3) to recognize the mistakes that human makes in the face of nature, (4) to be able to analyse and provide attitudes in benefits of the environment, and (5) being able to harmonize the environment with society (Effting, 2007).

As we can see, the environmental issue is increasingly present in the daily life of contemporary society, and especially in the challenge of preserving the quality of life of the population. In this scenario, the educational process involves social actors that will lead a transition towards environmental sustainability, thus environmental education emerges as a possibility for new knowledge and methodologies in an interdisciplinary perspective, presenting itself as an essential instrument for the transformation of concepts and conduct for with the environment (Segura, 2001). It is agreed that planning for the execution of projects is extremely important for the continuous improvement of student performance and the quality of teaching at the institution and is essential for the evolution of the teaching team. (Teixeira and Torales, 2014).

Additionally, environmental educational actions have been standing out in the current scenario mainly in relation to the socio-environmental crisis resulting from human behaviour (Tozoni-Reis, 2006). Especially with the increase in Ecological Movements that emerged in the early 90s because of society's perception of environmental problems such as environmental degradation and uncontrolled exploitation of natural resources (Layargues, 2001). Generating frightening consequences, compromising the lives of all living beings, including our own species (Loureiro, 2004). In the formal setting, most educational institutions strive to implement the objectives of Environmental Education, but some are truly consistent results with the desired practice (Krawczyk, 1999).

In this context, there is a need for strategic planning that makes Environmental Education viable, based on understanding its structure and function, whether at school, or in the surrounding community. (Freire, 1980). Planning is the crucial point for obtaining satisfactory results from a project or any other activity. According to Azevedo (2001) the SWOT analysis (Strengths, Weakness, Opportunities, and Threats): performs a diagnosis of strengths and weaknesses, opportunities, and threats, to develop medium- and long-term management plans. Being one of the main tools to be used in strategic planning (Roth, 2014). For example, can help the school management in the implementation of Environmental Education from the internal evaluation (strengths and weaknesses) and external environment (opportunities and threats), it can be observed and potential vulnerabilities that teachers and schools are subject in our society (Araújo and Schwamborn, 2013). Thus, with the diagnosis of Environmental Education from the perspective of SWOT, we assessed the strengths and weaknesses for the development of socioenvironmental educational practices in the schools network in the municipality of Marabá located in the state of Pará (Amazon region), Brazil.

II. METHODOLOGY

The study was carried out in two schools in the municipal network of Marabá (5 ° 22 '08 "S 49 ° 07' 04" O) in the state of Pará, Brazil. School 1: located in the urban area of the city (hereinafter, urban school) and school 2: in the rural area, is 78 km from the city of Itupiranga (Pará) and 110 km from the city of Marabá, but belong to network of Marabá (hereafter, rural school).

To create the SWOT matrix, the Excel program was used (Clavell, 2011). The research had a qualitative and quantitative character, in accordance with the ideas of Cappelle et al. (2011). The variables were observed characterizing them through an in-depth study of the environment in which it is inserted (Wainer, 2007). The research was experienced with managers (e.g. principals and deputy principals) and educators (e.g. teachers) who work in schools through dialogue. The importance of Environmental Education was placed on the agenda, then a questionnaire was applied with questions regarding the internal and external areas of the schools (Figure 1).

The data obtained were measured and analysed according to two environments (internal and external), where the school space is a reference. The internal environment corresponds to the expectations of the school itself and the external environment to the expectations of society. In the external environment, variables are still indicated regarding the proximity to the internal environment. The general and operational environment, allowing the analysis of potential, negative and positive trends. Each analysis topic (strengths, weaknesses, opportunities, and threats) can reach 100%. Therefore, this study had its sampling defined by accessibility (not probabilistic), considering that this research was carried

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out with the application of SWOT analysis in environmental planning.

Internal factors	
Item	**Question**
1	Is the school recognized in its environment?
2	Does the school have an innovative differential?
3	Are the infrastructure and physical space adequate?
4	As classes possuem número adequado de alunos?
5	Is the geographical location privileged?
6	Does the school have curricular autonomy?
7	Is operational efficiency a favorable factor?
8	Does the school have low staff turnover?
9	Are financial resources available?
10	Is management democratic and participatory?
11	Is there assertive communication between the actors at school?
12	Is there an updated pedagogical project?
13	Does the school develop environmental education projects?
14	Do educators have mastery of the socio-environmental theme?
External factors	
Item	**Question**
1	Is the school admired by the community?
2	Is it possible to establish strategic partnerships?
3	Is there political party influence in management?
4	Does the school take advantage of technological advances?
5	Does the school's financial budget meet the needs?
6	Does the school hold major events?
7	Interested in socio-environmental initiatives?
8	Existe suporte da gerência (municipal, estadual ou federal) para projetos socioambientais?
9	Does student family structure affect school performance?
10	Do students' parents participate actively in school life?
11	How do new technologies affect learning?
12	Is there a barrier to developing environmental projects?
13	Does the lack of public structures interfere with students' performance?
14	Does violence interfere with school performance?
15	Is the community surrounding the school interested in socio-environmental issues?

Fig. 1: List of all variables considered by the subjects, arranged by the internal environmental (Strengths and Weaknesses) and external environmental (Opportunities and Threats) applied in urban and rural schools in the municipality of Marabá located in the state of Pará, Brazil.

III. RESULTS AND DISCUSSIONS

The purpose of this study was to make a diagnosis of environmental education in the school environment in the city of Marabá, Brazil. As a result, we found that the SWOT analysis applied to school planning has benefits for managers and educators, by: 1) providing a “whole” view of the school situation in the development of the Environmental Education theme; 2) to manage preventive actions and improve the environmental approach through: dedication of school professionals, work in the community and participative management; 3) carry out a survey of the limitations of the school environment and demonstrate the remedies, since the principals responsible for the schools had as strengths a qualified and flexible team to internal and external changes; and 4) the low cost, the ease of using SWOT analysis, accredits it as a tool in school planning not only in the theme of environmental education, but also in the planning of the entire school environment.

The school in the urban area demonstrated the existence of "forces" for obtaining an adequate environment and a good location (in relation to the community), and they are always producing small events that have environmental relations and on the importance of preserving the environment. However, what becomes a "threat" and a "weakness" is the lack of financial budget from the municipal government for the production of large events, where there is inclusion of society and the public from outside the neighbourhood where the school is located. It is worth noting that at the global level, the resources allocated to education are insufficient: there are countries in Latin America and Africa that are investing less than 3% of GDP – Gross Domestic Product. Even when there is a desire to invest in education, these investments have, in many cases, been misdirected and inefficient (Arnaldo, 2018).

To build the knowledge of an individual, since childhood, it is necessary to relate a set of educational processes originating from family life, in teaching and research organizations, cultural and social movements, living with other beings and civil society organizations (BRASIL, 1996). Thus, it is necessary to collaborate for the development of knowledge in the social view, obtained from experiences inside and outside the school environment, which is significant for the pedagogical acquisition combined with family, school, and society. School events as a teaching methodology, in turn have the importance of disseminating culture, linked to the social. Thus, contributing to other strategies used by educational institutions to better relate to their students, thus resulting in notable benefits for society (Dalmoli and Kadota, 2015).

In seeking and adding pragmatic plans in didactics for children and young people, we must provide better reflection and analysis for both, which will contribute to the development of the most diverse school and social contents. As the student participates in school events, he acquires greater aptitude in making decisions in the face of different problems, due to the exchange of experiences, thus expanding the capacity to exercise a critical reasoning of the socio-environmental issues that are inserted (Cabral et al. 2020).

Schools located in rural areas have obstacles inversely proportional to their potential for modernization, since resources are not properly available for use (Arnaldo, 2018). Unfortunately, the focus of the public authorities in these schools is low, the infrastructure is limited, the teaching materials are not complete and teachers do not

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constantly participate in professional training programs, causing them to have a weakness regarding the organization of major events. The coverage of public investments in education helps in the formulation of inclusive policies, maintenance, and development of education, and in the expansion and improvement of schools of different levels and modes of education (INEP, 2020).

The school structure, as well as the public resources invested, and the students' development are inseparable elements. The school infrastructure and the financial resources applied are always related when it comes to the quality of Education. Both elements contribute to the good development of Brazilian educational institutions (Vasconcelos et al. 2020). Where, the educational quality is entirely linked with the government resources invested as well as the correct management and equal distribution of them (Vasconcelos et al. 2020). Another important point is that the educational quality of a country can represent the type of citizenship that shapes a society, that is, if there is no effective investment in education, the quality of citizenship and, consequently, the social, economic and democratic improvement will be negatively affected (Iosif, 2007).

The lack of opportunities raised by the rural school, provides a lagged teaching, resulting in the difficulty of updated information, trained teachers, lack of didactic material and among others. In both schools we find that there is a search for educational activities related to the environmental issue, but with difficulty in carrying them out due to lack of government incentive. However, in contrast to these difficulties and scarcity of resources and partnerships, school managers seek to development environmental awareness activities with reused materials, even if infrequently. A question arises for the governors "For the future of society", is: Environmental Education essential for the formation of the character of the citizen?"

Yes, environmental education is considered indispensable in human development. It must be approached beyond the school environment, as well as in all extensions of society to generate effective changes in the relationship between man and nature. Since environmental disturbances come from human activities to supply political, social, economic, cultural, and ethical conditions (Fernandes, 2010). According to Law No. 9,795 / 1999 of National Environmental Education Policy: Environmental Education of Brazil, it understands 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 the healthy quality of life and its sustainability.

Therefore, it is necessary to develop a group of reflections along with actions that result in social behaviours of commitment and social organization, focusing on the importance of belonging and responsibility. Environmental Education, in turn, aims to motivate an ecological awareness in individuals, striving to provide a perception that changes human attitudes aimed at protecting the natural environment (Sorrentino, 2004).

The school is considered one of the crucial spaces for the formation of a citizen, usually in educational institutions that have the first contact with awareness regarding issues of nature conservation. Based on the knowledge constructed at school, it is that students will follow the progress of socialization starting at home, thus playing an important role related to the social and environmental behaviour of the students. Therefore, teachers are fundamental in the process of sensitizing society, regarding environmental problems. (Silva and Bezerra, 2016).

Environmental Education will only reach its real goals if it is applied in a conceptual-methodological way, in the school plan of interactive work, questioner, proposer of effective updated actions, so that in this way it provides greater questioning on a large scale. Thus, contributing to the expansion of Environmental Education (Zuquim et al. 2012).

a) Strengths

Both schools proved to be recognized by the community to which they belong. However, the urban school had a score of 95 in contrast to the rural school a score of 45 (Figure 2). A good geographical location is a privilege for schools, with a greater chance of having public or private partnerships (Falcão and Roquette, 2007). Community participation enables knowledge, assessment of services offered and organized intervention in school life, which can influence the democratization of management and the improvement of teaching quality (Libâneo, 2001). The intention is that all the practice is consolidated through informed action in the partnership of the subjects within the school, and the educational institution with the family and the community as a whole, aiming to achieve mission and principles adopted by the school. Another point raised was the democratic management is participatory, and both schools are always developing environmental education projects with their own resources and partnerships from neighbouring regions, which help in the didactic and participatory development of the nearby community, allowing

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knowledge to be shared (Paro, 2006). Note that the reflection on the theme of democratic and participatory management becomes relevant because it is an emerging need in the reality of public schools and educational debates, in order to promote changes in education that has been witnessed today.

b) Weaknesses

We found a contrast in the scores for "weaknesses", where in the urban school it presented the value of 30 while in the rural school the value was 80 (Figure 2). However, in both schools, the main points are related to the number of people involved (employees and students) and the school space, which reflects the internal difficulties to develop the work of environmental education. Institutions that have administrative infrastructure such as the board of directors and the teachers' room, the presence of laboratories and the availability of internet; present a better educational performance. On the other hand, factors such as the number of classrooms, the number of employees and the number of students per class, are negatively related to the average proficiency in school subjects (Biondi, 2008). This is due to the increasing difficulty in managing larger units and overcrowding in the classroom, which tend to hinder learning (BRASIL, 2005). Another point raised is that the financial resources are not enough to carry out internal activities, therefore, it has the help of partnerships and interaction with the outside society. However, unlike the urban school, the rural school lacks teaching materials and teachers who have mastery of the socio-environmental theme, which makes it difficult to practice activities related to the environment. (Falcão and Roquette, 2007).

c) Opportunities

The schools in this study showed high values in relation to "opportunities", where they obtained the following scores: urban school value of 77.5 and rural school value of 67.5 (Figure 2). The urban school is admired by society (according to the SWOT analysis), because it holds major socio-environmental events, and are always taking advantage of technological advances to improve education, which helps in interacting with external society through events (science fair, water event, knowledge web etc.) and are always open to partnerships. On the other hand, the school in the rural area holds small events, it is worth noting that it is not for lack of interest from managers, but for lack of investments (Arnaldo, 2018).

The "opportunities" pointed out for both schools were: continued teacher training suggested by all the respective school principals; the indication of didactic projects by the Municipal Education Secretariat, and the support of a management within the specific school for the operationalization of socio-environmental themes. The possibility of partnerships with other schools, universities and research institutions, for example: Casa da Cultura de Marabá (House of Culture of Marabá - http://casadaculturademaraba.org/), Universidade Federal do Sul e Sudeste do Pará (Federal University of the South and Southeast of Pará - https://www.unifesspa.edu.br/), and Universidade do Estado do Pará (State University of Pará - https://www.uepa.br/).

The training of teachers as a professional preparation starts to play a crucial role, as it makes possible in their own learning process, the development of skills necessary to act in the scenario where the school is inserted, recognizing it as part of a trajectory of continuous education throughout of life (Mello, 2000). According to Selles (2002), it must be provided that the teacher can recognize that learning is built on a "two-way street". That is, not only the academic knowledge produced at the university must contribute to the teachers, but also, the experience derived from daily work at the school provides an important contribution to be explored theoretically. The approximation of the University and other research institutions to the school, however, cannot be reduced only to the insertion of academics in this favourable environment for the improvement of teacher education. It is also necessary to bring the school closer to the university, as it is in this instance that scientific knowledge is produced in relation to pedagogical practice. From the university, which radiates the knowledge built in the most diverse areas of knowledge (Scheid et al. 2009).

d) Threats

Both schools listed the main "threats" that are surrounding the school environment with the following values from the SWOT analysis; the urban school with a score of 67.5 and the rural school with a score of 77.5 (Figure 2). In both schools there is a clear lack of management support (municipal, state, or federal) for socio-environmental projects. The financial budget does not meet the needs of schools. Parents' lack of participation and family structure hinder school performance and affect student learning (Arnaldo, 2018). However, in rural schools, the threat is even greater, as they do not hold large events due to the lack of teachers in the various areas of Science in the school environment and the appropriate place for holding large events, and even for mandatory classes, as there are barriers that interfere in the development of projects (Falcão and Roquette, 2007). As stated, education is one of the main factors in the development and social inclusion of a nation. Making it

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quality to a larger number of people is a constant challenge for Brazil (Camâra, 2016).

The current advances in science and technology have caused profound changes in social behaviour, in the forms of communication, in the production processes, in the organization of work and, consequently, in the training of human resources. As a result of these changes, society has been demanding professionals who, in addition to technical competence, have the capacity for engagement, initiative and decision-making (Maricato et al. 2000). However, technology (smartphones) was also reported by managers as interfering with student learning, as there is no control over the use of electronic devices in the classroom, even with rules for use by students (Zuin and Zuin, 2018). In this way, new technologies, when used in excess, can cause negative consequences on student behaviour and learning. Immediate access to information can cause superficiality in the knowledge of users, thus impairing the system of memorization and understanding completely of different areas of knowledge, thus impairing the functioning of the brain (ÉPOCA, 2011). In addition to technological dependence, social isolation is another negative factor in the use of technologies, as children and adolescents spend so many hours involved in cyberspaces that it negatively affects their social, family and school life, thus impoverishing their interpersonal skills. Access to large amounts of information can also become a negative factor, as it can generate cognitive overload, leading to stress. As they spend part of their existence in the virtual world, it is difficult to distinguish the reality between the two worlds (virtual and real). Because more attention is needed to control the use of these revolutionary technologies, so that we cannot be controlled by it, nor cause damage to individual well-being (Oyama, 2011).

It is worth mentioning that the use of technologies in contemporary society has brought great positive impacts to several areas, including school environments. The use of technologies inside and outside the classroom is becoming increasingly necessary to achieve higher quality education. However, government investment is necessary for schools to acquire these technologies. (Maricato et al. 2000). Among the benefits generated from technologies in schools, we can highlight the speed at which content can be accessed, the scope and the power to choose which subjects are most relevant to certain situations, in addition to offering innovation, generating new ideas that lead to elaborate new ways and methodologies of approach and content dissemination. Thus, technologies in general are strong allies in the teaching-learning process (Oymar, 2011; Artuso, 2008). However, training of teachers in schools is necessary to be able to use technology in their favour and not against.

Fig. 2: Graphical representation of the scores found by the SWOT analysis when analyzing the internal and external environments between the positive points (green column) and negative points (yellow column) of: A) Urban school and B) Rural School in the municipality of Marabá located in the state of Pará, Brazil.

IV. FINAL CONSIDERATIONS

In view of the analysis of the data collected and interpreted by SWOT, it is evident that there is a concern on the part of schools in relation to environmental problems and the development of educational processes that encourage the teaching practice of environmental education. We found that there is an administrative effort to provide students with projects that raise environmental awareness in schools in the areas: urban and rural. Despite the insufficient support of the government (municipal, state or federal), the difficulty that the rural school has in relation to government visibility, as well as the acquisition of resources to develop socio-environmental projects, is clear in this work. Allied to this, the rural school goes through several "weaknesses and threats" in relation to the internal and external environment, the same occurs for the urban school, but in smaller proportions. Despite the innumerable challenges faced by rural schools, the importance that education has for these rural communities is notorious. After all, education in the rural and urban

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environment provides citizens with better intellectual performance, starting to adopt critical and productive behaviours, identifying themselves as transforming members of the environment. Thus, valuing the identity of this country and city population, as well as their respective culture (Ribeiro, 2014). We highlight the importance of the partnerships reported in this study by schools by the University and research institutions. Where, the public-school needs partners who contribute to raise the school environment and that this quality does not depend exclusively on government efforts. This project is still in continuity, because schools need support from universities and universities need the schools to build a better world.

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Brazilian Sign Language in Teaching degrees at the Universidade Federal do Maranhão/Brazil

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Abstract— *The primary goal of this article is to describe the context of the Brazilian sign language (Libras) in Teaching Degrees at Universidade Federal do Maranhão (Ufma). In this sense, we developed an exploratory research with a qualitative approach. Four professors who teach Libras for Teaching degrees and 98 students participated in this research. We collected the data through semi structured interviews with questions regarding the object investigated. Results revealed that, among the 17 teaching courses in the Dom Delgado campus, only five offered the Libras course for students. We observed the need for more clarification regarding the objectives of the Libras course, and considered its coursework inadequate for making students bilingual. Certain courses were offering the Libras course as optional instead of mandatory. Our findings correspond to the fact that good teacher qualification is extremely necessary to accomplish a bilingual education under the perspective of educational inclusion.*
Keywords— ***Bilingualism, Inclusive education, Teaching-learning, Teaching degrees, Brazilian Sign Language.***

I. INTRODUCTION

Discussing the importance of the Brazilian Sign Language (Libras) in teacher's education is necessary given that bilingual education pervades the instructor's actions. This is the key character for acquiring new knowledge, sharing experiences, and developing a critical sense. Therefore, we infer that operationalizing inclusive education enables both deaf and hearing students to learn and improve Libras in the Teaching degrees, only if they have a sufficient and adequate course load, as well as qualified professors in Libras and Portuguese, respectively. By comprehending such statement, we begin to conceive bilingual education as a real and possible modality that provides deaf students with an effective, dynamic, attractive, instigating and inclusive educational routine.

Studies by Skliar, Massone and Veinberg [1] signal that a bilingual and bicultural education must aim at creating a linguistic environment that enables deaf students to progress in terms of their cognitive abilities, guarantee the construction of a viable knowledge about the world and the opportunity for a qualitative and quantitative access to cultural and curricular information. As Brito [2] highlights, teaching must center on acquiring and developing the semantic system and concepts, since such a process facilitates deaf students' learning. Therefore, it is possible to understand the Portuguese language particularities in consonance with the already acquired ones, in Libras.

It is important to highlight that the professor has a crucial role for an effective bilingual education, since it is through its strategies that methodologies in both languages can be developed regarding the access to new knowledge. Such affirmatives demonstrate the need for learning the Brazilian Sign Language in teaching degrees, because it is during this primary education that future professors have their first experiences with the special education public, including deaf students.

In the context of the bilingual education of the deaf person, through law nº 10.436 [3] of April 24 2002, the Brazilian Sign Language is officialized as the way of communication and expression in which the linguistic system of visual-motor nature, with its own grammatical structure, constitutes a linguistic system for transmitting ideas and facts, originating from the deaf people communities of Brazil.

The Brazilian Sign Language is a visual-spatial language, which responds to the demand for deaf and hearing people using it for communicating, learning, and sharing experiences. Through this law, the Executive Power and public institutions must also use Libras as a way of communicating to answer the demands of Brazilian deaf people.

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Given these facts, educational public policies changed and through the Decree 5.626/2005 [4], Libras started being a mandatory discipline in all high school, teaching, pedagogy (teaching and bachelor's degrees), and phonoaudiology courses.

> Art. 3º Libras must be inserted as a mandatory curricular discipline in the teacher training courses for exercising magisterium in high school and higher education, and in the courses of speech, from public and private teaching institutions of the Federal, State, Federal District, and Municipality education systems.
>
> § 1º All teaching degrees, in all knowledge fields, the regular courses of high school and higher educational levels, the Pedagogy and Special Education courses are considered training courses for teachers and education professionals to exercise the magisterium. § 2º Libras will constitute an elective discipline for the other higher and professional education courses after a year of this decree's publication [3].

Along the years, universities and private and public colleges have Libras as a mandatory component for any teaching degree in their curriculum.

Regarding bilingual education, according to the Brazilian law for the Inclusion of Persons with Disability – Law nº 13.146/2015 [5], the teaching-learning process of deaf students will be carried out with Libras as the first language and, in the written modality, Portuguese Language becomes the second language, in bilingual schools and classes, and in inclusive schools. According to Godfield [6], there is no unanimity among bilingual education professionals for the deaf, because there are several ways of applying bilingualism in schools and other institutions. However, the author demonstrates two ways of defining the bilingual philosophy: the first is the sign language acquisition followed by learning the country's oral language. The second is that sign and oral languages are learned simultaneously.

The *Universidade Federal do Maranhão* (Ufma) has adjusted its Institutional Development Plan (IDP), which contemplates the obligation of Libras as a discipline for teaching degrees, Pedagogy (teaching and bachelors), and Phonoaudiology courses. In the IDP (2017 – 2021), UFMA also makes clear that the institution will offer Libras as a communicative way for employees, students, and the deaf community through trained professionals. The institution also has classes signaled by interpreters and textual productions in the Portuguese Language to enable its deaf students to access new knowledge through bilingualism.

This context has broadened the discussions about the relevance of bilingualism for making inclusive education more effective for deaf individuals in all instances of the educational process. Comprehension by the future teacher about inclusion, bilingual education, and Libras is thus necessary.

Given what we exposed here, we question: how has the teaching-learning process been occurring in the teaching courses at the *Universidade Federal do Maranhão* under the perspective of inclusive education?

From the presented scenario and conceptions about being bilingual, this article discusses the Libras teaching-learning process in Ufma's teaching degrees in São Luís/MA/Brazil, with bilingualism in the Inclusive Education perspective as a premise.

II. METHODOLOGY

This study employed an exploratory research with a qualitative approach, since it enabled the researchers to familiarize with the study object, as well as to know the phenomenon and describe its characteristics, establishing relationships between variables [8]. Research was conducted in the Dom Delgado campus (Ufma), a public higher education institution in São Luís/MA, maintained by the Brazilian Federal Government.

In total, the study comprised 102 participants with four being professors of the Libras course offered in the 2019.2 semester for Ufma's teaching courses: Letters/Portuguese and English language; Theater; Physical Education; Music, and 98 students enrolled in said course.

After the favorable decision of CEP/Conep/Ufma nº 3.690.353 (November 07 2019) on conducting the research, the data were collected through semi structured interviews since, according to Triviños [9], this technique "[…] favors not only the description of social phenomena, but also its explanation and comprehension in its entirety […]. Furthermore, it also maintains the conscious and active presence of the researcher in the process of collecting information" (p. 152), as well as has more flexibility and allows the interviewer to reformulate the question aiming for a better comprehension from the interviewee, enabling to obtain knowledge regarding the Libras teaching-learning process in the Bilingualism process, maintaining the freedom of answers for all research participants.

All data collection procedures complied with the research criteria involving human beings according to the Resolution nº 510/2016 [10] of the Ethics Committee. Participants were invited, informed, briefed, and signed the Informed and Free Consent Form (TCLE), agreeing to participate in this study. Interviews were recorded with prior consent from the participants and latter transcribed. Data were categorized and analyzed qualitatively.

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III. RESULTS

Here we present the results from this research, together with the analyses and discussions necessary to the investigated context.

Therefore, regarding the question about which were the Libras course goals, 34% of the students answered that these were Libras acquisition and 64% answered that it was both the acquisition and enhancement of the Brazilian sign language. Regarding the teachers, each emitted a different opinion, that is, one teacher said that goal was Libras acquisition; another said that it was enhancement; one answered that it was both Libras acquisition and enhancement; and one emphasized learning Libras.

Given the data obtained, there is no convergence in answers. Thus, Krashen's [11] studies clarify that language acquisition happens in the daily communication occurrences, that is, relationships of spontaneous assimilation of verbal expressions and the construction of the internal grammar of each individual. The author also demonstrates that learning a new language comes from systematization, a formal study through specific methodologies and instructive materials.

For Mitchell and Myles [12], the second language (L2) is mostly learned by more cognitively mature learners and, possibly, with more strategies regarding linguistic abilities. Such a statement corroborates with the Libras discipline public in the teaching degrees, since apprentices already know and use the Portuguese Language with fluency in the daily communicative relationships and look to learn Libras for a personal reason. This learning occurs in a pre-established period for each higher education institution, which already indicates a systematization as to Libras goals in teacher's training.

According to Veloso [13], Libras acquisition occurs through a natural, subconscious, and intuitive process through assimilation, which originates from interactions and daily experiences between signalers, in which the apprentice is an active participant. However, enhancing the signaled language tends to occur through the progression of the already acquired linguistic abilities, most of the times with fluency and proficiency. Therefore, signalers search to evolve their Libras communicability.

Regarding the question on whether the Libras discipline in Literature courses was being offered as mandatory or elective, professors were unanimous by responding that the discipline was mandatory, but 8% of the students answered that it in their courses it was an elective discipline.

In relation to the participants that stated that Libras was an elective discipline in their respective courses, it is necessary to clear two instigating situations in the Dom Delgado campus. First, there are 17 teaching and one Phonoaudiology degrees, distributed in six centers, and only five of these courses offered Libras as a discipline in the 2019.2 semester: Letters – English, Letters– French, Music, Theater and Physical Education. For this reason, all classes were mixed with students from several courses on campus. Second, even with the obligatoriness of Libras as a discipline according to the Decree nº 5.625/2005 [4], it was offered as an elective in the Exact Sciences courses, thus was attended at the student's choice.

In the investigated context, Ufma's Institutional Development Plan makes explicit that Libras will be offered at each semester for the whole academic community, but they do not highlight their obligatoriness in the teaching, pedagogy and phonoaudiology courses. Such situation demonstrates the fragility in offering this discipline as one of the subsidies and as a prior for obtaining a higher education degree [7].

Given these facts, Nascimento and Sofiato [14] question if the "insertion of this discipline would not be masking the real necessities of forming bilingual professors to attend deaf students" (p. 365), as seen in the operationalization "fragilities" of Decree nº 5626/2005.

Therefore, we need to highlight Quadros [5] when clarifying that Libras entered as a curricular component of all universities' curriculum. This way, sign language has been of great relevance for future professors, preparing them to the teaching-learning process in the context of Inclusive Education.

Regarding how much course work exists in the Libras course for Ufma's teaching degrees and if it enabled the development of linguistic abilities, participants unanimously responded that the course work was 60 hours. Students were also unanimous when stating that the course work should be higher since the development of linguistic abilities did not surpass the basic level. Their answers converged to the professors', who answered that the course work enables a partial development of linguistic abilities; minimal acquisition; does not enable development; needs a higher course work.

Given these data, it is necessary to emphasize that Quadros [5] states that partial acquisition of linguistic abilities will hinder the comprehension on the importance of didactic resources and methodologies adapted to teaching any discipline, with classes with deaf students, considering that this situation will promote more exclusion.

In the question about whether students, who will be teachers in the future, would be capable of communicating in a bilingual way by the end of the Libras course, half the professors answered yes, since fluency results from the

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fundamental information passed on and the individual commitment of every student. Further, students were able to understand and execute signs as they wrote in Portuguese Language. The other two professors emphasized that they would not because the course load is insufficient for an immersion in Libras.

Among the Libras course students, 41 stated that they would indeed be capable of communicating in both languages, since they learned the basics and could go further with practice. They also said that, even though they were not so skilled in Libras, there would be communication possibilities with deaf people; 57 students answered no to this question, because the discipline's course work is insufficient to make them bilingual.

Given these data, Quadros [15] explains that bilingual education must be organized so that students can experience the educational environment and learn equally in both languages. For Santos [16], professors must be capacitated by specific disciplines as in Libras and Special Education in this case, so that they can act in executing bilingual education.

In the same context, Albres [17] emphasized that the Libras discipline needs to focus on the linguistic abilities, bilingualism, communicability, and training of teachers under the light of inclusive education.

According to Gesser [18], Libras in the teaching degrees must also focus on the future teachers' field of work. Therefore, the specific signs of each course must be presented during the Libras teaching-learning process so that subjects are explained more equitably for both hearing and deaf students.

In agreement, Falcão [19] states that the curricular component analyzed with signaling as the central object will not enable future teachers to have the practical-theoretical basis for being an instructor on a bilingual perspective. In this context, we observe an incoherence regarding the data presented by the participants and the studies established by researchers. According to Facundo and Vitalino [20], the Libras discipline does not contemplate the possibility of becoming bilingual, especially given the minimal course work, as well as its syllabus, which privileges the repetitive signal practice. Therefore, as emphasized by Sá [21], bilingual education is a great challenge for the Brazilian educational system, since teacher qualification is still too fragile regarding linguistic diversity.

Finally, on the matter of the relevance of bilingualism to the teaching practicing in Inclusive Education, professors generally attributed the relevance of bilingualism to the novel linguistic experiences and to the inclusion of deaf people in social, educational and professional spaces, since deaf students need to access socialized knowledge in the academic environment.

For students, bilingualism is of great relevance, since it enables the communication between student and teacher; contributes to the culture of accepting differences; enables the teaching-learning process for deaf students, since future teachers will find deaf students in their daily lives and will need both Portuguese and Libras languages for communication; bilingualism favors relations and/or communications through language between deaf and hearing people.

Thus, it is important to highlight that bilingual education is ruled by the Libras Law [3], in the Libras Decree [4], and in the Brazilian Law for the Inclusion of Persons with Disability [5], which postulate that education for deaf people occurs with Libras as their primary language and Portuguese as their secondary language, in the written modality.

In this context, studies by Bassao and Masutti [22] describe bilingualism as extremely important for the dialogic relationship between teachers and their deaf students, since it enables new experiences in the teaching-learning process, the creation of affection and necessary bridges for understanding subjects and expanding senses. For Ferreira [23], "it is through language that people establish relationships, imposing meanings for both themselves and the environment they live in" (p. 33). Therefore, we highlight that bilingualism provides the acquirement of knowledge and experiences for the deaf person, as well as the construction of its own identity.

IV. CONCLUSION

Returning to this study's objectives, which were to describe and understand, based on the perceptions of interviewees, how the teaching-learning process of the Brazilian Sign Language was occurring in Ufma's teaching degrees under the perspective of Inclusive Education, our findings indicate that a quality teacher training is necessary for an effective bilingual education.

In this context, we must also mention other facts we verified so that they can be reviewed, reflected upon, and modified for the benefit of the initial education of students and future teachers of the target students of Special/Inclusive Education.

At Ufma, there are 17 teaching degrees but only five offer the Libras discipline to students, which points to the lack of compliance to the Decree 5626/05, which assures Libras as a mandatory discipline for all teaching courses in all knowledge fields. This is concerning considering it compromises the education of students and future teachers in the principles of Inclusive Education and in the context

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of bilingual education due to the absence of knowledge and experiences regarding Libras, deafness and deaf people. In the future, this may result in disoriented, exclusive, and oral professional practices in the teaching-learning process of deaf and hearing-impaired students.

In the Libras course plans analyzed, even though several syllabi are similar for all courses and the subjects' presentations are similar, there is no precise information regarding the course goals, specifically if the goals are acquisition or improvement and/or both. The Libras discipline was offered in some courses as an elective instead of mandatory as required by Decree nº 5626/2005.

The course work of this discipline is below the necessary regarding the bilingualism context, since most of the students highlighted that it only allows them to reach a basic communication level. This allows us to infer that many of these students will leave academia without the proper education to work with the target public of Special Education, specifically deaf students. This context will not support an equitable education between hearing and deaf students. Therefore, these will be new professionals with old exclusion practices.

By the end of the Libras discipline, most participants do not feel capable of bilingual communication because they consider their learning to be at the basic level.

Regarding the relevance of bilingualism, this is seen as of extreme importance since it enables the information and communication between hearing and deaf people, as well as the access to the knowledge produced and socialized in the academic environment.

Given what we outlined here, we make a few considerations with the intent of bringing changes in benefit of the teaching-learning process of Libras in the Ufma's teaching degrees under the perspective of Inclusive Education. These include: restructuring of the Brazilian Sign Language discipline syllabus with a clear and precise definition of its outcomes; increased course work; effective insertion of Digital Technologies in classes and practical Libras activities; increased offer of Libras classes per semester; exchange between people fluent in Libras, as well as professors of different areas who have experience with deaf people; talks and presentations in associations of people with hearing disabilities; technical and pedagogical supervision regarding the Libras discipline in the teacher training courses as a mandatory requisite.

We also expect that this study will instigate the academic community and society in general to acknowledge the relevance of bilingualism to the educational, social, and professional inclusion of the deaf person.

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Evaluation of Cupronickel Alloy Used in Sodium Chloride Solutions Contaminated with Nitrogenated Fertilizers.

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Abstract**—** *Cupronickel alloys have been used in the manufacture of equipment, pumps and pipes for refrigeration systems and heat exchangers, among other applications. Certain nitrogen fertilizer plants are built near seaports for the transport of products, and use seawater for refrigeration systems. However, in the case of accidental discharge, it is important that seawater capture does not cause damage to materials and equipment, preserving the integrity and guaranteeing the service life of the equipment. The present work analyses the behavior of cupronickel 90/10 alloy (Cu with 10 wt. % Ni) in relation to corrosion, through the development of gravimetric (mass loss) and electrochemical tests in solutions of 3.5 wt. % sodium chloride, with the additions of nitrogen fertilizer in several proportions. A superficial attack was observed on the surfaces of the alloy specimens, and the presence of pits was not observed. In addition, a greenish coloration on the surface developed with increased immersion time and with the greatest addition of fertilizer. The results of the mass loss tests of the cupronickel alloy with saline solution showed that for nitrogen fertilizer injection, in concentrations of 1, 3 and 5 wt. %, the corrosivity varies from low to moderate, and that despite suffering corrosion in the saline environment, cupronickel has a good resistance to this corrosive process, and can be considered the most suitable material for application in highly aggressive environments, such as in the sea water capture system.*

Keywords**— Copper-nickel alloy, corrosion, laboratory tests, nitrogen fertilizer.**

I. INTRODUCTION

Copper and copper-nickel alloys (also known as cupronickels) have been used for more than 60 years in seawater applications, typically in pipes, pumps, heat exchangers and condensers, due to their good resistance to corrosion. It is well-known from several previous reports [1-4] that the addition of nickel to copper, as a component alloy, to form cupronickel alloys gives rise to the production of corrosion-resistant material. For this reason, cupronickel alloys have been used in the construction of equipment for the chemical industry in general.

Fertilizers are products that constitute one of the main substances and/or mixtures in agricultural industry. The fertilizer industry is one of the most prosperous businesses in the agribusiness world. Industrial products such as nitrates can be used as petrochemicals and in mining, and in some cases are extremely toxic, flammable, or corrosive, bringing serious risks inherent to the population and the environment. In addition, these products have dangerous and unhealthy manufacturing processes, generating various wastes and ensuring that any type of leak may be harmful, at least [5,6].

In the same way that nitrate-based fertilisers are a source of nitrogen for the development of agriculture, so, against society, nitrate-based compounds serve the explosives and weapons industry. Hence, the positioning of accidents in the industrial sector. Accidents in fertilizer factories have occurred over the last few decades, and have brought to light the risks surrounding these industries [7].

In the present study, a fertilizer factory was examined, which will not be identified for privacy reasons, located near the sea port for the purpose of facilitating drainage, and where sea water is reused in the refrigeration system (very common in plants of this type).

In this cooling system, sea water is captured, used to exchange heat with the piping system, heat exchangers and condensers, cooling pumps, and then returns to the sea,

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without direct contact with any polluting material. Figure 1 illustrates a typical cooling system using sea water.

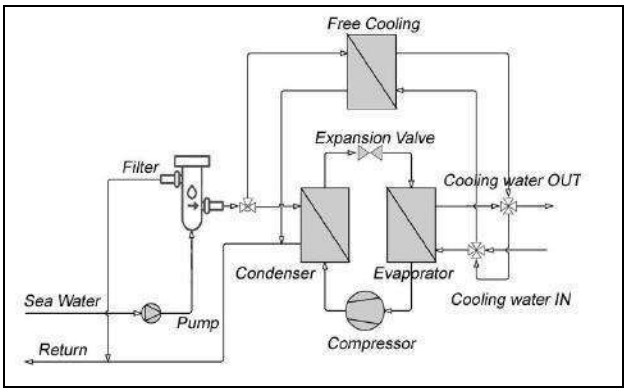

Fig. 1: Typical industrial cooling system using seawater

As the system uses sea water, cupronickel alloys are the material used to construct the equipment (pipes, pumps, compressors, and others).

However, at one point, an accidental dumping of nitrogen compounds and ammoniacal deposits occurred, and these materials may cause the corrosion process in the cupronickel alloys used in this system, and, as a result, leaks may occur that would impact the operation of the industrial unit, as well as the surrounding environment, and cause health risks to the general population.

II. MATERIALS AND METHODS

The material used for the manufacture of the coupons used in this study was the cupronickel alloy consisting of copper (87.50%), nickel (10.4%), iron (1.51%) and manganese (0.59%), the chemical composition of which is framed in ASTM standard B171/B171M-12[8].

The coupons used in the gravimetric tests (weight loss) had the following dimensions: 3.0 cm × 1.5 cm× 0.2 cm, while the coupons for the electrochemical assays were cut in the following dimensions: 0.5 cm × 0.5 cm × 0.2 cm.

All specimens were previously treated by sanding using four sandpapers of different granulations (80, 120, 180 and 320), in order to guarantee the homogeneity of the metallic surface. The previously-cut samples were carefully sanded with the appropriate grain in one direction, and then at 90° from that direction until the first scratches disappeared, then returning to the original direction. This procedure ensured the removal of the original surfaces and provided a surface with an adequate roughness for the tests. The coupons were cleaned with acetone and ethanol, and dried with hot air.

The corrosive medium used to represent seawater was a solution of sodium chloride (NaCl) (3.5 wt. %) containing 800 mg and 400 mg, respectively, of magnesium chloride ($MgCl_2$) and calcium chloride ($CaCl_2$). The pH was set between 7.2 and 8.0 by addition of sodium hydroxide (NaOH).

To represent the spill of nitrogen fertilizer in seawater, a commercial "NK" type fertilizer, consisting of a mixture of potassium nitrate (KNO_3) and sodium nitrate ($NaNO_3$), was added; thus, forming a product containing 15% nitrogen (N) and 11% potassium (K). The additions of this commercial nitrogen fertilizer were in the proportions of 1, 3 and 5 wt. %.

2.1 Gravimetric test (weight loss)

The test consisted of two stages, in which the performance of the specimens in a static and dynamic state was analyzed.

In the case of the static gravimetric test, the tests were performed with the placement of the coupon in polyethylene containers with a capacity of 100 mL, where the alloy specimens were completely immersed in 3.5 wt. % NaCl saline solution, containing 800 mg of $MgCl_2$ and 400 mg of $CaCl_2$, with the addition of nitrogen fertilizer in 3 different proportions (1, 3 and 5 wt. %). Tests were carried out at room temperature and ambient pressure, with exposure times of 15, 30 and 60 d, and were completely static, as shown in Figure 2.

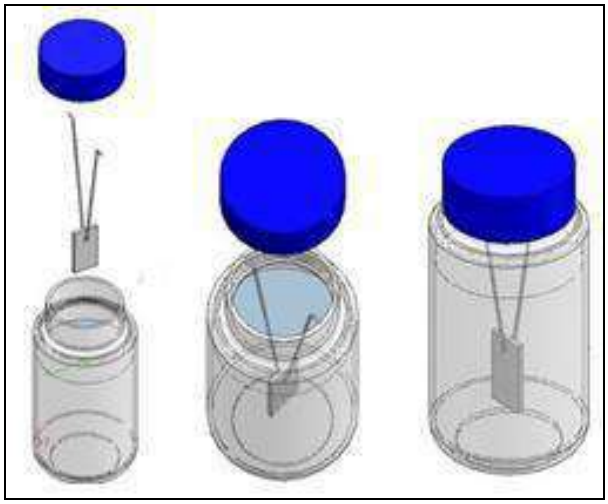

Fig. 2: Static gravimetric test

In the case of the dynamic gravimetric test, the tests were carried out by placing the coupons in plastic containers with a capacity of 55 L, where they were loaded with 40 L of 3.5 wt. % NaCl saline solution, containing 800 mg of $MgCl_2$ and 400 mg of $CaCl_2$ with the addition of nitrogen fertilizer in the proportion of 5 wt. %. Tests were carried out at room temperature and pressure environment, with exposure times of 15, 30 and 60 days,

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choice justified as being the most critical situation of the present test. The dynamic gravimetric test setup is shown in Figure 3.

A continuous circulation system was mounted on the plastic container, using a submerged pump, and the injection of compressed air by an air compressor was used in order to keep the oxygenation rate constant, aiming to replicate conditions simulating a maritime environment, more aggressive than in the static test.

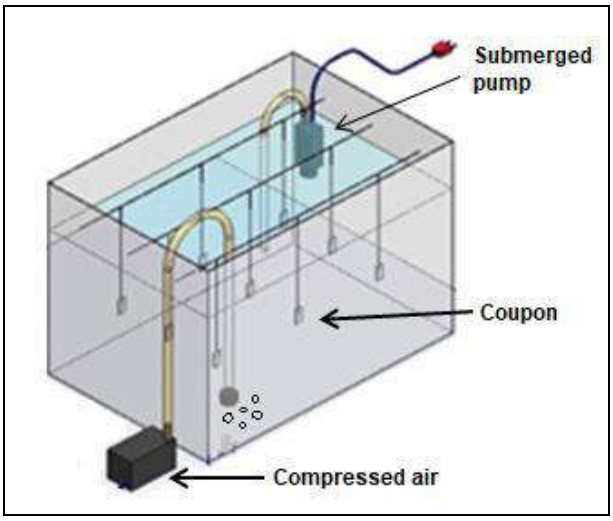

Fig. 3: Dynamic gravimetric test

Corrosion rates were calculated in mm/y, as established in ASTM standard G1-03 [10], based on the total initial surface area of the specimen and mass lost during the test, using the equation:

$$CR = \frac{K.W}{A.t.\rho}$$

Where,

CR = Corrosion rate, mm/y;

K = constant (8.76×10^4);

W = mass loss, g;

A = area, cm^2;

t = exposure time, h;

ρ = specific mass, 8.9 g/cm^3.

2.2 Electrochemical test

For the polarization measurements, samples of the cupronickel alloy were cut in order to obtain an electrode surface of 0.5 cm × 0.5 cm. The alloy was then embedded in a polyester resin and the samples sanded in a polishing machine using grade 100 to 1200 sandpaper, as shown in Figure 4. After this procedure, the samples were washed and passed through ultrasonic cleaning equipment for 3 min, in order to remove residues that may have aggregated during sanding [11,12].

At this point, the samples were inserted into a conventional polarization cell with a volume of 200 mL, consisting of a working electrode, a platinum counter-electrode and a saturated calomel reference electrode (SCE), as shown in Figure 5.

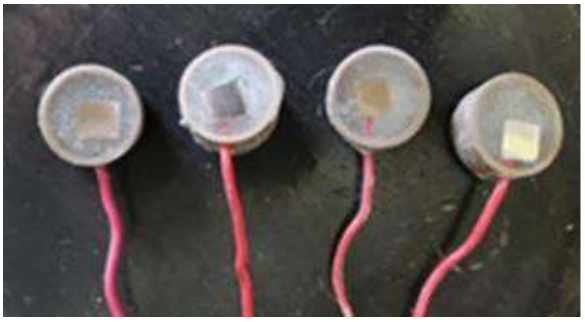

Fig. 3: Electrochemical coupons

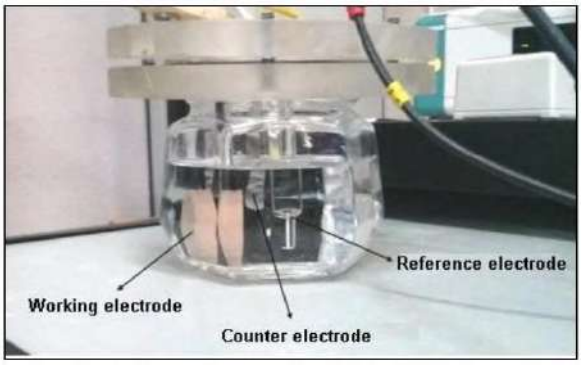

Fig. 5: Conventional polarization cell [11].

The polarization curves were recorded with an Autolab potentiostat, Type III, by varying the voltage at 60 mV/min over a range of −250mV to +250mV, with respect to open circuit voltage. All measurements were carried out at a constant temperature of 25 °C and without agitation. A solution of saline water containing 3.5 wt. % NaCl, 800 mg/L of $MgCl_2$ and 400 mg/L of $CaCl_2$, with the pH set between 7.2 and 8.0, was used. The nitrogen fertilizer was added to the saline in concentrations of 1, 3 and 5 wt. %.

All measurements were repeated at least three times to ensure good reproducibility. The data obtained were analyzed using Origin Lab Pro software (version 7.1).

III. RESULTS AND DISCUSSION

The results obtained in gravimetric and electrochemical tests for the cupronickel 90/10 alloy, in solutions of saline water with nitrogen fertilizer additions, are presented in the following sub-sections.

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3.1 Static gravimetric test

As described in section 2.1, the cupronickel alloy coupons were tested statically over a period of 2 months (15, 30 and 60 days), with saline as the electrolyte and with additions of nitrogen fertilisers in concentrations of 1, 3 and 5 wt. %. The results of the averages of the corrosion rate (mm/y) are shown in Figure 6.

A superficial attack is observed on the surfaces of the specimens, without the presence of pitting, as shown in Figure 7. The possible occurrence of slight corrosion by differential aeration on the surface of the hole, where the specimen is suspended by a Teflon wire, is highlighted. In addition, there was a greenish coloration on the surface which developed with increased immersion time and with the greatest addition of fertilizer.

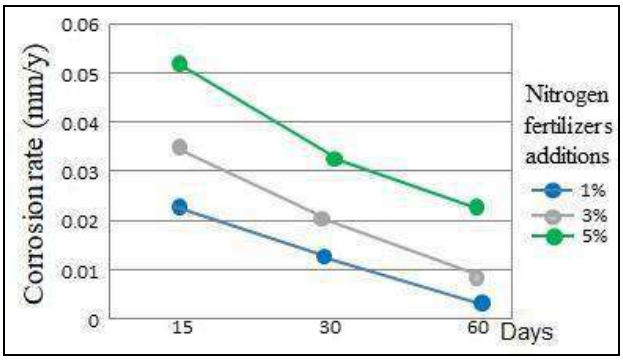

Fig. 6: Static gravimetric test results

Fig. 7: Surface of the specimens removed from static gravimetric testing

3.2 Dynamic Gravimetric test

The results from nine coupons of cupronickel 90/10 alloy submitted for dynamic testing over periods of 15, 30 and 60 days, in saline solution with addition of 5 wt. % nitrogen fertilizer are shown in Figure 8. In Figure 9, a visualization of the specimens after the dynamic test is presented. The results show that the continuous bubbling of air and the agitation caused by the submerged pump in this assay are more aggressive conditions than those in the static assay.

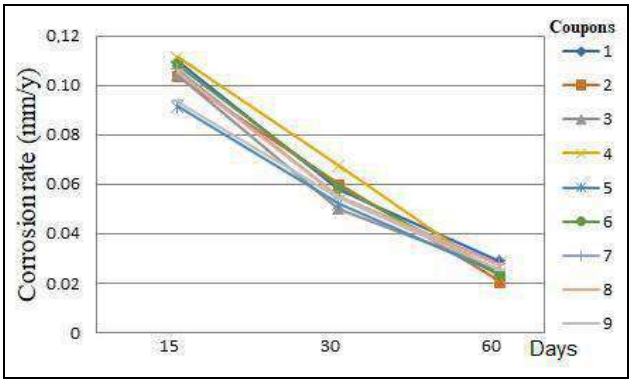

Fig.8: Dynamic gravimetric test results

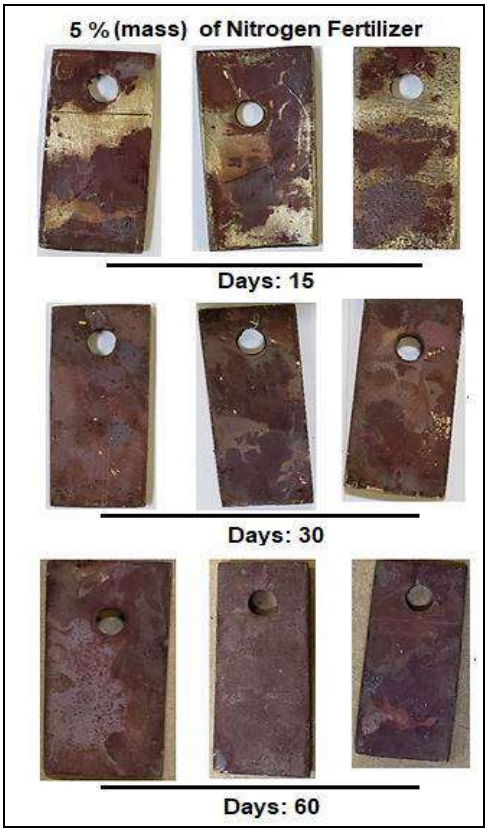

Fig. 9: Surface of the specimens removed from dynamic gravimetric test

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Table 1 of Standard NACE-RP-07-05[13] below shows that the corrosion rates of cupronickel alloy coupons immersed in NaCl solutions, contaminated with nitrogen fertilizer in the mass loss tests (static and dynamic), are classified as low to moderate.

Table 1: Average corrosion rate of Standard NACE-RP-07-05[13].

Average corrosion rate, mm/y	Corrosiveness
<0.025	Low
0.025 - 0.12	Moderate
0.13 – 0.25	High
0.25	Severe

Figure 7 shows the macroscopic morphologies of the surfaces of the corroded coupons of the cupronickel 90/10 alloy, immersed in 3.5 wt. % NaCl solution without air bubbling and with additions of 1, 3 and 5 wt. % of nitrogen fertilizer for 15, 30 and 60 days. An oxidized film (Cu_2O) is observed that darkens as the immersion time increases from 15 to 60 days. It was also observed, for some coupons with holes, a slight corrosion due to concentration differential from the Teflon wire supporting these coupons.

Figure 8 shows the macroscopic morphologies of coupons removed from the dynamic assay with the same saline solution, and the addition of 5 wt. % nitrogen fertilizer with continuous air bubbling. An adhered film with a yellow brick-red coloration is noted, which changes to brick-red and even black as the immersion time reaches 60 days.

The X-ray diffraction analyses carried out on the deposits adhering to the surface of the specimens reveal that they mainly consist of cuprous oxide (Cu_2O). In some samples, in addition to Cu_2O, cupric hydroxide ($Cu(OH)_2$) and cupric hydrochloride traces were also identified. No copper or nickel nitrate compounds were observed, which is expected considering they are completely soluble.

The formation and properties of the passivating Cu_2O layer on the surface of cupronickel 90/10 alloy have been studied in several previous reports [14-19]. Importantly, in the literature, no report could be found where the concentrations of sodium nitrate and potassium could alter the properties of the Cu_2O layer.

Based on the studies mentioned above, the formation of Cu_2O on the surface in cupronickel 90/10 alloys can be explained by the following reactions:

Cathodic reaction: $H_2O + ½\ O_2 + 2e^- \rightarrow 2OH^-$

Anodic reaction: $Cu + 2Cl^- \rightarrow [CuCl_2]^- + e^-$

Hydration of $[CuCl_2]^-$ favors Cu_2O formation, based on the following reaction:

$$2[CuCl_2]^- + H_2O \rightarrow Cu_2O + 4Cl^- + 2H^+$$

3.3 Electrochemical test

Figure 10 shows the polarization curves of the cupronickel 90/10 alloy in a solution of 3.5 wt. % NaCl, at room temperature without air bubbling and with addition of nitrogen fertilisers at concentrations 1, 3 and 5 wt. %. Values for the polarization resistance (R_p), potential (E_{corr}) and corrosion current density (I_{corr}) were obtained by extrapolating the Tafel slope of the polarization curves, and are shown in Table 2.

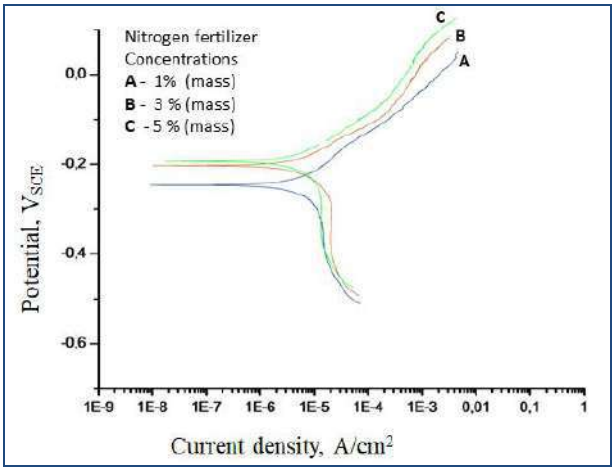

Fig. 10 :Polarization curves of the cupronickel 90/10 alloy in a solution of 3.5% NaCl, at room temperature without air bubbling, and with addition of nitrogen fertilisers in the concentrations 1, 3 and 5 wt. %.

Table 2 – Polarization resistance (R_p), potential (E_{corr}) and the corrosion current density (I_{corr}) of Polarization curves

Nitrogen Fertilizer	I_{corr}, A/cm^2	E_{corr}, V	R_p, Ω.cm^2
A – 1%	4.8 x10^{-5}	-0.240	5.2x10^4
B – 3%	4.5 x10^{-5}	-0.210	4.6x10^3
C – 5%	8.1 x10^{-5}	-0.190	3.3x10^3

The potentiometric curves presented in Figure 10 show some similarity, indicating that nitrate additions do not modify the contour of the curves. The results of each parameter in Table 2 also do not show a significant difference, confirming the results of corrosion rates observed in the static tests.

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According to Ezuber et al.[20], the formation of a Cu_2O protective film associated with another layer of cupric hydroxychloride favors the formation of an inert film, reducing the current density. The formation of these films is also in agreement with Mathiyarasu et al[19].

IV. CONCLUSION

Based on the bibliographic references and the results of the laboratory tests, it is concluded that:

- Although the cupronickel alloy with 90% copper and 10% nickel (ASTM C70600 specification) is used for the manufacture of equipment and piping for seawater collection and cooling systems, corrosion can be expected if a high injection of nitrogen fertilisers occurs;
- The mass loss tests of the cupronickel alloy with saline solution showed that, in cases of injection of nitrogen fertilisers in concentrations of 1, 3 and 5 wt. %, the corrosivity varies from low to moderate;
- The formation of a cuprous oxide (Cu_2O) film, identified by X-ray diffraction and supported by laboratory tests, passivates the cupronickel alloy surface;
- It is essential to monitor for possible leakages of nitrogen fertilisers from industrial stations to preserve the environment and human health;
- Despite suffering corrosion in the saline environment, cupronickel has good overall resistance to the corrosive process, and can be considered as the most suitable material for application in highly aggressive environments, for example, the system for capturing sea water.

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Reuse of waste from the manufacture of the granilite floor

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Abstract**—***The purpose of this article is to seek a use for the waste obtained through the reuse of the waste from the breakdown of granilite. In order to become a more economical and beneficial option for use in the mortar mix. The tests were carried out at the Civil Construction Laboratory of the Instituto Tocantinense Presidente Antonio Carlos, ITPAC-Porto in Porto Nacional, Tocantins. Granilite rejects were added in percentages of 5, 10 and 15 in traces of mortar idealized for plastering the wall, then tested and analyzed, where the objective was to develop a resistance equal or superior to that of a conventional mortar, working at a lower cost and evolving into a new mortar additive for plastering purposes.*

Keywords**— Cement, concrete, granilite, recycling.**

I. INTRODUCTION

The progress and growth of civil construction in the urban environment is visible, each. The number of materials used in this field is growing, and it is noticeable that amount of tailings leaving the construction sites, tailings that can be highly polluting and which are often destined in unsuitable areas, causing irreparable impacts.

It is of fundamental importance that technical measures are developed to reduction of "debris in civil construction", as well as a correct disposal of this material, such as recycling, which is unfortunately very delayed in Brazil. For this, the recycling process needs to be less complex and expensive, and this is only possible with research and use of techniques capable of improving the quality of the reusable product (MIRANDA, 2000).

A very important factor in encouraging recycling is to avoid the problem of contamination and degradation of the environment. Due to the generation of damage to the atmosphere, soil, fauna and flora, water table, throughout the life cycle. Thereby, universities and companies invest more and more in research on the topic "Recycling", but even so Brazil still needs to reach several levels on this subject (RUFINO and GALDINO, 2015).

When it comes to recycling waste from the construction industry, sustainable practice is consolidated, as resources are seen as limited. In view of this paradigm, the need to reuse materials, which contributes both to sustainable development and to economy (JOHN, 1999; CIRELLI, 2004).

Construction waste accounts for approximately 61% of the counties. Where each municipality is required to carry out an Integrated Construction Waste Management. And the material most used in these constructions is concrete. A material used on a large scale around the world. Cement is used in several steps within a building, including the floor. Floors are considered any continuous surface or not, that allows transit, whether heavy or light. Have resistance to wear caused by friction, as well as diversification of colors and dimensions. They must have easy conservation and hygiene and their resistance must be adequate according to the norm for each building (CAMARGO,2010).

The challenge of designing and executing ever larger floors is a major bottleneck in the construction industry. Therefore, the need to analyze the floors andof its best features.

1.1 Granilite

According to Francelino (2012), Granilite is understood as a coating concrete, that is, composed of water, cement and aggregates. The aggregates can be made of marbles or granites and are called granitina or granilha.

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In addition to contributing to strength, these materials also have the function decorative for its texturing.

They are rigid floors, used on a large scale, at low cost. They feature high resistance to abrasion, immune to the action of oils, good impermeability, and easy maintenance. They can be of the polished or fulge type, while the first receives the smooth finish the second keeps the relief of granitinas. Pigments do not affect the resistance of the floor, can be organic with greater capacity of dyeing, and inorganics with greater durability. Must undergo a cure minimum of 7 days (CAMARGO, 2010).

It is considered a micro concrete, being executed on a subfloor level and with expansion joints. They are mortar, and can be prepared directly on the construction site, the application is done in the same way as the plaster, by launch (GUIMARÃES, 2015).

They are brittle coatings, modulated in loco where they are usually polished. Inits composition takes the aggregant (cement) and aggregate (mineral) from the marble, limestone, quartz, granite and etc. when adding water and passing through the homogenization process the 1: 1.5 trace mortar (cement, granitin). Right after the polymer expansion joint is proportionally measured and seated on the counter floor or dead floor forming a box, if starts the filling process (MIRANDA, 2000).

According to Camargo (2010), after seven days of curing the granilite coating, with the aid of water, the grinding machine is used, where the "inserts diamonds or emery"of weight 0 # to 400 # are responsible for the process granilite dilapidation and polishing, providing the coating with an evenly matte gloss finish.

Once the granilite is dilapidated and polished, it is carefully washed, where post-drying the application of plaster begins, (mortar prepared with cement and white glue) that will be used in the drawing and filling of the voids leaving the coating with better rolling and uniformity.

1.2Reject

During the "hydrated dilapidation" of the granilite floor, the tailings produced that have the characteristic of viscous mud, which is basically the powder of this binder with its clusters. In which it is usually carelessly discarded reaching streams, rivers or lakes, polluting and contaminating nature.

With that, it was thought about reusing the waste from the production of granilite. Since it is discarded as waste from civil construction, there is no utility employed. Studies will be developed for preliminary analysis of material.

The main reuse will be as a mortar additive, aiming to increase the resistance, reducing costs and recycling material that was previously destined improperly. In mortar specifically, it is expected that the material will decrease the use of cement, increasing workability and strength.

Adherence tests "PULL - OFF" will be developed as an analysis of the parameters, seeking to evaluate by comparison the resistance and adhesion of the material.

It is necessary that we find a use for this waste to be less polluting, low cost and easy handling. Trying tolessen the impacts through reuse and creating a starting point for further studies and research in this segment.

Materials obtained in works in the region will always be used, always seeking to meet technical standards and basic safety and sustainability requirements. The tests were developed at the institution itself, with the support of the same.

The research aims to evaluate the best trace with the aggregate of the effluent waste from dilapidation of the manufacture of the granilite floor, in order to know if it will be possible to increase the workability and strength of the mortar at low cost using as additive the tailings obtained from granilite.

II. MATERIAL AND METHODS

The residue from the breakdown of granilite after naturally occurring dry, went through a brief manual grinding using the stainless steel diameter of 2.4 mm for the purpose of a brief inspection, in which it was removed any organic or mineral contaminants such as: kindling, plastics, rocky or similar fragments. Then he spent 24 hours in study to ensure the removal of moisture.

Table 1. Characteristics of aggregates

Aggregates	**Fine Aggregate**	**Granilite tailings**
Specific mass of aggregates (g / cm³)	2,632	0,00
Unit mass (Kg / dm³)	1,644	0,660
Maximum characteristic dimension (mm)	-	2,40

Pin-type wooden crates, 75 cm in size, were made 80 cm which, after being sealed with a release agent, were used as forms for the proof bodies.In the laboratory, preliminary tests were carried out that classified and prepared the materials that would be used in the mortar

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mix, in which it was empirical formulation for the mortar1: 1: 1: 6.

Where the proportional volume required for mixing was 8 kg of cement, 8 kgof lime, 8L of water and 48 kg of sandThe materials used for the trace were coarse sand with 15% moisture, Nassau "CP-II E" cement, hydrated lime from the Hydra brand, and water distilled.Each line was subjected to the Flow Table Test, carried out in accordance with the procedures provided for in NBR 13276.

The first stroke to be rotated was used as an initial basis for analysis comparative, in which it would not take the rejection of granilite in its composition. The second streak received 400g of granilite tailings from 8 kg of cement, 5% of 8 kg. The third streak was replaced with 800g of the 8kg granilite residue of cement, 10% of 8kg. The fourth line was replaced with 1200 g of granilite of 8 kg of cement, 15% of 8 kg.After the lines were prepared, the wood shapes were filled and carefully vibrated for the best settlement and accommodation of the mortar, seeking to follow the same pattern for all specimens. A point to note was that right after the first 20 minutes, the dashes with 0.0%, 5% and 10% showed visible in the specimens, obtaining the same characteristics.

Numerous authors cited by Goodwin and West (1980) observed a maximum adhesion for a given moisture content on the substrate.

Considering this, the molded specimens were waited 24h, where all specimens were immersed in a water tank for 28 days. On the 28th day, they were removed and kept for 24 hours for the start of the adhesion.

Each specimen after being removed from the tank went through a cleaning being removed any impurities that could prevent a better adhesion of the glue, for this was used a steel brush with three rows of bristles polished carbon steel with running water.For the adhesion test, we implemented the use of a drill holder with a bench vise from the Sparta brand, which aimed straight and with greater precision, avoiding the loss of the 90º angle as a specimen, and preventing the dimensional loss of the hole.For gluing the tablets, special series plastic glue based on polyester resin from the Anjo brand, where the catalyst used was the catalyst for glue plastic based on Angel organic organic peroxides.

Given the start of the test, a 50 mm diamond cup saw was used for the proper holes in the specimen where the first was 0.0% addition, after the eleven holes have been drilled, using a medium sized hand air pump all residue from the hole was removed, leaving all the holes clean and free of particles. The plates were glued and waited 24 hours to be given the start of the. These procedures were carried out systematically with all the specimens where the 44 were methodically performed (forty-four) pull-outs, 11 (eleven) of which by specimens.

The entire assay used as an analysis standard was the NBR 13528.

III. RESULTS AND DISCUSSION

The results obtained on the consistency table, Flow Table Test were; for 0.0% of tailings addition obtained 263mm of cohesion, for 5% of tailings addition obtained 239mm of cohesion, for 10% of tailings addition it obtained 218mm and for 15% addition of tailings obtained 160mm of cohesion.

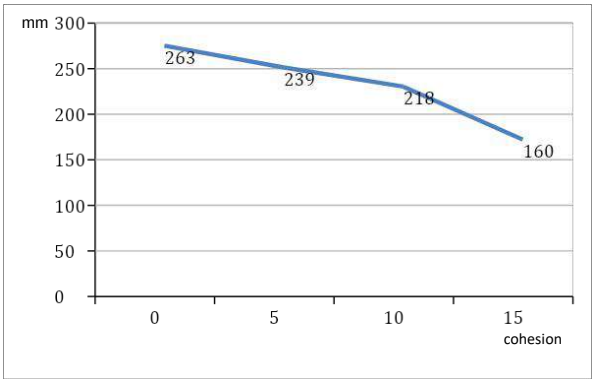

Fig 1: cohesion index graph

A few hours after the specimens were molded with the mortars, a longitudinal crack was observed in the specimens of 00% of 5% and 10% addition of the tailings, where after 28 days of curing, the demoulded this crack evolved into a crack after being demoulded.

As for the pathology, possibly "the phenomenon is caused by the dosage inadequate or inferior quality of the materials present in the mixture. Contribute for water loss failures in determining the type and content of binders, errors in the percentage of fines and the poor granulometric distribution of the sand"(AECWEB.2020). As well as indications indicate that this pathology has a correlation with cohesion index due to the retraction . In the adherence exit, three main types of disruptions being them.

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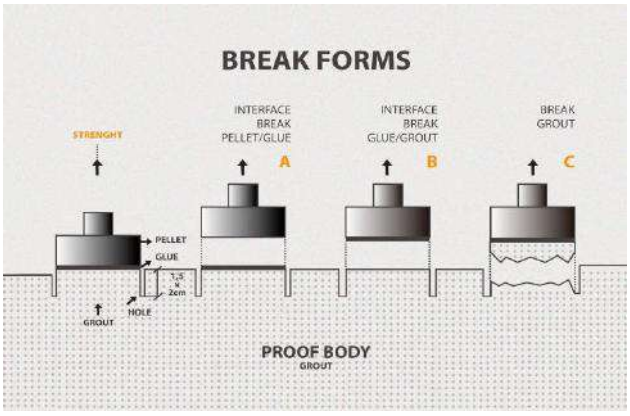

Fig. 2: forms of rupture

- Break in the insert / glue interface: indicates failure in execution (BARRETO and BRANDÃO, 2014).
- Break in the glue / mortar interface: considered as adhesive breaksindicates that this is the weakest layer of the coating. In this case, when results are low means that initial resistance is inadequate (powderiness) (BARRETO and BRANDÃO, 2014).
- Mortar break: Breaks are called cohesive when they occur in the internal regions of some constituent material (BARRETO and BRANDÃO, 2014).

To performing the test on the specimen we obtained the following data.

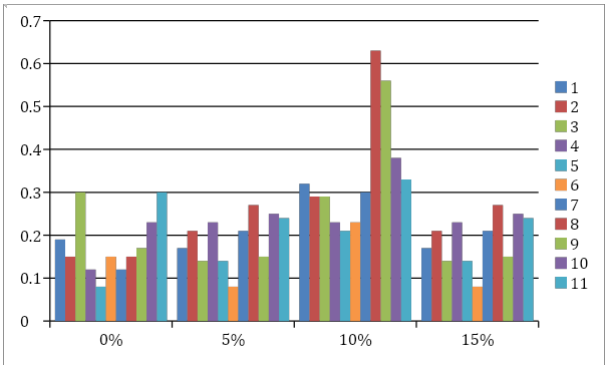

Fig 3: pullout graph

In the 11 (eleven) pull-offs performed on the specimen of 00% addition. I got 6 (six) adhesive breaks and 5 (five) cohesive breaks. In the specimen of 5% of addition we obtained 7 (seven) adhesive breaks and 4 (four) cohesive breaks. At the specimen of 10% addition we obtained 8 (eight) adhesive breaks and 3 (three) cohesive breaks. In the 15% addition specimen we obtained 10 (seven) breaks adhesive and 1 (one) cohesive breaks. There was not a break in the interface pastille / glue. Of the 44 holes, 29.6% resulted in cohesive rupture and 70.4% resulted in adhesive break. There is an increasing adhesive rupture, which points out that add the granilite tailings if there was a considerable increase in the characteristic powderiness. Data which was already expected due to the degree of fineness of the tailings.

Analyzing by the average of the efforts applied to each specimen we obtained the following parameters.

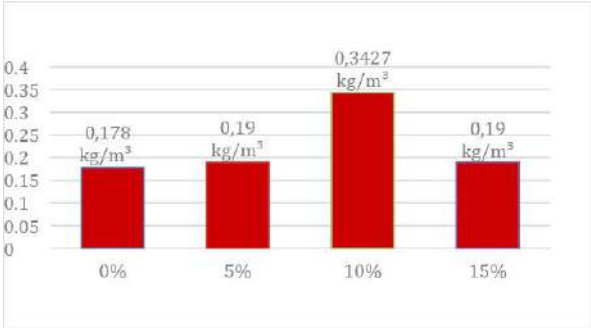

Fig. 4: averages chart

IV. CONCLUSION

When analyzing the results, some important points were obtained, among them evaluate the source of the tailings and the characteristics of the conditioning materials in its formation, such as the stone used in the execution of the floor that may be limestone or granite that due to the hardness index influences the dilapidation process, resulting in a rejection of greater or lesser weight, affecting the consistency that will result in the tailings. The pathology found in the specimens, possibly by the fine characteristic of the aggregate, limits its possibility of use, bringing greater attention to the possible use of mortars with the tailings.

As for the pullout result, in which 70.4% rupture of "adhesive" characteristic, demonstrates a worrying degree of powderiness, in which the chosen mortar mix was inadequate for the purpose. By analysis average of the efforts applied, it is observed that the bodies of evidence that received the granilite tailings in their composition behave positively, showing to support the efforts, the traction, as much as the sample without the rejection in composition, thus proving that it is possible to reuse this type of waste for civil construction works. It is also stated the importance of further studies and tests, like the ones presented in this article, for a better security of your application.

V. SUGGESTIONS FOR NEXT STUDIES

- Pathologies in plasters from purulent aggregates.
- Hardness index for materials based on granilite

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For a landscape policy in urban municipal planning – The paradigm of Salvador-BA, Brazil

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Abstract**—** *This text reflects on what comes to be landscape, through a visit to its history in brief lines, and what is its role in law. How the latter supports it in the Brazilian ordering from federal to municipal level. Likewise, it explores the curious theme under the construction of a historical teleological hermeneutics, touching on the sense of managing the landscape to maximize the socioeconomic well-being of the population of Salvador. The research carried out was of a descriptive nature, the method, which provided the logical bases, was the hermeneutic-phenomenological method. The collection of data and information was carried out through bibliographic searches. It is concluded, at the end, that the Master Plan of Salvador needs regulation in landscape matters, complex and dynamic cultural asset, which needs its own Landscape Plan, in a law that guarantees popular participation, under the terms of the Right to the City, in pursuit of sustainable development. To this end, it is essential to have a Public Policy in favor of the landscape, whose aim is to improve the quality of social and economic life and to accommodate movement within the city to stimulate income distribution.*

Keywords**— Landscape, Municipal Planning, Urban Law, Gentrification.**

I. INTRODUCTION

The construction of Salvador's landscape, aiming the maximization of social well-being through investments that mitigate the socioeconomic discrepancy, are part of a conception that faces the need to implement a landscape policy - this article's theme. The delimitation of the theme arose from the observation that, although there is still no national landscape legal system, nor specific law that provides for it, the protection of the landscape has gained strength in the Brazilian legal system, with its positivism in Federal Constitution of 1988. Since it is little explored, its protection gains greater importance as the demands of environmental comfort increase.

In this context, the Municipal Urban Master Plan of Salvador – Law 9,069/2016 decides to implement legal devices for the protection of the landscape in its core, already provided by the Federal Constitution of 1988. The concern with the protection of the landscape is due to the very need for obtaining a better quality of life for the population of Salvador, mainly due to the disorderly growth of the city. Thus, by becoming law, the landscape protection, at the municipal level reveals more than ever the importance of the institute for improving the quality of life of the city and preserving the urban environment.

However, despite the Municipal Urban Master Plan, as a municipal legal system, having incorporated the protection of the landscape, it is still very discreet when it comes to landscape management. We must recognize the legitimate attempt, however timid to protect small sites, with the provision of areas such as Cultural and Landscape Protection Area, with guidelines that, however, are not effective in planning and managing the landscape. On the other hand, it indicates that studies will be done for a law that regulates the provisions in the matter. At this point, it is essential to create a public policy aimed at regulating landscape planning, in harmony with the concept of landscape as a human right, already recognized by the European Landscape Convention of 20 October 2000.

Unfortunately, due to the absence of the regulation of Landscape Plans, what we have today in the Brazilian landscape order appears more as an adjective than as a program, not getting the relevance it deserves within the creative process of the city. Thus, the aim of this article is to perceive the landscape as the way to maximize

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socioeconomic well-being, since empty urban spaces, belonging and aesthetics are inseparable for the construction of quality of life. Fundamental rights are inherent to human beings who, when they are in clearly degraded space constructions, which are reflected through the landscape surroundings, affront human rights.

The approach methodology used was descriptive, aided by the phenomenological hermeneutic method, which led to the criticism of the institute in the current form that is prostrated in the local order, and also its being in a perspective of time and axiology. This manuscript is divided into six topics, including this introduction; the second topic is a historical revisitation of the landscape, its history, context, and concept, until the approach of its legal sense. In the third topic, the reader is invited to reflect on the legal production of landscape in the Brazilian system. In the fourth topic, its studies landscape protection at the level of the Municipality of Salvador. Finally, in the last topic, it presents the conclusions, with the identification of a segregating reality and the need to elaborate a landscape policy in favor of creating Landscape Plans for Salvador in order to decrease gentrification.

II. REVISITING THE LANDSCAPE

Landscape is a plurivocal term, it encompasses cities, forms its characteristic outline, also a signaling of the quality of life in the dialectic of human nature in search of harmony. The landscape is influenced by culture, its complex and polysemic, due to what Anthropology, Geography, History, Ecology attribute to it. Thus, the landscape that is built or protected, occurs, from inversions of public policies or their absence in a flow of space and time, being the result of their economic relations [1].

Nowadays, the mass consumer society prints the values of waste, an impression that occurs through gentrific planning, reflected in a concave way in the city, making it into a risky society. Thus, people's rights and domestic law, in some nations, add forces to curb the wear and tear caused by disorderly growth [2]. This need to protect the landscape is at the heart of the circle of technical revolutions that culminated in the Industrial Revolution.

This “brought catastrophic consequences for the cities, whose urban landscapes showed a reality of degradation and low quality of life for the majority of the population” [3]. Developmentalism constitutes fuel for the stratospheric increase in production and demand and the impetus of the revolution transformed provincial cities into busy and chaotic centers and removed people from the countryside and the domestic environment, concentrating them on the urban peripheries.

It turns out that this growth was not added to sustainability, because poverty persisted. Also, pollution, deforestation, the disordered occupation of urban, rural and natural spaces, as well as social segregation, increased. The growth of cities occurred in an accelerated and anarchic manner, giving rise to deplorable health conditions. The dominant ideology of progress went hand in hand to these technical revolutions, taking for granted "that the growing dominion of nature by man was the very measure of the advance of humanity” [4].

In the West, the old motto of the 19th century, “where there’s mud, there’s money” is perfectly suited for today, when Public Policies are gentrific. Likewise, with the prevalence of individualism, sites of transtemporal importance went down in favor of speculation, allowing subjects to become millionaires with the construction of a single well-located building. As Eric Hobsbawn explains, city centers, large and small, have been reinvented, "incidentally destroying medieval cathedrals in cities like Worcester in Great Britain or Spanish colonial capitals like Lima, Peru", and the historian says that "the decade of 1960 is likely to be the most disastrous in the history of human urbanization” [5].

With the advent of globalization, everything becomes more contingent and faster. In the same way that it is produced with a greater quantity in a shorter period, it is also discarded in the same measure, and cities do not escape this logic. According to the teachings of Ngaire Woods, globalization would be composed of four aspects: “internationalization, technological revolution, deterritorialization and liberalization” [6]. The first element (internationalization) is related to greater interdependence between nations, due to the increase in agreements, investments and capital flows; the second (technological revolution), the way in which the new media have made distance and location an irrelevant factor, mainly due to the advent of the internet; the third (deterritorialization) is linked to the decrease in the influence of local powers, as well as the fall of borders in which there had been particularities and a great local cultural diversity before; and the fourth and last (liberalization) is related to the distancing and weakening of the State in the economic sphere, as well as to an increasing timidity in relation to social benefits.

In other words, the landscape undergoes a new configuration in view of the aspects because in globalization there is a universal tendency to standardize spaces and, in underdeveloped countries, this uniformity occurs through social segregation, printing on the landscape all the distortions caused by the globalizing perspective [7]. When witnessing such a scenario of socio-

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environmental crisis from the second half of the 20th century to the present 21st century, with the explosive urbanization of the globe, especially in the third world, with more than half of the world population living in cities (see the example of Brazil: “in 1940 the urban population was 26.3% of the total and in 2000 it was 81.2% ”) [8], there is a concern for the protection of an institute little debated in the legal scenario, namely: the Human Right to Landscape.

This was born as a natural evolution of Environmental and Urban Law, as a necessity, in terms of the pursuit of sustainable development. It is that the citizen is not satisfied only with the supply of basic needs, but goes further, aiming at the realization of his subjective right to enjoy the quality of life, a concept that brings together aesthetics. In this way, in history, through which man travels, the landscape appears as a social and legal phenomenon, as a diffuse and collective interest, a fundamental right of third generation [9].

The administrative action, then, interferes in sectors and areas that “because they are natural like life itself, there is always the moment in which the habit has been the object of intervention[10]”, and so it happens, also, with the consumables, susceptible of exhaustion. But the landscape is never exhausted. There it remains, in constant transformation, and may reflect heaven or hell. And it is precisely because of its dynamic essence that, over time, the landscape transmutes. Thus, it transforms and degrades, being worthy of planning.

In addition, we must never forget that growth is “a journey with more shipwrecks than navigators - it excludes much more people than it is capable of integrate” [11]. In fact, attempts to achieve first world status led to third world countries, unwillingly, to develop underdevelopment. Brazil is a clear example since gentrification persists. For Sérgio Buarque de Holanda, “in Brazil, where, since ancient times, the primitive type of the patriarchal family reigns, the development of social imbalance is a mark, whose effects remain alive today” [12]. If before in this country it was seen "if not the true earthly paradise, undoubtedly a simile in everything worthy of it"[13], what would those navigators of the 16th century say if they unshiped Brazil in the 21st century? Perhaps they thought they had succumbed and sent to limbo. For, in countries where social inequality prevails, urban life is a purgatory.

In risk societies, there is a collective malaise due to the unfair distribution of income and social pressures from the periphery to the center. And precisely for that reason, there are also movements in response to the crisis caused by progress. The protection of the landscape is, in this way, identified as one of these movements, necessary for the achievement of sustainable development. For, the landscape is necessary in a spiritual, aesthetic, economic and quality of life sense, because it is healthy and pleasant to contemplate it, and it is necessary that it can also be economically evaluable. In other words, a landscape, as a regulatory outline, "is a guarantee against the arbitrary, because provides the satisfaction of the spirit" [14].

Thus, throughout history, the social machinery, deeply disturbed, oscillates between an improvement of historical importance or a catastrophe. And it is up to Law, through the defense of diffuse and collective interests, to make sure that this dazed social gear generates a historical improvement for the population, and the protection of the landscape is essential for this improvement. Precisely because the protection of the landscape is associated with the very idea of citizenship: “houses make a city, but citizens make a citizenship. The ability to translate into symbolic forms and human models a representative portion of a culture is the city's hallmark” [15].

As public policies must accompany the historical teleology that ensured the protection of the landscape as a legal institute. It must be created, transformed, and reinvented through urban planning that is committed to maximizing the city's socioeconomic well-being, also exalting its history. In this way, in order to protect the landscape, it is essential to know its transformation, identify its main features, characterize and balance its primordial estimates; so that, based on this holistic understanding, be able to act in safeguarding and strengthening this set of urban and environmental values together with the participation of the population - which define their character and identity. Paying particular attention to empty urban spaces for the purpose of democratize them.

The landscape can be conceptualized as a complex reality, as it is the result of material and immaterial, tangible and intangible components; dynamics, the result of environmental, cultural and social processes that have taken place over time in a certain space, marked by the ways of life, policies, attitudes and beliefs of each society; a sign of quality of life, also very important for tourism and internal movement of the city. There is a tendency for people to increasingly close themselves in clusters, excluding the rich city from the poor city. Landscape plans aim to democratize the space, leading to the most sensitive regions attractive to people living in other regions of the city, stimulating a movement that will directly influence neighborhood economies by promoting income

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distribution, thus, the landscape must be inserted in the Public Policies to come.

III. LANDSCAPE PROTECTION IN THE BRAZILIAN LEGAL ORDER

It should be noted that the landscape protected by law is dynamic and can be improved or worsened. But, despite the apparent confusion that these indeterminate terms ("worsened" and "improved") could cause, the doubt that hangs over them is clarified by constitutional and legal hermeneutics, according to their historical-teleological sense. Historically, the landscape is the result of Environmental and Urban law, it protects the spiritual, aesthetic, and economic sense of quality of life. Teleologically, it exists to protect and develop the urban and natural environment, in the dictates of Constitutional leadership.

The governing Brazilian Constitution of 1988, with its programmatic norms present in article 23, 24 and 216, protects remarkable natural landscapes, the environment, forests, fauna, and flora. It also requires observing the balance between development and well-being. It emphasizes the protection of the landscape heritage and determines the liability for damage to the environment and property and rights of landscape value. And adds that the assets of a material and immaterial nature, taken individually or together, bearing references to the identity, action and memory of the different groups that form Brazilian society, which include urban and rural groups, are part of the Brazilian cultural heritage. sites of historical, scenic value [16].

As per the Brazilian Federal Constitution of 1988, in article 23, III, it is the common competence of the Union, the States, the Federal District and the Municipalities to protect goods of historical and cultural value, remarkable natural landscapes and archaeological sites. Complements with article 24, items VII and VIII, when determining that it is up to the Union, the States and the Federal District to legislate concurrently on protection of the landscape heritage; liability for damage to the environment, property and rights of landscape value. Finally, it complements with its article 216 affirming that assets of a material and immaterial nature, taken individually or together, bearers of reference to the identity, to the memory of the different groups forming Brazilian society, which include urban complexes and sites of landscape value, are part of the Brazilian cultural heritage [17].

The tutelage of the institute radiates from the Constitution to hierarchically inferior norms, such as the City Statute, Law no. 10,257/2001. This regulates articles 182 and 183 of the Brazilian Federal Constitution of 1988 and, when establishing the general guidelines of urban policy, define as scope, in its article 2nd, order the full development of the social functions of the city and urban property, through the protection, preservation and recovery of the landscape heritage. In other words, it already exalts the importance of aesthetics, albeit implicitly, as it refers to improving the landscape through recovery.

City Statute (Law 10,257/2001) goes further, as provided in its article 37 on the Neighborhood Impact Study, which will be carried out in order to contemplate the positive and negative effects of the enterprise or activity on the quality of life of the population living in the area and its surroundings, including the analysis of the urban landscape. This article corroborates the perception of the dynamics of the landscape, as it reveals that an intervention may cause worsening or improvement in the landscape aspect of a given territory. When it comes to the construction of an industry, i.e., cannot escape the elaboration of a Neighborhood Impact Study, which may reveal the coherence or not of the enterprise, and the interest in seeking a more sustainable alternative [18].

Legal norms, in reality, already provided for the protection of the landscape long before the 1988 Brazilian Constitution, when in Decree Law no. 3,365/1941, in its article 5, considered that the protection of the landscape is a case of public utility. This decree deals with expropriation for public use, revealing the importance that the legislator offered to the landscape, decades ago. This device complements what has been stated so far in terms of landscape protection [19].

Furthermore, among so many attributions conferred to the Public Ministry, in the exercise of its investigative function, Law 8,625/1993, article 25, determines that this body must ensure the protection, prevention and repair of damages caused to goods of landscape value. It is up to the institution, when promoting its inquiries and public civil actions, to ensure the conservation of good landscapes. Once again, the legislator makes clear the importance of the institute [20].

In addition, the protection of the landscape in Brazilian law provides for sanctions of the last ratio against activities harmful to the landscape. Law no. 9,605/1998 clarifies, in article 63, that the alteration of the aspect or structure of a building or place protected by law, administrative act or judicial decision, due to its landscape value, without authorization from the competent authority or in disagreement with the one granted, may be penalized with imprisonment from one to three years and a fine. In article 64, determines the penalty of detention from six

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months to one year for those who promote construction on non-edible land or in its surroundings, thus considered due to its landscape value. Once again, the importance given to the institute is clear, since even criminal law typifies behaviors that damage the landscape [21].

It should be noted that criminal sanctions do not exclude administrative sanctions for the same reasons mentioned in the previous paragraph. Decree no. 6,514/2008 imposes fines from R$10,000.00 (ten thousand reais) to R$200,000.00 (two hundred thousand reais) for altering the aspect or structure of a place protected by law or construction on unbuildable ground or in its surroundings due to of its landscape value [22].

It is worth clarifying that this work does not intend to exhaust all the laws in landscape matters, nor does it provide material for a compilation of Landscape Law. Precisely for this reason, it will not mention all the legal provisions that aim to protect the institute, such an assumption would be totally incompatible with the object of this research. Thus, a final analysis of the rule will be made, as it deals with the Law of the State of Bahia with hierarchy over the Municipal Urban Master Plan of Salvador.

Law no. 10,431/2006 article 5, identifies the landscape as a natural resource, and environmental degradation is characterized by altering the characteristics of environmental resources resulting from activities that, directly or indirectly, affect aesthetic conditions, urban image, and landscape. In turn, the degrader is a person or legal entity, public or private, responsible, directly, or indirectly, for an activity that causes environmental degradation. It also emphasizes that the environment is the totality of elements and conditions that, in their physical, chemical, biological, socioeconomic and cultural complexity, and in their interrelationships, support all forms of life and determine their existence, maintenance and propagation, covering the natural and artificial environments. Thus, an urban park also fits the concept of the environment [23].

With the combination of the values listed above, it will be possible to fill the gap in the concepts of “better” or “worse” landscape. It will be better the closer you get to the principles listed above and grasped by constitutional and legal, historical-teleological hermeneutics. And it will be worse the further you are from these principles [24].

So, it is easy and safe to assess whether a road project or construction of a building, or intervention, will improve or worsen the landscape dynamics. It is possible to measure in which places of the layout of a road, or of civil construction, the landscape can be improved with its execution, as well as what damage it may cause. There are also ways to calculate the damage done and the compensation amount. This evaluation will be carried out through a survey that considers local customs, recreation, aesthetics, history, botanical relevance, or the auspices of the local population, all in the dictates of Brazilian constitutional system.

IV. THE RECEPTION OF THE LANDSCAPE PROTECTION IN SALVADOR’S MASTER PLAN

The Municipal Master Pan of Salvador lists as pillars, the foundations expressed in the Federal Constitution, in the Constitution of the State of Bahia, in the Organic Law of the Municipality of Salvador and in the Statute of the City (Federal Law no 10,257/2001). It states that the Municipal Urban Master Plan of Salvador must consider the provisions in the national and state plans and laws related to the urban development, mobility, housing and sanitation policies, and the environmental plans and policies. Such provisions of article 1 of Municipal Law no. 9,069/2016 - Municipal Urban Master Plan of Salvador, reaffirm the above understanding that the gaps regarding the protection of the landscape must be completed from a historical-teleological interpretation of the constitution and other laws that provide for landscape [25].

In article 2nd, it is stated that the Municipal Urban Master Plan of Salvador is part of the ‘Salvador 500 Plan’ - it is the strategic development plan for Salvador, with a horizon until the year 2049. In this plan, they establish guidelines and strategies for socioeconomic, cultural, and urban environmental development institutionalized in the Municipal Urban Master Plan. It is the plan proposed by the city in 2014, with the objective of ordering and controlling the growth of the city and is subject to principles and rules, many of them listed by the Municipal Urban Master Plan of Salvador itself [26].

Indeed, in its article 10, the Municipal Urban Master Plan of Salvador brings the principles that govern the Urban Policy of the Municipality of Salvador. Firstly, there is the right to a sustainable city, which implies a series of transformations in the form of production and consumption of cities with the aim of covering marginal urban areas. Likewise, the sustainable city corresponds to socially justice, environmentally balanced and economically viable development, aiming to guarantee quality of life for present and future generations [27].

This principle brings with clear objectives, set out in article 11. of the Municipal Urban Master Plan of Salvador, which states that the scope of the Municipal

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Urban Policy is to raise the quality of the urban environment. The improvement in quality would occur through the preservation and recovery of natural resources, the use of clean energy and technologies, the promotion and maintenance of environmental comfort. And finally, the protection of the landscape heritage.

In addition, it lists as guidelines of the Municipal Urban Policy the preservation of memory and local identity, by maintaining the symbolic and material characteristics of the spaces, scenarios and monuments that define the image of Salvador. That is, with its viewpoints, corridors, spaces, and visual cones, which privilege the elements of the natural and built landscape. Thus, it brings to light that it matters little whether the landscape is natural or urban, it must be preserved or improved; never deteriorated in favor of real estate interests. What we have in mind is that the Municipal Urban Master Plan of Salvador protects the interest of the population of Salvador and the right to the landscape is intertwined with the principle of a sustainable city.

Still in the guidelines, the Municipal Urban Master Plan of Salvador states, in its article 43, that the areas that contain landscape elements and that are configured as opportunities for cultural development must be identified. This is intended to preserve the landscape sites, as they directly reflect on the quality of life of the city population. Thus, the principle of sustainable cities is respected. The Municipal Urban Master Plan of Salvador itself already identifies some relevant areas, including landscaping sites (Area of Cultural and Landscape Protection).

Along this path, in his article 129, the Municipal Urban Master Plan of Salvador goes on to state that it is the objective of the Municipal Urban Policy to promote the conservation of the original landscape units. Likewise, the remnants of the different ecosystems in the municipal territory. Such preservation must occur with the possibility of its coexistence in the city space as elements of environmental comfort, economic development, and urban qualification.

The Municipal Urban Master Plan of Salvador creates a system of protected areas, which is extracted from article 126, when he affirms that the structuring elements are the axes that constitute the urban space with characteristics that allow to achieve greater balance between the built areas and the open spaces. Among these, the System of Areas of Environmental and Cultural Value is comprised. This is constituted by a set of spaces of relevant interest and environmental quality and by the landscape set, among others, becoming landmarks of the city, also comprising parks and squares for the population to live together.

The Municipal Urban Master Plan of Salvador, in article 194, further determines that the Law on Land Use and Planning should classify land use in relation to the negative in the urban landscape. It is admitted, as already mentioned, that the landscape is dynamic. Interference can worsen the landscape, and this is not in the Municipality's interest. This worsening should only happen when, in a weighing of public interests, there is no other way; and that the right to be protected is more important, in that panorama, than the protected landscape.

In its article 130, the Municipal Urban Master Plan of Salvador characterizes macrozoning as the instrument that defines the structuring of the territory in view of the strategic urban and socioeconomic development actions established for the duration of the Urban Master Plan. Such structuring aims to constitute the spatial basis of other instruments of the Urban Master Plan and to combine social and economic demands with the needs of environmental conservation and the enhancement of the urban landscape.

Corroborating this understanding, the law determines, in article 156, the objectives of the territorial conservation of the Environment Conservation Macro-zone. Specifically, it would have the function of guaranteeing the conservation of the Cultural and Landscape Protection Areas, members of System of Areas of Environmental and Cultural Value. It remains clear the cohesion of the Municipal Urban Master Plan of Salvador when it comes to protecting the landscape. From principles to delimitations, Municipal Law No. 9,069/2016 provides sufficient legal grounds for the protection of the institute, as it values its preservation and improvement. In other words, it is harmonic with the constitutional and legal norms listed in this work.

Regarding macro areas, in almost all of them, the Municipal Urban Master Plan of Salvador provides for enhancement and protection of the landscape. For this work, the most important devices that refer to macro areas are articles 158 (reference to the enhancement of the landscape), 143 (values the quality of the landscape), 150 (improvement of the urban landscape) and, especially, article 151, as it deals directly with the conservation of the areas that are part of System of Areas of Environmental and Cultural Value and the Cultural and Landscape Protection Areas, mainly with the preservation of environmental quality and landscape attributes. In other words, it protects the macrozones of environmental conservation in several articles.

Such an approach expresses the self-sufficiency of devices in favor of protecting the landscape in the

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Brazilian legal system. Although there is still no Brazilian law that deals with the landscape in isolation, which would be positive, as it would give greater security to the Justice in the application of the institute, since the sparse norms when concatenated can be said to form a national landscape system, although still timid that there is no one hundred percent law dedicated to the topic. Thus, it is proven that in Brazil, from the constitutional to the Municipal level, there is an immense list of rules and principles in various laws in favor of the protection of the landscape, but still lacks in public policies in its favor.

V. CONCLUSION

As mentioned, the landscape is a complex and dynamic cultural asset. In other words, its transformation, with a view to bringing improvements to the population, results from the development of society, whether from the micro or macro dynamic point of view. However, the construction of the desired landscape must undoubtedly be sponsored by the government, through the production of a public policy aimed at improving the landscape and the historical conservation of the Salvador memory, with a view to bringing not only comfort to the population, improving their quality of life, but, in the case of Salvador, also for the economic stimulus through tourism.

With regard to the city of Salvador, the main owner-entrepreneur agents are companies, individuals, the State, associations and churches, with real estate companies having the land ownership of most of the land related to this universe, 32.6%, and of built area, 51.1%; meanwhile, State production is restricted to a paltry 2.8%. The commercialization of access to urbanized spaces is patent and restricted to the minority of the population that has the monetary capacity to be inserted in these commercial relations [28].

Very soon, the Municipal Urban Master Plan of Salvador of 2016 brings in its center couple areas considered as Area of Cultural and Landscape Protection, wanting to give guidelines for the use and zoning of them, what is verified, in reality, is the construction of the landscape not by the State, which leads to the risk of the city's disorderly, gentrific and unequal production. The profit maximization logic makes the real estate companies, in the production of space, not interested in investing in infrastructure devices for the population. There is the implantation of these structures in ‘clusters’, with leisure equipment structured only to enhance the rich. The State then has a fundamental role in the redistribution of these investments since the capitalist logic deepens the segregation of space. In fact, housing is a commodity that requires a high level of resources for those who want to access it. In Brazil, there is a historic inequality of income distribution, the logic is repeated, to the point of reproducing wealth in the hands of a few. The role of the State is essential to equalize this balance. It happens that the State is controlled by the dominant bureaucracy, this one, conducts its actions and thoughts in the sense that corresponds to the interests of the social group of which it is a part, and from this the production of life is sponsored and by ricochet, the production of space.

City statute required direct and substantial popular participation in the implementation and execution of the Master Plans in all urban planning processes. Scientific positivism applied to public administration, in the urban-rationalist and purely technocratic realm, without popular participation, leads to the mismatch and disruption of the singularity of individuals, their traditions and history. The consequence of this is the expulsion of low-income populations to the most extreme areas of the city with inadequate services and equipment.

It is up to the State, then, not only to present texts such as 'dead letter', in guidelines that will never be realized. It is essential that, initially, through a policy in favor of the landscape, a landscape plan is established for these regions, with their conservation, development, restructuring or tipping and allocation of resources, depending on the case, but always with a view to reducing inequalities and provide access to the landscape for the population that needs it most. Thus, there is an urgent need for the creation of a law that establishes a Landscape Plan for Salvador and that assure popular participation in this process, to guarantee the human right to landscape.

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Systematization of Nursing Care in Wound Treatment

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Abstract *— The present study aims to investigate, in the scientific literature, the Systematization of Nursing Care in Wound Treatment. This is a bibliographic study, systematic-review type. The search for articles was performed; published in the past ten years (2010 to 2020); in Portuguese, English and Spanish; fully available. The following data platforms were consulted: BDENF, LILACS, MEDLINE and SciELO. The data were organized and presented in figures and tables. The results of the study revealed that, of the 506 studies found, 15 were available at BDENF; 29 at LILACS; 459 at MEDLINE; and 3 at SciELO; however, after reading, only those that met the inclusion and exclusion criteria described in the methodology remained, totaling 6 studies. After reading the selected studies, the articles were categorized into thematic clippings, classifying the knowledge produced about the theme. This study revealed the importance of nurses in the clinical care of wounds, and their search to specialize in the care of the patient. An essential professional in the prevention of the disease, restoration of health, patient education and dressing.*

Keywords *— **Nursing Care**, **Patient Care Planning**, **Wounds and Injuries**, **Therapeutics.***

I. INTRODUCTION

With numerous causes, wounds are defined with the "discontinuity of a body tissue", and may be associated with metabolic problems, circulatory impairment, continued pressure, in addition to traumas, surgical procedures and therapeutic measures such as catheter implantations. Skin lesions represent a public health issue, of worldwide scope. In Brazil, approximately 3% of the country's population have some type of injury [1].

The treatment of wounds was historically inserted as a practice of the nurse class. The care of injuries is attributed to the nurse, as legally established by Resolution of the Federal Nursing Council 501/2015. The treatment of wounds is a specialization of Nursing, recognized by the Brazilian Society of Dermatological Nursing (SOBEND) and the Brazilian Society of Stomatherapy (SOBEST), which guarantees autonomy to the specialized professional to work at the various levels of complexity in health [2, 3].

As the basis of this type of care, we have the Systematization of Nursing Care (SNC) and the 5 stages of the Nursing Process (NP), which support the organization and clinical reasoning of the nursing professional, aiming to provide comprehensive and holistic care to patients affected with skin injury. And for this care to be recognized internationally, there is a recommendation to standardize vocabulary and classification system [4].

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To this end, the Taxonomies NANDA I (North American Nursing Diagnosis Association), NIC (Nursing Interventions Classification) and NOC (Nursing Outcomes Classification) are tools that enable this systematization in accordance with current legislation. This allows nurses to present real or potential problems, in addition to therapeutic possibilities and evaluation parameters of the interventions performed, at the level of nursing competence internationally [3].

The elaboration of this study is associated with the need to explore comprehensively this public health issue that represents so much complexity and challenges, whether in the hospital or outpatient context and that has nursing as the protagonist of the process. The aim of this study is to investigate, in the scientific literature, the Systematization of Nursing Care in wound treatment.

II. METHODS

This is a bibliographic study, integrative-review type, in which search for articles for methodological development was carried out and the following steps were covered: elaboration of the guiding question and objective of the study; definition of inclusion and exclusion criteria for scientific production; search for scientific studies at databases and virtual libraries; analysis and categorization of the productions found; results and discussion of the findings [5].

For the survey of the guiding question, the PICO strategy was applied (P-population/patient, I-intervention/interest, C-comparison/Absence and O-outcome). Strategy based on the segmentation of the hypothesis, which aims to collect data systematically [6].

Thus, the following research guiding question was defined: "How is the systematization of nursing care performed for wound treatment?" (Figure 1).

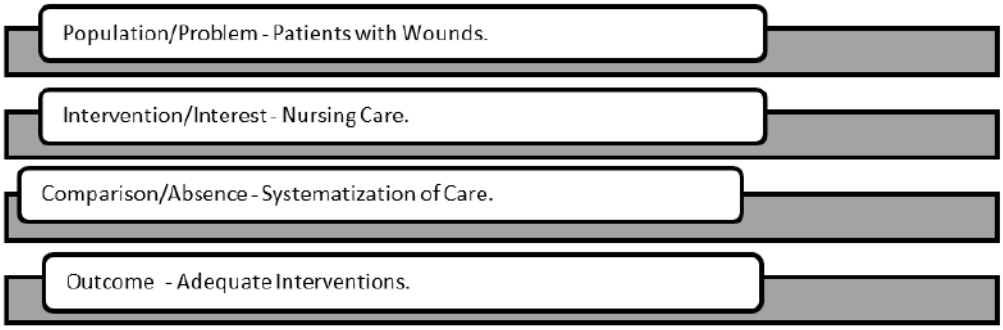

Fig.1: Definition of the guiding question according to the PICO strategy, Recife, Pernambuco, Brazil, 2020.

Source: Created by the authors.

For the selection of articles, the following inclusion criteria were used: be an original article, published in Portuguese, English or Spanish, in the past ten years (2009 to 2019) and be fully available. Theses, dissertations and monographs, editorials, case studies, integrative, systematic and conceptual reviews, as well as repeated studies found at more than one database or virtual library, as well as articles that did not answer the guiding question, were excluded.

Data collection occurred during January and March 2020 at the following databases and virtual libraries: Nursing Database (BDENF), Latin American and Caribbean Health Sciences Literature (LILACS), Medical Literature Analysis and Retrieval System Online (MEDLINE) and Scientific Electronic Library Online Library (SciELO). Those databases and libraries were chosen because they comprise the published literature, as well as Brazilian technical-scientific references in public and collective health. The descriptors were crossed. "Nursing Care", "Patient Care Planning", "Wounds and Injuries" present at the base of Health Sciences Descriptors (DeCS) combined with the Boolean operators AND and OR, performing joint and individual search for possible differences to be corrected.

The selection of studies was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses – PRISMA, a checklist with 27 items and a four-step flowchart, with the objective of assisting in the development of articles [7]. At first, duplicate studies were eliminated by reading titles and abstracts. Those pre-selected were fully read in order to verify those that met the guiding question and the inclusion/exclusion criteria. The final sample was then constructed with studies relevant to the pre-established criteria (Figure 2).

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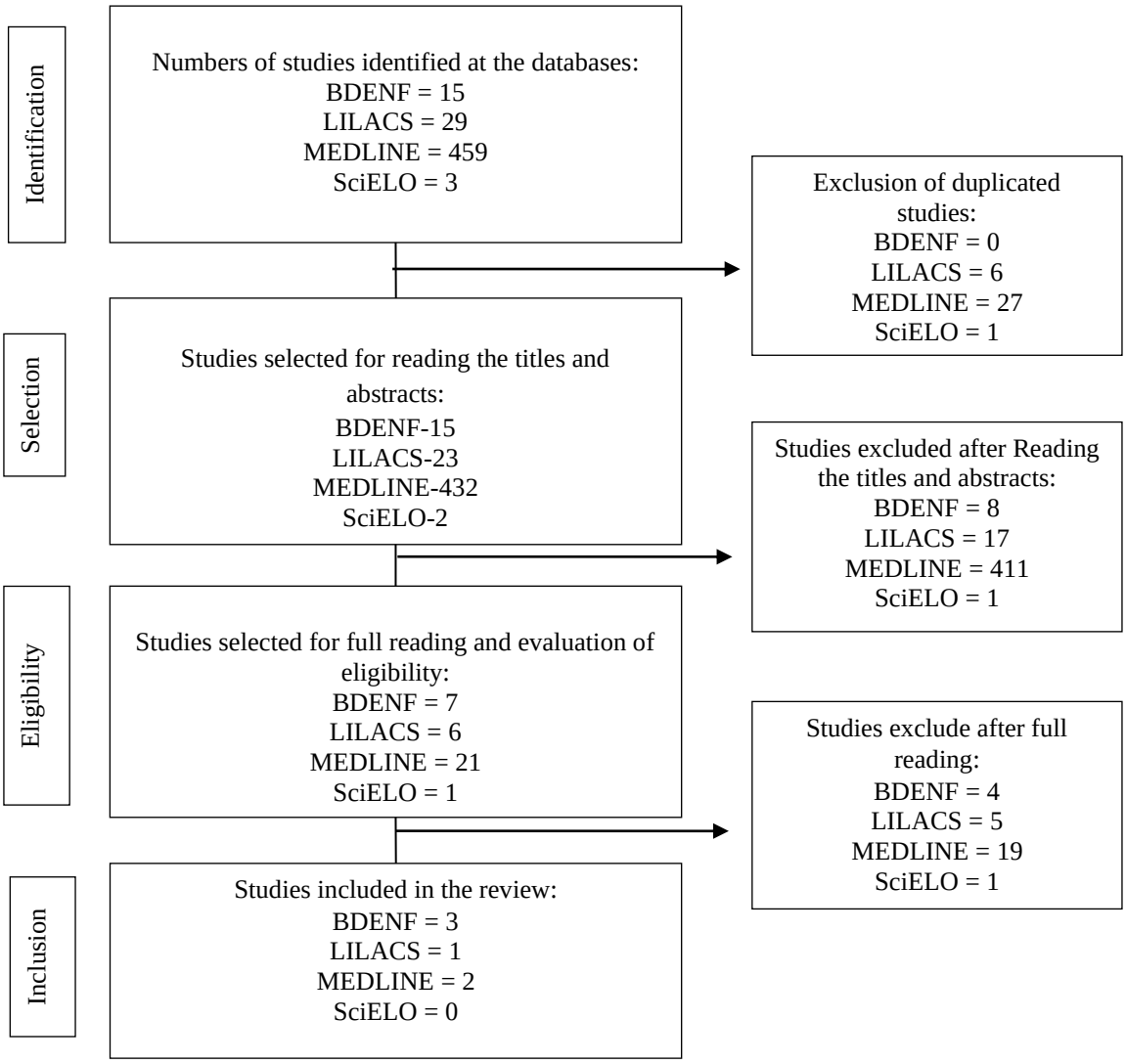

Fig.2: Flowchart of the selection of studies according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2015). Recife, Pernambuco (PE), Brazil, 2020.

Source: Created by the authors.

The level of evidence of the selected studies was determined according to the Agency for Healthcare Research and Quality [8]: Level I- Meta-analysis of multiple controlled studies; Level II - Individual studies with experimental design; Level III- Study with a quasi-experimental design as a study without randomization with a single pre- and post-test group, time series or case-control; Level IV - Study with non-experimental design as correlational and qualitative descriptive research or case studies; Level V- Case report or data obtained systematically, of verifiable quality or program evaluation data; and Level VI- Opinions of reputable authorities based on clinical competence or opinion of expert committees, including interpretations of information not based on research.

In order to simplify the understanding of the publications selected in this integrative review, the data were organized in figures and tables, exposed descriptively.

III. RESULTS

Of the 506 studies found, 15 were available at BDENF; 29 at LILACS; 459 at MEDLINE; and 3 at SciELO; however, after reading, only those that met the inclusion and exclusion criteria described in the methodology remained, totaling 6 studies.

Table 1 highlights the selected publications according to the databases analyzed.

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Table 1: Selected publications on the topic, organized according to Databases/Virtual Library. Recife, Pernambuco (PE), Brazil, 2020.

Database/ Virtual Library	Articles Found	Articles Selected for Full Reading	Final Sample
BDENF	15	7	3
LILACS	29	6	1
MEDLINE	459	21	2
SciELO	3	1	0

Source: Created by the authors.

In table 2, the studies surveyed are arranged highlighting their titles, authors, years of publication, design, location and language. Most studies were national, published in Portuguese in the past 4 years (n=4), an article was international and published in Spanish.

Table 2: Results found in studies according to title, database, authors, year of publication, design, location and language. Recife, Pernambuco (PE), Brazil, 2020.

	Title/Database	Author/Year	Design	Location/Language
A	Nurses' performance in the care of skin lesions (BDENF).	(CAUDURO et al., 2018).	Descriptive and exploratory study with a qualitative approach.	Rio Grande do Sul (Portuguese).
B	Nursing diagnoses in outpatient care for patients with wounds: cross-mapping (BDENF).	(OLIVEIRA et al., 2017).	Retrospective observational, cross-mapping research.	Rio de Janeiro (Portuguese).
C	Nursing care for adult patients: prevention of cutaneous mucous lesions and patient safety (BDENF).	(BUSANELLO et al., 2015).	Descriptive and exploratory study with a qualitative approach.	Rio Grande do Sul (Portuguese).
D	Classifications of nursing interventions and outcomes in patients with wounds: cross-mapping (LILACS).	(OLIVEIRA et al., 2016).	Retrospective observational, cross-mapping research.	Rio de Janeiro (Portuguese).
E	Care for people with oncological wounds: permanent nursing education mediated by educational technologies (MEDLINE).	(VICENTE et al., 2019).	Qualitative, exploratory-descriptive research.	Santa Catarina (Portuguese).
F	The advanced practice nurse in the adequacy of care of chronic complex wounds (MEDLINE).	(JIMÉNEZ-GARCÍA et al., 2019).	Quasi-experimental pre-post-study without a control group.	Andalusia (Spanish).

Source: Created by the authors.

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After reading the selected studies, the articles were categorized into thematic clippings, classifying the knowledge produced about the theme, in levels of evidence, mostly level IV- Study with non-experimental design as descriptive correlational and qualitative research or case studies [8].

The main findings, arranged in the objectives and conclusions, are directly associated with nurses' actions in the care of skin lesions as shown in table 3.

Table 3: Results found in the studies according to the levels of evidence, objectives and conclusions. Recife, Pernambuco (PE), Brazil, 2020.

	Level of Evidence	Objective	Conclusion
A	IV	To know the role of nurses in caring for patients with skin lesions.	There was improvement of nurses, through permanent education, teamwork and the assistance of the Commission for Prevention and Treatment of Wounds, a strategy for skin care stimulating clinical reasoning through discussions of case studies, analyzing the nurses' behavior and directing professional practice towards collective, dialogic and critical care.
B	II	To cross-map the terms identified in the medical records of patients with wounds according to the NANDA International Nursing Diagnosis Classification.	Cross-mapping allowed the identification of the main nursing diagnoses in patients with wounds, indicating the possibility of developing a clinical protocol, which will contribute to a nursing advanced practice.
C	IV	To identify nursing care for the prevention of cutaneous-mucosal injuries in adult inpatients and possible difficulties found by professionals to promote those actions.	The care provided for the prevention of cutaneous-mucosal lesions is mostly in accordance with what the literature recommends. However, the meaning of patient safety is restricted to care with the prevention of falls and the prevention of pressure ulcers.
D	II	To cross-map the terms referring to nursing interventions and outcomes in the medical records of patients with wounds compared to the classification of nursing interventions and outcomes.	The cross-mapping of nursing interventions and outcomes in patients with wounds suggested the inclusion of taxonomies to adapt to outpatient care.
E	IV	To recognize the educational technologies used in the process of updating nurses in the care of people with head and neck cancer.	The technologies should be integrated with permanent education, in order to achieve the various benefits recognized in professional practice.
F	III	To determine the impact of nurses with advanced practice in the care of chronic wounds in the adequacy of treatments for patients with chronic wounds and in the consumption of dressings in the districts where they were implemented.	The prevalence of chronic wounds during the 2 years of implantation decreased by half, a correct adaptation of the training and consultancy plan was achieved, managing to rationalize health expenses and an efficient service to people with chronic wounds.

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IV. DISCUSSION

The treatment of wounds aims to accelerate healing, consists of a complex approach of the individual who is injured and needs treatment, being more than a simple execution of the dressing, and the nurse has autonomy for evaluation and intervention in this situation, and must structure his/her actions in the Nursing Process, as well as document it. Technical-scientific knowledge is required to address the needs of patients with wounds. Therefore, to organize nursing care, it is essential to use the Systematization of nursing care [9, 10].

The nurse's knowledge of acting before people with wounds is protected by several authors as an evaluation, in which systematic steps ordered by a routine are preferably used, almost always by the Nursing Process. Thus, the evaluation is seen as support for the elaboration and development of an appropriate strategic treatment plan, bringing together a broad therapeutic approach with varieties of methods conducive to perform it, providing effective healing and comfort for the patient [11, 12, 13].

The construction of the Systematization of nursing care is also composed of the elaboration of diagnoses, which adds the imprescindibility of modifying the focus for the patient as a whole, to plan effective actions that can enable an improvement in quality of life. Therefore, it is essential that the nursing professional responsible for the basic team be trained with essential knowledge about wound care, providing individualized and comprehensive care to the patient and his/her family. As it is a complex process, it is crucial that nurses perform systematized evaluations, with different prescribed frequency of type of dressings ideal for tissue reconstitution, considering the environmental and physiological factors that interfere in the evolution, in quality and healing time [10, 14].

The nurse should perform a thorough evaluation of the wounds, since their characteristics will guide the selection of treatment. For this reason, the professional must have technical and scientific knowledge to be able to point out the appropriate individualized therapeutic option. Studies have shown low knowledge about the evaluation and treatment of injuries, which may end up harming the nursing process in the early stages. Inadequate treatment can cause the development of infections, delay the healing process, increase the length of hospitalization, the use of multiple antimicrobial therapies, compromise patient safety, reduce the quality of life of individuals and burden the costs of care [15].

Under the interventionist view of nursing, the information collected should be recorded in specific documents or systems of each institution, aiming at improving care, maintaining multidisciplinary communication and conferring security of the client's records, containing the essential findings for treatment. The records also contribute to the continuation of care after the individual returns to his/her residence, considering several aspects, such as the socioeconomic, family and nutritional situation that directly influence the care plan, especially in the acquisition of medications and dressing materials, which portrays the vulnerability of the person [13, 16].

Studies reveal a scarcity of nursing documentation in different aspects of care. Referring to wound care, a study in an Intensive Care Unit showed that in 65% of the wound records there was no type of tissue, in 85% the type of exudation was missing, in 100% there was no measurement of the wound and in 80% there was no record of the characteristics of the margins and the bed of the wounds [15].

The guidelines are of great significance in outpatient care, especially in the care of wounds. In services where patients receive care weekly, or fortnightly, the guidelines on the procedures for performing the dressings at home are duties of the nursing team. Through them, self-care can be provided and patients can be empowered by the necessary subsidies for their own care. Among the guidelines, we highlight factors associated with the periodicity of dressing change according to the product in use and measures to control infection in wounds [1].

Therefore, nursing professionals are among the members of the multidisciplinary team most requested to perform care for people with wounds. As for institutional protocols, its importance is perceived for the team, because, in addition to contributing to the members of the skin/wound committee, they can provide security to other professionals who answer the client, guiding people with wounds regarding the importance of continuity of treatment [10, 15].

V. CONCLUSION

The integrative review elaborated allowed detecting the apprehension with the treatment of wounds, since they can lead to a high degree of dependence and alter the patient's quality of life. Thus, it was observed the importance of nurses in directing their care to the person individually, preserving his/her autonomy in an attempt to contribute positively to the treatment. However, there is a scarcity of studies valuing the professional, essential in prevention, health promotion and ongoing education.

The execution of the steps of the SNC, especially collection of data, diagnoses and interventions, tends to provide a greater promotion of good outcomes. Therefore, this study revealed the importance of nurses in the clinical care of wounds and their search to specialize in care for the patient. An essential professional in the prevention of the disease, restoration of health, patient education and dressing.

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Recycling of plastic waste in the 3D printing process with the potential for stem production, mobile part of the facial protector: Literature review

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Abstract**—***When the health system goes into crisis and the lack of personal protective equipment becomes a reality, it is recommended to cancel all procedures that are not urgent, to carry out the contingency in the use of personal protective equipment. Besides for this scenario, the use of masks beyond the expiration date designated by the manufacturer and their reuse are actions indicated by the National Health Surveillance Agency (ANVISA) in a Technical Note released on March 31, 2020. To minimize the contamination of the mask, the health professional should use a face shield: The rapid technical evolution of additive manufacturing (AM) allows a new path to a circular economy using recycling and distributed production. This article aims to examine the current advances in thermoplastic recycling processes using additive manufacturing Technologies. After proposing the production of the stem using recycled material for DRAM, a comprehensive and in-depth review of the literature on the feasibility and state of the art of reusing plastic waste in materials using the Scopus, web of Science, and Springer databases. The results suggest that few works have been carried out for the recovery and preparation stages, while a major advance has already been made for the other stages to validate the technical feasibility, environmental impact, and economic feasibility. The development of each proposed stage using the open-source approach is a relevant way to dimension the DRAM to reach the technical potential for producing the stem.*

Keywords**—Additive manfacturing; Individual protection; Plastic recycling.**

I. INTRODUCTION

The WWF study [1],indicates that the volume of plastic that leaks into the oceans each year is approximately 10 million tons, which is equivalent to 23,000 Boeing 747 planes landing in the seas and oceans each year.To tackle this problem of waste accumulation, the european strategy for recycling plastics and the increase in the circular economy, highlights the political and business debate around the sustainable development of industrial production [2]. The circular economy addresses a central question of society about the current principle "take, make, dispose" (linear economy) and its negative effects caused by the depletion of natural resources, waste generation, loss of biodiversity, pollution (water, air, soil) and not sustainable economy [3].

The validation (technical, economic, legislative) of plastic waste as a secondary raw material in industrial processes is now considered a central objective to integrate the EC in the plastic value chain [4]. Open and closed loop recycling strategies, as well as upcycling and downcycling functionality approaches can offer ways to validate secondary raw materials [5].

Recycled materials have also been used in additive manufacturing (MA). In this process, the pieces are made by the consecutive deposition of layers of material guided by a three-dimensional (3D) model of computer aided design (CAD). With the end of the FDM process patent in

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the 2000s, the development of self-replicating machines known as RepRap (Replicating Rapid Prototyper) began. These printers have open source software and hardware available for anyone to download the software and projects, building their own version. In economic terms, the global additive manufacturing market is expected to reach US $ 23.33 billion by 2026 [6]. However, determining when and how to reap the benefits is a challenge for traditional means of production.

From the point of view of society, [7] product development may change from traditional stage-gate models to iterative and agile processes, changing the scenario by 2030. A large number of products can now be manufactured with additive manufacturing, which affects the geographic distribution and density of supply chains. global values [8]. It is expected that the range of products produced by additive manufacturing to date is printable and that in the near future it will be much greater, since the production of multi-material and built-in functionalities (for electronic products) is already possible in large quantities. In addition, the production of spare parts can be carried out on site, changing the role of suppliers in the production lines [9]; [10] explored the stages of distributed model factories and types of decentralized production ranging from distributed resources to cloud production. Thus, the need for transportation will be much more careful due to the fact that additive manufacturing allows the decentralization of production to locations close to customers or in the most extreme scenario distributed at the customer's premises [12]; [13]. In addition, this technology makes it possible to reduce barriers to market entry, reduce capital requirements and achieve a minimum efficient production scale to promote distributed and flexible forms of production [14]. This allows an alternative option from an economy of scale to an economy of scope, where products are highly personalized.

A better understanding of the different steps required to transform plastic waste into secondary raw materials for additive manufacturing is needed. Therefore, this work presents a study of systematic literature review. Addressing some important points regarding the problem in relation to the polymeric mixture, polymers versus additive manufacturing and environmental issues.

II. METODOLOGY

Five reviews have been identified in the literature [15], which address the qualitative and quantitative environmental impact of 3D printing in order to provide a comprehensive understanding and better guide research on the subject. A framework has been proposed to assess and improve the sustainability of 3D printing processes through the integration of CAD and LCA software, followed by a review [16]. The environmental performance of additive manufacturing was analyzed, showing that most authors are concerned with the energy consumption of additive manufacturing equipment. [17] describes the evolution, advances and predictions of the 4D printing life cycle, focusing on intelligent materials and associated characteristics as their response to stimuli, along with future challenges. The review of [18] analyzed the state of the art of sustainable additive manufacturing and classified 63 articles in three areas: environment, economy and society. Finally, a review conducted by [19] assesses the economic and environmental sustainability of additive manufacturing techniques by analyzing different sources in the literature, including standards proposed by different regulatory bodies located around the world, highlighting the importance of models for the construction of indicators risk.

In several studies examined in this literature review, comparisons have been made between conventional machining processes in the additive manufacturing process using LCA software as a comparison tool.

[20] assessed supply chain delivery times, primary energy consumption in the life cycle, greenhouse gas emissions and the life cycle costs of a product produced by additive manufacturing. [21] compared the environmental impact of conventional additive manufacturing using carbon fiber composite material in production. [22], assessed the environmental impact of additive manufacturing and rapid prototyping to assess manufacturing time and the cost of manufacturing metal components. [23] compared a centralized manufacturing system on a conventional mass scale for the production of a glass frame, with a distributed manufacturing system compatible with 3D printers. [24] carried out a study of the environmental impact of different impeller manufacturing methods, by immersion milling (CM), laser coating formation (MA combined with CM) and remanufacturing of additives (RM).

[25] related energy consumption and the environmental impact of direct energy deposition with traditional machining processes. [26]; [27] compared the environmental impact of the machining process taking into account a conventional approach using single scale or batch production. [28] studied the effects of recycling up to four extrusion cycles on electronic waste and the production of virgin plastic filaments, proposing a mechanism for integral semi-quantitative degradation supported by FT-IR and TGA results. [29] indicated the

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different approaches to manufacturing aluminum alloy components manufactured by additive manufacturing and other traditional processes. The results revealed that, for the case studies analyzed, additive manufacturing is a sustainable solution for the production of aluminum components for the following specific scenarios: when creating highly complex shapes, when significant weight reduction is necessary and when be used in transport systems. [30] assessed the environmental impact of additive manufacturing based on the robotic welding process, a 3D metal printing technique, and compared it with the green sand casting process and Computer Numerical Control milling. Through the literature and databases, they concluded that the results can vary significantly according to the shape of the product, its function of the materials used and the configuration of the process.

The rapid prototyping technique has also been used to assess environmental issues related to additive manufacturing. [31] showed additive manufacturing processes through the sintering process and selective laser fusion, identifying their most significant environmental impacts. Subsequently, [32] developed a method considering all the flows involved (material, fluids, electricity) in order to obtain the environmental impact study. This method was developed based on a predictive model of flow consumption to produce a certain part that was defined by the manufacturing route and the CAD model.

III. RESULTS AND DISCUSSION

The European Commission, plastic materials are a priority area aiming to make all packaging made of recyclable material by 2030 [33]; [34]. In addition, it is a key enabler for circular economy, to close the polymer waste cycle [35]. However, mechanical recycling encounters several obstacles, since management and collection are complex technical considerations of plastic degradation [36]; [37]. The incompatibility between most polymers makes the classification process essential for satisfactory properties [38]. The separation of flexible laminated structures (for example, food packaging) for recycling, not economically, which explains that packaging applications, the biggest contributor to the production of plastic waste, are sent to landfills [39].

From a logistical point of view, the recycling process is less economically viable and the complex heterogeneity of the waste mixture that implies an investment in means of transport, storage and sorting. In addition, the price of recycled plastic is a function of the prevailing oil price [40]. Therefore, creating a context that improves the economy and quality of plastic recycling are essential issues to be resolved in order to create value from these secondary resources. Specifically, assessing the quality of materials, components and products upstream and downstream from the point where they are disposed of as waste are the most important aspects to be determined [41]. Where, chemical recycling appears as a preferable option for complex and contaminated waste [42]. “Fig.1” presents data on production, use and destination of all plastic [43].

Additive manufacturing is defined as a process of joining materials to make objects from 3D models, where the manufacturing process is done layer by layer [44]. Accordingtothe ISO standard, thesevenmainprocesscategories are: (1) binderjet, (2) directenergydeposition, (3) extrusion material, (4) material jet, (5) powder, (6) sheetlaminationand (7) light curing.

Polymeric materials are by far the most used material [45]; [46]: Thermoplastics, thermosets, elastomers, hydrogels, functional polymers, mixtures of polymers, compounds and biological systems. Recent work has presented a complete review of polymeric materials [47], additive manufacturing with a focus on 4D printing [48]. Elastomers [49]. Based on additive principles that apply to all manufacturing technologies, depending on the construction principle of each technique, it requires attention, since there are different physical aspects for the union of the material. Such a procedure generates different requirements for functionality and other parameters need to be considered to ensure a holistic technical understanding of the material, processes and properties. Most of the thermoplastics processed by the extrusion process are amorphous. The technical requirements of the material extrusion process include interfacial adhesion and undisturbed polymer entanglement to manufacture non-porous objects with mechanical properties similar to products made by conventional techniques [49]. In addition, rheological, thermal and mechanical properties need to be characterized to validate the use of a particular material. In the scientific literature, there have been many advances in the three-dimensional control of parts produced by the additive manufacturing process [50], mechanical properties, such as traction [51]; [52]; [53], fatigue [54]; [55], flexion [56], thermal properties [57]. In addition, several applications have successfully used polymeric materials, including dentistry [58].

However, from a technological point of view, different challenges have been identified for the development of additive polymer manufacturing in order to improve its competitiveness [59]. This competitiveness is related to the

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functionality of the printed object, evolving from rapid prototypes or tools to the user's final product. Efforts have been made to reduce the anisotropy of printed parts [60]. Often, products produced by the additive manufacturing process have inferior mechanical properties compared to other manufacturing techniques in many cases, especially in the direction of construction [61]. In addition, manufacturing speeds are lower than traditional processing, such as injection molding. On the other hand, the current development of 4D printing is an important way to develop smart polymer materials. Polymers with shape memory, hydrogels or compounds based on active polymer are currently explored in several studies in order to evolve the 3D printed static part to change its shape, given a specific trigger or environment [62]. Objects with complex shapes, compositions (multimaterials), gradients (multicolored) and multifunctional (hard-soft) in a single step are advanced systems of additive manufacturing.

In the environmental aspect, the clear advantage of additive manufacturing has the strong point of delivering more complex, optimized components and reducing assembly operations. It has greater flexibility in relation to traditional manufacturing, thus reducing it with less time, cost and improving the product development cycle [63]; [64]; [65]. However, other factors such as operational requirements do not meet the process have restrictions and limitations on absolute geometric freedom [66]; [67].

In the production phase, three main aspects stand out: resource consumption, waste management and pollution control. In consumption, several studies have measured the energy consumed by 3D printer equipment and its auxiliary subsystems [68] Material consumption [69] and comparison between traditional and additive processes [70]. Considering waste management in comparison between the weight ratio of the final product versus the weight of the input material. [71] reported a complete review on zero waste manufacturing, in which additive manufacturing represents an opportunity to implement this work. The mentioned challenges of plastic waste shape a scope of recycling and a loop framework of the closed loop recycling structure for Recycling distributed via the 3D manufacturing process is proposed in order to identify the scientific literature at each stage based on the literature on polymer recycling [72]. This will allow us to identify advances in the global value chain that enables the production of the face shield stem with recycled polymer.

Redistributed to manufacturers that use manufacturing technologies such as additive manufacturing or 3DP as part of a circular and sustainable production and consumption system.

IV. CONCLUSION

In the present work, a review of the literature on additive manufacturing processes was carried out, seeking to recognize and identify the relevant aspects in relation to the recyclability of materials currently used in additive manufacturing and the environmental aspects in relation to production by additive manufacturing. Likewise, this study highlights the importance of considering some aspects in relation to the circular economy and sustainability in relation to the production processes related to additive manufacturing.

The increase in the number of publications on the topics presented in this study shows that researchers are paying more attention to the sustainability of the additive manufacturing process. This suggests that the limitations of manufacturing in terms of reusing and recycling materials for rod manufacturing, the mobile part of the face shield will be quickly reduced.

Materials with better recyclability will be more favorable for the production of the stem, the mobile part of the facial protector in a short period of time since production by additive manufacturing is the evolution and further studies in this area will consolidate this process.

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The Reflexes of the Brazilian Forestry Code in Agribusiness

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Abstract**—** *The research addresses the reflections of the Brazilian Forestry Code inserted in the context of agribusiness, observing its development in parallel with environmental preservation. The objective is to identify the repercussion of forest legislation on agribusiness, promoting reflection on the unrestrained exploitation of nature resources in Brazil, which cause present and future impacts on the environment, especially in Conservation Units. The expansion of agribusiness has advanced and transformed socio-environmental relations, so that the effectiveness of forest legislation is fundamental to ensure an ecologically balanced environment. However, it is essential to highlight the awareness policies for preserving the Conservation Units as a means of achieving the sustainable development of agribusiness. The article is of a descriptive nature, using bibliographic research, data gathering, Brazilian Forest Code legislation and other scientific bases. Thus, it was verified that the current forest rules seek environmental preservation, which is fundamental for the safety of future generations. Also, the agribusiness was benefited, because the Forest Legislation made the suspension of fines more flexible, in the case of the institution of Permanent Preservation Areas and Legal Reserves, besides the creation of the Rural Environmental Cadastre and, consequently, the exemption from the registration of the Legal Reserve.*

Keywords**— Agribusiness; Environmental Preservation; Brazilian Forestry Code; Nature Resources.**

I. INTRODUCTION

This article was prepared under the Scientific Initiation Program of the University of Rio Verde, in the modality PIBIC/CNPQ (2019-2020), with support from the National Research Council - CNPQ.

The research consists of a study on the legislation of the Brazilian Forest Code of 2012 and its repercussions on agribusiness and the environment, since environmental impacts occur in an exacerbated manner over the years.

The objective is to make an analysis about the repercussion occurred in the current Brazilian Forest Code (Law n. 12.651/2012), and its scope to promote the regularization of agribusiness in parallel to environmental preservation.

Besides, the present work was developed with theoretical character, aiming a better understanding of the approached subject. It contextualizes facts and concrete data, through bibliographical analysis, promoting reflections about the existing Conservation Units, in order to explain the effectiveness of the legislation about the environmental preservation and the regularization of protected areas, which reflects directly on the agribusiness.

To this end, it addresses agricultural expansion and the importance of the 2012 Brazilian Forestry Code, explaining the relevance of the Conservation Units and the Cerrado biome for the development of agribusiness and environmental preservation, in addition to the regularization of rural properties in light of previous forestry legislation and current legislation.

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Thus, the article seeks to identify the reflexes of the current Brazilian Forest Code in relation to environmental preservation, with notes on natural resources and the occurrence of environmental damage from agribusiness, as well as the importance of sustainable development and the need for regularization of rural properties in light of current forest legislation.

II. METHODOLOGY

The methodology adopted in this research work is of a theoretical nature, using doctrines, bibliographies in general, scientific databases and legislation, such as the Federal Constitution of 1988, the Brazilian Forest Code of 2012, the Forest Code of the State of Goiás and the Environmental Crimes Law.

During the research, a study was carried out with scientific data and information, as well as legislation related to the central theme, by means of concrete and recurrent facts in the past and current environmental daily life faced in Brazil.

With this, the interpretation of the material found was passed, giving focus to the innumerable reflections on the subject, so that it was demonstrated the need to promote a sustainable development of the Brazilian agribusiness, since the environmental preservation can guarantee the existence of the Conservation Units that, in turn, conserve the finable natural resources and make possible the extraction of raw material.

In the end, the procedure adopted presents practical results about the reflexes of the current Brazilian Forest Code of 2012 in the context of agribusiness and environmental preservation.

2.1. EXPANSÃO AGRÍCOLA E AGRONEGÓCIO

Agriculture is considered, without a doubt, one of the oldest activities performed by man, since it is from it that he draws food for his livelihood, and it is the basis for the consolidation of his activities.

Over time, individuals have over-exploited natural resources, which has resulted in marks on the environment, so that the forests are no longer totally natural and have become a field for the development of agribusiness.

> Now in the 21st century, we are living several experiences of scarcity of natural resources that were once considered inexhaustible. Not only for lack of legislation aimed at their protection, but also for lack of inspection and effective punishment for offenders, who know it is more advantageous to pay small and insignificant fines than to stop making large financial profits, exploiting the resources that nature took centuries to form (CÉSARO; FERREIRA, 2018).

It is understood that the expansion of arable areas for the production of grains and intensification of farming entails losses both in terms of social welfare and the scarcity of numerous natural resources in Brazil, in addition to demonstrating a significant increase in the incidence of constant environmental damage together with negligence in the inspection by government agencies.

> Due to the nature of the climate and the type of vegetation, the presence of fire is, to a certain extent, a natural phenomenon in the Cerrado - this is why vegetables and some animal species are adapted to survive the fires. However, the fires, criminal or not, which are sometimes counted as "grazing activity" cannot be underestimated in their effects on biodiversity and the regional climate [...] (MILARÉ, 2018).

With the expansion of land to benefit the development of agribusiness, changes have occurred in this territory, making the Cerrado one of the biomes with the highest rates of damage resulting from human interventions, which has led to soil erosion, pollution of aquifers, extinction of animal species, in addition to compromising the incidence of rainfall by evapotranspiration. Such changes also occur due to the numerous areas deforested over time, which cause environmental impacts and undermine the conservation of natural resources as a source of raw material for food production.

> The Cerrado has a total area of 2,047 million km2, which is divided among several states in Brazil. Therefore, it is considered the second largest biome in South America, occupying about twenty-four percent (24%) of Brazilian territory, and its origin occurred through phenomena such as fire, forming a savannah with several species of vegetation, which were surviving the dry soil and prone to burning (MILARÉ, 2018).

It is pointed out that the Forest Legislation of the State of Goiás - Law n. 18.104/2013 - established the

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protection of the native vegetation of the cerrado and instituted the new Forest Policy of the State of Goiás, with the objective of controlling the environmental degradation of this biome.

Although the search for environmental preservation is tireless, it is necessary to align the proper management of agricultural and farming practices, in order to enable sustainable development, because agribusiness provides the increase of exports in Brazil, benefiting the economy. According to data released by the Secretariat of Agriculture, Livestock and Supply of the Government of the State of Goiás, in October 2019 the development of agribusiness resulted in the participation of about 70.6% of exports in its territory.

With this, it can be seen that the current Brazilian Forestry Code has positively influenced and benefited agribusiness in view of the flexibility regarding the legal reserve, as well as the suspension of fines for rural producers who have committed environmental crimes, provided they occurred prior to July 22, 2008.

Thus, considering the environmental damages that the agricultural expansion has caused throughout the years, as well as the irregularity of tenants and rural landowners in face of previous forestry legislation, it is observed that the current Brazilian Forestry Code - Law no. 12,651/2012, made the regularization of properties that were irregular flexible, benefiting agribusiness in a significant way.

2.2. SUSTAINABLE DEVELOPMENT OF AGRIBUSINESS

The search for sustainable development is growing more and more in Brazil, and practices are being adopted that aim at environmental preservation allied to agribusiness. The use of land without sustainable practices can generate irreparable damage to the environment, and economic losses within the activity.

Sustainability consists of the existing natural resources, while without it, far beyond society, biodiversity would also be vulnerable, resulting in serious risks to the global ecosystem (MILARÉ, 2018).

As for natural resources, their definition is very broad, since it covers land, soil and its topography, water, climate, ore, as well as the possibility of fishing, integrating the location and geographical extension of these resources (BURANELLO, 2018). For this reason, the awareness of agricultural entrepreneurs about the protection of the Conservation Units is of extreme importance so that entrepreneurial actions are carried out with special attention to sustainable development.

Antunes (2019) defines Conservation Units as "[...] territorial spaces which, by virtue of an act of public authority, are destined for the study and preservation of specimens of flora and fauna [...]".

According to article 2, item XI, of Law 9.985/2000, sustainable use is about exploring the environment in a way that guarantees the continuity of renewable resources and ecological processes, so that biodiversity is maintained in a fair and economically viable way.

Although the environment presents an abundant ecosystem, sustainability is still difficult to achieve, since the great majority of the population does not recognize the importance of natural resources for agribusiness.

With the transformations that the environment undergoes as a result of exploitation, specifically for agricultural expansion, native flora and fauna are harmed, since burning and deforestation occur, in addition to the high rate of water use and land use in an immoderate manner. The indiscriminate use of natural resources can cause irreversible damage, involving current and future generations.

"Thus, environmental management in agribusiness must be based on an ecological approach, whose focus implies the integral treatment, before, during and after production, of all relevant environmental issues [...]" (BURANELLO, 2018).

> The relevance of the studies and the achievements in favor of the protection of the natural environment of the group of scientists protecting nature, from the 19th century on, under the aspect of valuation and care of forests, fauna and flora, deserves to be reassessed in the light of current legislation. This new evaluation of the natural environment in the XIX century will provide reflections and practices for the maintenance of the vegetation still existing in Brazil, as well as, the regularization (spontaneous or coercive) of rural areas, public and private, that had irregular suppression of vegetation by anthropic actions (CÉSARO; FERREIRA, 2018).

"Sustainability is associated with economic and material development without harming the environment, using natural resources wisely so that they can be conserved in the future, i.e., they aim at the very survival of the planet [...]" (MOREIRA, 2018).

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In fact, especially in the Cerrado biome, sustainability becomes a challenge, since society does not understand that fauna and flora, while a diverse set of native vegetation and animals, carry a commercial potential of great value (MOREIRA, 2018).

Thus, it can be observed that from the 19th century on, through research by scientists and scholars who were concerned with nature, the protection of the fauna and flora in Brazil began to be valued, so that the practices of maintenance and conservation of vegetation in rural and urban areas have been gaining focus in the current forest legislation.

2.3. REFLEXES OF THE FOREST CODE IN THE LEGAL RESERVE

The Legal Reserve has its concept expressed in art. 3º, of Law 12.651/2012, where it foresees that it consists of an area of environmental conservation, of limited percentage in rural properties, with expressive relevance, since it is a good of interest of the society, with function to assure the sustainable economy of land use in rural properties.

It is a delimited rural area that must be preserved, given the existence of native vegetation.

> The legitimate function of the Legal Reserve Area is to assist in the conservation and rehabilitation of ecological processes and to promote the conservation of biodiversity, as well as the shelter and protection of wildlife and native flora; in short, it is to conserve and contain forest devastation (LIMA; FERREIRA, 2018).

"[...] Forests and other forms of native vegetation, except the APPs, are susceptible to suppression, provided that a percentage is maintained as RL (BURANELLO, 2018).

Antunes (2019) emphasizes that the Legal Reserve is an indispensable component within the property, since it is part of an area expressed in law, varying according to its particularities, such as the region and the ecological conditions in which it is located, being prohibited the deforestation of trees to be used for traditional economic purposes.

In this sense, the percentage of the RL area is subject to some factors, such as the location and the predominant biome, according to article 12, of Law n. 12.651/2012:

> Art. 12. [...]
>
> I - Located in Legal Amazon:
>
> a) 80% (eighty percent), in the property located in forest area;
>
> b) 35% (thirty-five percent), in the property located in the cerrado area;
>
> c) 20% (twenty percent), in the property situated in a general field area;
>
> II - Located in other regions of the country: 20% (twenty percent) (BRAZIL, 2012).

According to article 17, paragraph 1, of Law n. 12.651/12, in the RL area only "economic exploitation of the Legal Reserve by means of sustainable management, previously approved by the competent agency of Sisnama, in accordance with the modalities provided for in article 20 of the law, is allowed".

> The National Environmental System - SISNAMA is, in law and in fact, an official political-administrative, governmental structure, although open to the participation of non-governmental institutions and society, through the competent channels. It is constituted by the organs and entities of the Union, the States, the Federal District, the Cities and the Foundations instituted by the Public Power, responsible for the protection and improvement of the environmental quality [...] (MILARÉ, 2018).

In turn, article 20 expresses: "In the sustainable management of the RL forest vegetation, selective non-commercial exploitation practices will be carried out for own consumption and sustainable management for commercial exploitation" (BRAZIL, 2012).

In addition, family farming properties are currently allowed to include as a Legal Reserve areas that have fruit and ornamental trees, i.e., exchange the native forest for a plantation. This management does not require authorization from environmental agencies, as long as it is destined for their own use, although it has an annual limit of 20 (twenty) cubic meters, as provided by the current Brazilian Forest Code.

Another innovation that Law n. 12.651/2012 brought, was the possibility of computing the Permanent Preservation Area in the calculation of the Legal Reserve area, as foreseen in article 15 of the referred forest legislation. The clauses of art. 15 express that the act is allowed only in the following hypothesis: when it does not imply in conversion of areas for destination other than the

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registered one; when the computed area is conserved or going through a recovery process, by means of proof of the owner with the competent organ of Sisnama; when there is a request of registration of the property in the Rural Environmental Register (BRAZIL, 2012).

The 1965 Forestry Code did not foresee the mentioned possibility, and the registration of the Legal Reserve should be done outside the registration of the property, which represented an expressive financial cost to the rural producer. With the sanction of the current Forest Code - Law 12.651/2012, in its article 14 allows the RL to be registered in the Rural Environmental Registry - CAR, dispensing with the registration and, consequently, representing lower financial cost.

It should be noted that the Legislation maintained the possibility of the producer or tenant to constitute a Legal Reserve in another municipality or even in another state, provided it is in the same biome. Therefore, the Forest Code of the State of Goiás has adopted this provision for an extra-ownership reserve, since the Brazilian Forest Code allows the constitution of a legal reserve in this modality.

2.4. REFLEXES OF THE FOREST CODE IN THE AREA OF PERMANENT PRESERVATION

According to art. 3º, of Law n. 12.651/2012, the Permanent Preservation Areas consist of an area of conservation of native vegetation, which has the objective of protecting the soil, protecting the river slopes against the impacts of heavy rains and reducing the arrival of sediments to water courses.

> Art. 3. [...] means: I (...); II - Permanent Preservation Area - APP: protected area, covered or not by native vegetation, with the environmental function of preserving water resources, landscape, geological stability and biodiversity, facilitating the gene flow of fauna and flora, protecting the soil and ensuring the well-being of human populations (BRAZIL, 2012).

These are areas that aim at the conservation of riparian forests, as well as vegetation on the slopes of rivers, lakes and hills. "[...] Permanent preservation forests cannot be managed in such a way as to suffer shallow cuts" (BURANELLO, 2018).

It is verified that the APPs serve as filters for the sediments that reach the river and lake beds, thus promoting environmental preservation. "The main purpose of the establishment of permanent preservation flora in the above mentioned places is to avoid land erosion and soil destruction, preserving the integrity of geographical accidents [...]" (ANTUNES, 2019).

For Lima and Ferreira (2019), the deforestation and use of land around the APPs causes the accumulation of sediments, compromising the water surface and causing damage to the population. Another degradation factor is the pollution caused by sewage and garbage accumulated in the pits that are built in permanent preservation areas.

For this reason, Law n. 12.651/2012 in its article 7 to 9, provides the Regime of Protection of Permanent Preservation Areas, whose article 7 expresses that the vegetation located in these areas must be maintained by the owner, possessor or occupant, and in case of suppression of the vegetation located there, the person responsible for the area is obliged to perform the recomposition of the vegetation, except when it is a use in which the authorization is expressed in Law. Also, art. 8, §1 of the Law, foresees that it is allowed the intervention or suppression of vegetation in APP, which protects springs, dunes and sandbanks. However, this suppression or intervention may occur only in cases of public utility, social interest or low impact on the environment, with due authorization from the Federal Executive (BRAZIL, 2012).

Buranello (2018) states that, in addition to the aforementioned suppression or intervention of native vegetation, the current Forestry Code allows the transit of animals and people in these areas, with the specific purpose of obtaining water and actions that do not have a high impact on the environment. The author states that the 1965 Forest Code allowed this access with the sole and exclusive purpose of obtaining water, and with the condition that no suppression or intervention of native vegetation be carried out.

Thus, when there is an incidence of suppression or intervention with environmental impacts, it stands out for the existence of the necessary recomposition in consolidated rural areas, as is the case of Permanent Preservation Areas. This is the "restoration of an ecosystem or a native biological community degraded or altered to a non-degraded condition, which may be different from its original condition", according to item VIII, of article 2, of Decree nº 7.830/2012, which provides for the Rural Environmental Cadastre.

Still, the article 61-A, §13, of the Law n. 12.651/2012, foresees that the recomposition can occur in the following way:

> § 13. [...]
>
> I - conduction of natural regeneration of native species;

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> II - planting of native species;
>
> III - planting of native species combined with the conduction of natural regeneration of native species;
>
> IV - intercalated planting of woody, perennial or long cycle, exotic species with native species of regional occurrence, in up to 50% (fifty percent) of the total area to be recomposed, in the case of the properties referred to in clause V of the caput of Article 3 (BRAZIL, 2012).

The forest legislation innovations presented the possibility of using a percentage of the APPs in the calculation of the Legal Reserve, whose prevision is disposed in art. 15, of Law n. 12.651/2012. The legal provision points out some requirements that, among them are: the benefit granted does not result in alternative use of the soil; the computed area must be preserved or in recovery; and that the owner or possessor has registered the property in the Rural Environmental Register (BRAZIL, 2012).

In this context, Permanent Preservation Areas are essential as a natural resource, and it is essential that there is awareness on the part of society, especially in the agricultural activities sector, which need water for their effectiveness.

2.5. THE FOREST CODE AND THE RURAL ENVIRONMENTAL REGISTER

The CAR - Rural Environmental Registry, is an innovation provided for in Article 29 of the Brazilian Forest Code of 2012, which consists of an electronic and mandatory public registry for rural properties, with the purpose of storing georeferenced environmental data of a property or rural property, for the control, monitoring and combating deforestation of forests, native vegetation and preservation of Conservation Units.

The registration occurs following some requirements expressed in §1º of art. 29, of Law n. 12.651/2012, such as: identification of the owner or that has ownership of the rural property; proof of ownership or possession; identification of the property, presenting the plant, descriptive memorial and indicating the geographic coordinates, as well as the areas of native vegetation, which consist of Permanent Preservation Areas, Areas of Restricted Use, Consolidated Rural Areas and Legal Reserve, if it exists on the property (BRAZIL, 2012).

Likewise, the current Forestry Code presents the mentioned innovation in the matter, since there is the possibility of waiving the registration of the Legal Reserve in the registration of the property, as long as the owner or holder makes the registration in the Rural Environmental Register, as provided in § 4 of art. 18 of Law no. 12,651/2012 (BRAZIL, 2012). This is what highlights Milaré (2018) when dealing with the exemption in the obligation of registering the Legal Reserve with the Real Estate Registry Office, being necessary, currently, only the registration in the competent environmental agency, through registration in the CAR.

Before the legislative alteration, the property that does not have environmental liabilities related to the Legal Reserve, Permanent Preservation Area and Restricted Use Area, or that presents liabilities, but with the commitment to recover the damage, may have the CAR regular and, after the registration of the property in the referred mechanism, the future suppression of protected areas depends on authorization. The owner or owner of the rural property who claims the existence of environmental liabilities for suppression of native vegetation or areas destined for preservation, guarantees the possibility of adhering to the Environmental Regularization Program - PRA, as long as it occurred prior to July 22, 2008 (BURANELLO, 2018).

According to art. 59, § 2 of Law n. 12.651/2012, the registration of the rural property in the Rural Environmental Register is a mandatory requirement to adhere to the PRA, and must be requested within 2 (two) years (BRAZIL, 2012). The PRA consists of a program that enables the adaptation of rural properties to comply with the Forest Code in force, specifically regarding Permanent Preservation Areas, Legal Reserves and Restricted Use.

With the adhesion to PRA, which represents an evolution of the Forest Codes, a great part of the rural properties could be regular under the current legislation. The regularity occurs through compensation, recovery, regeneration and recomposition of protected areas. That is, the owner or possessor presents a plan to repair the environmental damage that, after approved, is signed by means of a term of commitment, constituting an extrajudicial executive title. The recovery may not exceed 10 (ten) years, and during the period established in the commitment term, the fines for environmental infractions are only suspended, as expressed in articles 59, §§ 3, 4, 5 and art. 60, of Law n. 12.651/2012 (BURANELLO, 2018).

Furthermore, the respective legal provision expresses that the PRA must be implemented by the Union, States and Federal District, aiming at the regularization of rural properties and possessions.

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> As long as the obligations established in the PRA are met, within the deadlines and under the conditions agreed upon in them, the fines imposed on the consolidated rural areas of the property will be suspended. They will only be considered as services of preservation, improvement and recovery of the quality of the environment, as defined in the current Forest Code, in art. 59 and art. 60, § 2, after their full compliance, making the punishment provided for in the Environmental Crimes Law extinct. If for any reason the terms of the agreement are not complied with, the violator will be sued for the full amount of the fine previously due (CÉSARO; FERREIRA, 2018).

Finally, Buranello (2018) elucidates the benefits of registration in the CAR for rural producers, which include: legal security, suspension of fines, the possibility of acquiring agricultural credit and adherence to the environmental regularization program, planning of rural property and purchase and sale of environmental reserve quotas.

In view of this, it is possible to observe that the Rural Environmental Cadastre is an innovation of the current Forest Code, providing a system that stores nationwide records, with the capacity to integrate information related to rural properties through a satellite, which makes up the rural property database.

Therefore, adhesion to the Environmental Regularization Program is a benefit granted by forestry legislation, as long as the producer or tenant registers his property in the CAR, representing in a significant way the recovery of the environment, since many rural properties were able to stay regular by adhering to the requirements established in the legislation.

2.6. REFLEXES OF THE BRAZILIAN FORESTRY CODE IN THE ENVIRONMENT

Actually, we are living several experiences with the lack of natural resources, which used to be considered infinite. As can be seen, this occurs due to the lack of awareness, inspection and punishment of transgressors.

In 1934, the first Forestry Code came into force in Brazil, through Decree n. 23,793, which was later revoked by the second Forestry Code - Law n. 4,771/65. During this period, sustainable development was not the focus of the concerns of landowners and the government, which were only interested in agriculture, cattle raising and wood production, in addition to the conviction that natural resources would never cease (CÉSARO; FERREIRA, 2018).

With the advent of the 1965 Forest Code, in the midst of military intervention, the squatters who occupied Amazonia were allowed to partially deforest their plots - up to 50% (fifty percent), and if they did not, the State would have the power to resume ownership of the property. This caused irreparable damage to the environment, causing the property to be irregular under the Forest Code in force at the time (LIMA; FERREIRA, 2018).

Subsequently, the Federal Constitution of 1988 inserted article 225, with emphasis on the environment, imposing rights and duties on everyone, in favor of environmental preservation, and determining the application of sanctions to anyone who infringed the legislation.

> Art. 225. Everyone has the right to an ecologically balanced environment, a good for the common use of the people and essential to a healthy quality of life, imposing on the Public Power and the collectivity the duty to defend it and preserve it for present and future generations. § 3º - The conducts and activities considered harmful to the environment will subject the offenders, individuals or companies, to criminal and administrative sanctions, regardless of the obligation to repair the damage caused (BRAZIL, 1988).

In addition, the Federal Constitution had already instituted the Conservation Units in the mentioned legal provision, imposing as a State attribution:

> III - to define, in all Federation units, territorial spaces and their components to be specially protected, being the alteration and suppression allowed only by law, forbidden any use that compromises the integrity of the attributes that justify their protection (BRAZIL, 1988).

In the words of Milaré (2018), this provision in the Federal Constitution emphasizes the principle of public nature of environmental protection, which recognizes the environment as public heritage, seeking to ensure a relationship of balance and harmony between the human being and nature.

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Therefore, the Environmental Crimes Law - Law n. 9.605/98, which stipulated and detailed these possible sanctions in the civil, criminal and administrative spheres to those who cause environmental damages, was in force. "[...] From what is understood in the constitutional text, one responsibility does not exclude the possibility of another, so that the system of environmental responsibility is multiple and must be articulated, jointly and systematically" (BURANELLO, 2018).

In this sense, through Law No. 12,651 of 2012, the third and current Brazilian Forest Code was sanctioned, which deals with the protection and suppression of native vegetation, the imposition of fines and the regularization of the Rural Environmental Cadastre.

One of the most important normalizations implemented by the current Brazilian Forestry Code was the creation of the Rural Environmental Cadastre (CAR), since this is a mechanism for the control and monitoring of environmental damage in rural properties, which have expanded intensely over the years. The CAR released the rural producer from the obligation of registering the Legal Reserve on the property registration with the Land Registry Office (CRI), since the percentage of the RL area is monitored via an electronic system, which is stored in a database.

The Forest Legislation establishes the Conservation Units, which aim to reduce the environmental impacts, in order to promote the maintenance of the environment. In turn, it deals with the APPs - Permanent Preservation Areas - which have the function of protecting the soil, since they contribute to reducing the impacts caused by the rains on rivers and lakes.

The importance of maintaining the APPs on rural and urban properties, as well as the need to observe the marginal strips in the water courses, following the footage and widths, are provided for in Article 4 of the respective forestry legislation.

> The protection of APP and RL is not a mere conservation of the Brazilian forest heritage. It is a matter of constitutional principles that aim to ensure the functioning of ecological services of natural resources for the enjoyment of the owner and society. However, this new understanding of the socio-environmental function of rural property, the notion of rights and duties are not watertight, since the duty is not directly linked to a legal restriction (BORLACHENCO Et al., 2014).

The Brazilian Forest Code, through Law no. 12,651 of 2012, made changes to the Permanent Preservation Areas, regulating the extensions of the marginal strips of watercourses, which must be protected for preservation purposes, in addition to changes in relation to the Legal Reserve, where the sum of the APPs was authorized for the calculation of the RL. Among the alterations to the current Brazilian Forest Code in the area of environmental preservation, there is also a reduction in the extensions of protection relating to Permanent Preservation Areas.

It is pointed out that the Legal Reserve in rural properties aims to ensure a sustainable economy, while maintaining the conservation of biological diversity, protecting native fauna and flora. This species of Conservation Unit (RL), consists of the minimum percentage that must be safeguarded for the preservation of native vegetation, of which the size of the rural property, the species of existing vegetation and the location in which it is located is limited. "It is a very important socio-environmental reserve of the rural property, which must be geographically rented and, even being of private property, is an asset of common interest" (CÉSARO; FERREIRA, 2018).

In this context, in relation to production and regional economy, the Cerrado biome, which has an estimated territorial area of about 24%, is the second largest biome in South America (MILARÉ, 2018).

Thus, agribusiness represents the main source of economy in Brazil, since it is the territory with the highest levels of food production, and especially the State of Goiás, which is located in this important biome. "In 2001 the sector was responsible for 17.54% of the product generated. Studies have shown that about 41% of the Goiás municipalities have their main economic activity in agriculture" (FERREIRA Et al., 2019).

On the other hand, agribusiness is used as a justification for environmental degradation, since there is intensification of agricultural expansion through deforestation, which mostly occurs irregularly, generating serious environmental damage.

With this, the Brazilian Forestry Code addressed the need to preserve the environment, however, it foresees the possibility of suspending fines prior to July 22, 2008, as well as calculating the Permanent Preservation Area in the calculation of the Legal Reserve, the implementation of the CAR and the non obligatory registration of the RL in the property registration.

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The Brazilian Forest Code, in its articles 52 to 58, also innovated by including small family farmers in this context and granting special treatment to small rural owners. In this case, family farming properties are allowed to include as RL areas with fruit and ornamental trees, i.e., to exchange the native forest for a plantation. In addition, this management does not require authorization from environmental agencies, as long as it is intended for their own use.

In view of this, countless rural properties have acquired regularity before the Forest Code in force, which means that the forest legislation has made a rule more flexible for the benefit of a production class.

III. RESULTS AND DISCUSSIONS

The research approaches the reflexes brought by the current Forest Code in Agribusiness, so that it demonstrates its effectiveness for the growth and development of the agricultural economy allied to the preservation of the environment.

In view of the great exploitation of natural resources in favor of agribusiness, it describes the changes brought about by the Brazilian Forest Code of 2012, informing and seeking to raise awareness of the importance of complying with environmental standards in order to achieve success in environmental preservation and development of agribusiness, demonstrating that both should walk side by side.

Thus, considering that agribusiness is developing in a growing way, becoming evident the importance of the Conservation Units and the Cerrado biome for its development, and especially for the effective conservation of natural resources, it has been verified that there are countless reflexes of the exacerbated exploitation of agribusiness with regard to the environment, as well as the importance of complying with environmental legislation.

It was possible to verify that the Brazilian Forestry Code implemented norms that made possible the regularization of several rural properties, being a significant advance, because rural producers that committed environmental infractions until July 22, 2008 may have the suspension of environmental fines, as long as there is adhesion to the Environmental Regularization Program - for the recomposition of the damage caused - after the registration in the Rural Environmental Register.

Thus, despite the existence of debates about the effectiveness of the Forest Code of 2012 for the environmental preservation of the Conservation Units, it can be seen that agribusiness has benefited, since there have been flexibilities in the regulation of Permanent Preservation Areas and Legal Reserves, as well as the exemption of the latter from registration in the registration of the property and the need for registration in the Rural Environmental Register, which represents a major innovation for the compatibility of the environment and agribusiness.

It is concluded that the Forest Code in force as of 2012 - Law n. 12.651/2012, made the environmental rights too flexible, decreased the extension of protection of the Permanent Preservation Area and Legal Reserve, besides granting amnesty to those who illegally deforested the prohibited area until mid-2008, generating a suppression of the forest rights acquired.

IV. CONCLUSION

It is noted that the Conservation Units and the Cerrado biome are essential areas for the great biodiversity of plant and animal species in Brazil, and therefore there must be effective conservation of natural resources.

There are innumerable reflections of the immoderate exploitation of agribusiness for the environment, as well as the importance of complying with what is established in the Brazilian Forest Code of 2012 and its extravagant legislation.

Thus, changes in legislation have a significant impact on agribusiness and the environment, and the rules on the preservation and regularization of the Conservation Units have brought about the possibility of recomposing environmental damage by adhering to the Environmental Regularization Program and registering with the Rural Environmental Registry, which has become mandatory and dispensed with the registration of the Legal Reserve area in the property registry.

It is concluded that the Brazilian Forest Code - Law n. 12.651/2012 made the environmental rights too flexible, reducing the extension of protection of the Permanent Preservation Area and changing the calculation of the Legal Reserve, besides granting amnesty to those who illegally deforested the prohibited area until mid-2008, generating a suppression of the forest rights acquired and benefiting the Brazilian agribusiness sector. However, this legislation is an effective mechanism in environmental preservation and agribusiness, since it has enabled the regularization of numerous rural properties.

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Health Systems and the Financial Impact of Dental Treatment in Cancer

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Abstract**—** *The Brazilian Health care System is Universalist, where the treatment of patients with cancer is full and free, secured by law with the obligation to be initiated within sixty days of its diagnosis. The regulation of antineoplastic therapy and the hospital network that is licenced and certified for the treatment of cancer is standardized by the Ministry of Health / National Cancer Institute José Alencar Gomes da Silva [Instituto Nacional de Câncer José Alencar Gomes da Silva] (INCA). Dental care in cancer patients is mandatory to prevent and treat oral complications; whose protocol is standardized by INCA to be applied throughout the hospital network enabled in oncotherapy.* ***Objective****: A study of the dental treatment was carried out in patients diagnosed with cancer attended at a High Complexity Oncology Care Unit / Unidade de Assistência de Alta Complexidade em Oncologia (UNACON) in order to evaluate the financial impact of oral care in oncotherapy.* ***Material and Method:*** *Evaluation of the medical records of patients treated at the Oncological Dentistry Service (SODONCO) of UNACON of the General Hospital of Palmas (HGP) / Tocantins (TO) from April 2011 to December 2016.* ***Results:*** *A total of 607 medical records were reviewed, showing a significant financial impact in dental treatment in oncotherapy.* ***Conclusion****: The study shows the importance of standardizing the oral care protocol in oncotherapy, the organization of a structured database for the registration of dental treatment, in spite of carrying out the planning of human and financial resources for dental treatment in cancer patients.*

Keywords**— Cancer therapy, Cancer treatment protocols, Health systems, Oral complications.**

I. INTRODUCTION

The Constitution of 1988 of the Federal Republic of Brazil in the articles 196 to 200 defines the legal framework of the Unified Health System / *Sistema Único de Saúde* (SUS), and establishes that: "... *Health is a right of all and a duty of the State ...* . "; and in concomitance with the Organic Health Laws, Law 8.080 / 1990 and Law 8.142 / 1990 establishes the competencies, governmental powers and guidelines for the SUS: decentralization, integrality, and community participation through municipal, state and national health[1] councils. Dental treatment is offered to all users of the System free of charge in Primary Care (preventive actions); in Secondary Care at the Centers of Dental Specialties-CDS (restorations, periodontics, endodontics, prostheses, orthodontics, implantology and minor oral surgery); and in Tertiary Care in a hospital environment (traumatology, special patients, cleft lip and palate, oncology) [1-3].

The National Cancer Institute José Alencar Gomes / *Instituto Nacional de Câncer José Alencar Gomes da Silva* (INCA) is the government agency responsible to assist the Ministry of Health (MH) in the formulation of the National Policy for the Prevention and Cancer Control / *Política Nacional de Prevenção e Controle do Câncer* (PNPCC)[4]; having as free integral mandatory dental treatment to the oncologic patient[5], and the beginning of the antineoplastic therapy within sixty days of its diagnosis[6].

In order to improve and standardize the dental treatment for cancer patients, a protocol of oral care and dental procedures was published in 1990 by INCA to be applied throughout the hospital network enabled in oncotherapy[7].

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Hemorrhage, infection (bacterial, viral, fungal), mucositis, xerostomia, radiation caries, trismus, avascular osteonecrosis, osteorradionecrosis, periodontal changes, dental and craniofacial development are oral complications that may occur during and after anticancer therapy[8-14]. These effects may lead to temporary or permanent discontinuation of treatment, impairment of disease control, and overall survival rates[15,16]. Prevention and treatment of oral complications of antineoplastic therapy are important to increase quality of life, reduce morbidity and treatment costs[17-25].

Canada has a Health System that guarantees universal access and coverage, described as an interwoven set of ten provincial and three territorial health insurance plans; with few public subsidies for access to dental care[26]. It presents twenty-four centers specialized in oncotherapy; and only six provide dental treatment without a defined protocol; the other centers provide oral care through universities and non-governmental organizations[27,28].

The US Health System consists of government programs targeting the low-income population (Medicaid), and individuals over 65 (Medicare), with only 6% of dental care funded by public agencies[29,30]. The National Cancer Institute (NCI) licenses cancer centers for their ability to conduct oncology research. Despite the rigorous evaluation of the NCI to grant the qualification in Cancer Integral Center, they do not have a common protocol defined for the prevention and treatment of oral complications due to oncotherapy[31-34].

Spain has a National Health System (NHS) of universal coverage, promulgated by the Spanish Constitution of 1978, supported by the General Health Act (14 of 1986). The full cancer treatment is carried out in specialized care, where most of the Oncology Centers have Dental Service at their facilities[35-37]; wherein a research conducted in the nine University Hospitals of the region of Madrid observed a great diversity regarding the management of the oral care in patients irradiated in the region of head and neck[38].

The Norwegian Health System has universal coverage, with free public dental care for children and young people aged 0-18. Youth 19-20 years must pay 25% of costs. Mentally disabled adults, the elderly and people with chronic illness pay reduced rates[39]; whereas for adult survivors with dental and orofacial consequences, effects of antineoplastic therapy of acute lymphoblastic leukemia (ALL), which occurred during childhood and youth, the health system of Norway does not provide free dental treatment, since it considers that the patients are free of the disease[40,41].

Sweden has a Universal Health System under the Health and Medical Services Act 1982. Dental care is provided by the Public Dental Service and by private care providers; which are free for people under 20 years of age and out of the pocket for others, with a higher contribution rate between 20-29 and over 75 years[42]. Recently, the Swedish government has initiated a national reform to standardize the flow of cancer patient care in order to regulate cancer treatment, reduce waiting times for oncotherapy, and minimize regional inequalities[43].

The UK National Health Service (NHS) was created in 1948, of universal feature, where patients must pay an out of the pocket fee for dental treatment which varies according to the complexity of the same[44]. England has 56 multidisciplinary teams treating head and neck cancer; which do not comply with the oral care protocol for patients undergoing head and neck radiation therapy recommended by the National Institute for Health and Clinical Excellence (NICE) [45,46].

In view of the significant demand for dental care for cancer patients and the financial resources allocated to this action, a study of dental treatment was carried out in patients diagnosed with cancer attended at a High Complexity Oncology Care Unit / *Unidade de Assistência de Alta Complexidade em Oncologia* (UNACON) aiming at improving the public health policies of oral care in oncotherapy.

II. MATERIAL AND METHODS

The design of this study is descriptive, observational.

A survey was performed in the files of the Oncological Dentistry Service of the General Hospital of Palmas / Tocantins, from patients diagnosed with cancer treated from April 2011 to December 2016.

The protocol of this research, through the Brazil Platform, was submitted to a Research Ethics Committee (REC), in accordance with the directives and norms regulating research involving human beings issued by Resolution No. 466 of December 12, 2012, of the National Health Council[47], hence, obtaining a favorable consolidated opinion from the REC with the number 1,402,219.

Data from each patient were computed on a database table structured in the Excel program (2013) for Windows[48], according to Dental Procedure (DP) (Table 1), and Dental Procedure for Tooth (DPT) (Table 2).

Oral care and dental treatment were performed in accordance with the guidelines established by INCA[7].

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The structured database table was made in continuous line in the following order: PO.1 to PO.31; tooth 51-55; tooth 61-65; tooth 71-75; tooth 11-18; tooth 21-28; tooth 31-38; tooth 41-48.

A descriptive statistical analysis of the data was performed.

For the evaluation of the financial impact of DP and DPT, a comparison was made between the values of the dental procedures included in the Unified Table of the Management System of Procedures, Medications and OPM of SUS (SIGTAP) [1,49], with the values of the Table of Reference Values for Dental Procedures [*Valores Referenciais para Procedimentos Odontológicos*] / Syndicate of Odontologists of the State of São Paulo [*Sindicato dos Odontologistas do Estado de São Paulo*] (VRPO / SOESP), edition 2016, of the National Commission of Accredited Agreements[50]; and the UTSH (Unified Terminology of Supplementary Health) table of the National Agency of Supplementary Health-ANS[51]

Table 1 - Dental Procedure (DP)

DP.1- initial dental consultation / clinical examination
DP.2- return
DP.3- panoramic radiography
DP.4- periapical radiography
DP.5- computed tomography
DP.6- magnetic resonance imaging
DP.7- ultrasonography
DP.8- preventive procedures / prophylaxis
DP.9- individual educational activity
DP.10- educational guidance of radiotherapy / chemotherapy
DP.11- topical application of fluoride by hemi-arch
DP.12- supra-gingival scraping by hemi-arch
DP.13- subgingival hemi-arcade scraping
DP.14- alveoloplasty by hemi-arch
DP.15- maxillary molding with alginate
DP.16- jaw molding with alginate
DP.17- individual maxillary tray for fluoride
DP.18- individual law tray for fluoride
DP.19- removable partial denture maxilla
DP.20- removable partial denture jaw
DP.21- maxillary total prosthesis
DP.22- jaw total prosthesis
DP.23- low power laser therapy
DP.24- biopsy
DP.25- prosthesis relining
DP.26- desensitization hemi-arch
DP.27- abscess drainage
DP.28- maxillary sealing plate
DP.29- resin eyelid prosthesis
DP.30- silicone eyelid prosthesis
DP.31- silicone nasal prosthesis

Table 2 - Dental Procedure per Tooth (DPT)

DPT.1- sealant by dental element
DPT.2- deciduous tooth restoration with glass ionomer by element
DPT.3- deciduous tooth restoration with amalgam by element
DPT.4- deciduous tooth restoration with photopolymerizable resin component
DPT.5- endodontic treatment in deciduous tooth
DPT.6- pulpotomy
DPT.7- extraction of deciduous tooth
DPT.8- restoration of amalgam 01 face in permanent tooth per element
DPT.9- restoration of amalgam 02 faces in permanent tooth per element
DPT.10- restoration of amalgam 03 faces in permanent tooth per element
DPT.11- restoration of amalgam 04 faces in permanent tooth per element
DPT.12- restoration in photopolymerizable resin in permanent tooth 01 face per element
DPT.13- restoration in photopolymerizable resin in permanent tooth 02 face per element
DPT.14- restoration in photopolymerizable resin in permanent tooth 03 face per element
DPT.15- restoration in photopolymerizable resin in permanent tooth 04 face per element
DPT.16- restoration of permanent tooth with glass

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ionomer per element
DPT.17- permanent tooth endodontic treatment uni
DPT.18- permanent tooth endodontic treatment bi
DPT.19- permanent tooth endodontic treatment tri
DPT.20- permanent tooth endodontic retreatment uni
DPT.21- permanent tooth endodontic retreatment bi
DPT.22- permanent tooth endodontic retreatment tri
DPT.23- delay dressing
DPT.24- intra core
DPT.25- permanent tooth extraction
DPT.26- residual root extraction
DPT.27- retained tooth extraction
DPT.28- temporary crown
DPT.29- unitary dental prosthesis (total crown, inlay, onlay)
DPT -30- alveolitis treatment per tooth
DPT.31- root burial
DPT.32- splitting by element
DPT.33- crown with post
DPT -34- clinical crown increase

III. RESULTS

The DP and DPT (deciduous and permanent dentition) of 607 records of the Oncological Dentistry Service of the General Hospital of Palmas / Tocantins (SODONCO / HGP / TO) were analyzed.

In the period from 2011 to 2016 in SODONCO / HGP / TO, 607 initial dental consultations (DP.1) were performed; 1799 returns (DP.2); totaling 2406 appointments; with an average of four visits per patient to complete the proposed dental treatment.

The complete distribution of DPs performed, and the comparison of the financial impact between the VRPO / SIGTAP / TUSS tables can be observed in Table 3, where we can highlight 543 of DP.3; 316 of DP.8; 371 of DP.9; 223 of DP.10; 375 of DP.11; 769 of DP.12; 682 of DP.13; and 229 of DP.23.

Regarding DPT in deciduous dentition, 196 procedures were performed, with relevance for 30 restorations with glass ionomer (DPT.2); 79 restorations with photopolymerizable resin (DPT.4); and 66 dental extractions (DPT.7). The disposition of DPT in the deciduous dentition, and the comparison of the financial impact between the VRPO / SIGTAP tables can be visualized in Table 4.

2310 DPT were produced in permanent dentition, with emphasis on 932 restorations on single and double-face light-curing resin (DPT.12 + DPT.13); 153 glass ionomer restorations (DPT.16); 740 dental extractions (DPT.25); and 103 residual root extracts (DPT.26). The organization of DPT in permanent dentition, and the comparison of the financial impact between the VRPO / SIGTAP tables can be examined in Table 5

IV. DISCUSSION

In Brazil, the treatment of patients with malignant neoplasm is a right guaranteed by Law[1] and regulated by the Ministry of Health[5]; in contrast, in the countries studied, the access and initiation of oncoterapeutic treatment, as well as the right of patients to anti-neoplastic therapy, do not follow the standard and regulation defined according to their respective health reports[26,30,35-37,42,44] and studies[14,28,37,43].

The Brazilian Health System is of predominantly universalist characteristic with a financial transfer from the Union to States and Cities[1]; yet the dental procedures for antineoplastic therapy are considered highly complex, but billed by the federal sphere, with a basic care chart[1,49]; highlighting a lack of a financial health policy for oral oncotherapy on the part of the Ministry of Health; In relation to the Health Systems analyzed, there is a mixture of the Universalist System with Social Security Model and the Assistencialist Model[26,29,30,35,39,42-44], where their respective health reports describe the out of the pocket system of dental treatment to the general population, lacking further explanations in relation to cancer patients[10,28,29,32,40,46].

In Brazil, the protocol of dental treatment and oral care in the antineoplastic therapy is standardized to be performed in the entire hospital network enabled in oncotherapy[5,7]; in agreement with the authors analyzed who corroborate that oral care in oncotherapy should be standardized and followed by cancer treatment centers[8-15,20-25,27,45,46]; evidencing that the international community still argues which best protocol deserves to be implemented and applied in the analyzed Health Systems in the World[8-11,13-25,20-25,27,28,45,46]; sharing the importance of the standardization of dental treatment in oncotherapy; to increase the quality of life, the reduction in complications that can delay or stop oncotherapy[19,32-34,41] thus interfering in cancer treatment costs[10,12,15-18,24,32,40]; and stimulating the elaboration, by the nations, of public health and

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financial policies to ease the access of the cancer patient to the dental care and costing of the same[10,13,17,29,36,38,40,45,46].

Hence, the research carried out contributes to the world scientific scenario, since it follows and applies the national cancer care policy advocated by the Federal Government and the Ministry of Health, encouraging in Health Systems in the World, the elaboration and standardization of protocol for oral care in antineoplastic therapy, and the planning of human and financial resources for dental treatment in cancer patients.

V. CONCLUSION

The study reveals the importance of a structured database for the individualized registry of dental treatment performed in patients diagnosed with cancer; in order to promote the development and standardization of the oral care protocol in antineoplastic therapy in the World Health Systems, the planning of human and financial resources for dental treatment in cancer patients, and the elaboration of public policies to improve the right and access of cancer patients to dental therapy in oncotherapy.

Table 3 - Distribution of DP and comparison of financial impact between tables VRPO / SIGTAP / TUSS

DP	2011/2016	VRPO*	VRPO*	SIGTAP**	SIGTAP**	TUSS***	TUSS***
DP.1	607	**R$ 110,45**	R$ 67.043,15	**R$ 6,30**	R$ 3.824,10		
DP.2	1799	**R$ 110,45**	R$ 198.699,55	**R$ 6,30**	R$ 11.333,70		
DP.3	545	**R$ 84,92**	R$ 46.281,40	**R$ 9,03**	R$ 4.921,35		
DP.4	114	**R$ 22,85**	R$ 2.604,90	**R$ 1,75**	R$ 199,50		
DP.5				**R$ 86,75**	R$ 1.214,50	**R$ 247,62**	R$ 3.466,68
DP.7	3			**R$ 24,20**	R$ 76,60	**R$ 56,06**	R$ 168,18
DP.8	316	**R$ 100,83**	R$ 31.862,28				
DP.9	371	**R$ 72,74**	R$ 26.986,54				
DP.11	375	**R$ 59,27**	R$ 5.556,56				
DP.12	769	**R$ 122,47**	R$ 94.179,43	**R$ 1,24**	R$ 953,56		
DP.13	682	**R$ 162,60**	R$ 110.893,20	**R$ 1,24**	R$ 845,68		
DP.14	23	**R$ 170,01**	R$ 3.910,23	**R$ 12,98**	R$ 298,54		
DP.15/16	261	**R$ 98,16**	R$ 12.809,88				
DP.17	119			**R$ 23,54**	R$ 2.801,26		
DP.18	136			**R$ 23,54**	R$ 3.201,44		
DP.19	4	**R$ 668,19**	R$ 2.672,76	**R$ 150,00**	R$ 600,00		
DP.20	2	**R$ 668,19**	R$ 1.336,38	**R$ 150,00**	R$ 300,00		
DP.21	4	**R$ 1.496,06**	R$ 5.984,24	**R$ 150,00**	R$ 600,00		
DP.22	2	**R$ 1.496,06**	R$ 2.992,12	**R$ 150,00**	R$ 300,00		
DP.23	229					**R$ 130,05**	R$ 29.781,45
DP.24	10	**R$ 172,56**	R$ 1.725,60				
DP.25	12	**R$ 348,66**	R$ 4.183,92	**R$ 1,16**	R$ 13,92		
DP.26	16	**R$ 77,57**	R$ 1.241,12				

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DP.27	3	**R$ 104,28**	R$ 312,84				
DP.29	1			**R$ 61,19**	R$ 61,19		
DP.30	1			**R$ 61,19**	R$ 61,19		
DP.31	1			**R$ 61,19**	R$ 61,19		
TOTAL			**R$ 621.276,10**		**R$ 31.663,72**		**R$ 33.416,31**
TOTAL			**US$ 117,001.15**		**US$ 5,963.04**		**US$ 6,293.09**

Source: SODONCO/HGP/TO (2016) 01US$ (American Dollar) = 5,31 R$ (Brazilian Real)

Table 4 - Disposition of DPT in deciduous dentition and comparison of financial impact between tables VRPO / SIGTAP

DPT	**2011/2016**	**VRPO***	**VRPO***	**SIGTAP****	**SIGTAP****
DPT.1	7	**R$ 68,10**	R$ 476,70		
DPT.2	30	**R$ 107,77**	R$ 3.233,10	**R$ 0,00**	R$ 0,00
DPT.4	79			**R$ 0,00**	R$ 0,00
DPT.5	4	**R$ 250,00**	R$ 1.000,56	**R$ 5,59**	R$ 22,36
DPT.6	3	**R$ 140,17**	R$ 420,51		
DPT.7	66	**R$ 83,00**	R$ 5.498,46	**R$ 0,00**	R$ 0,00
DPT.23	1	**R$ 181,86**	R$ 181,86	**R$ 0,00**	R$ 0,00
DPT.31	6	**R$ 65,96**	R$ 395,74		
TOTAL			**R$ 11.206,93**		**R$ 22,36**
TOTAL			**US$ 2,110.53**		**US$ 4.21**

Source: SODONCO/HGP/TO (2016) 01US$ (American Dollar) = 5,31 R$ (Brazilian Real)

Table 5 - Organization of POD in permanent dentition and comparison of financial impact between tables VRPO / SIGTAP

DPT	**2011/2016**	**VRPO***	**VRPO***	**SIGTAP*****	**SIGTAP****
DPT.01	79	**R$ 68,10**	R$ 5.379,90		
DPT.12	723	**R$ 112,90**	R$ 81.626,70	**R$ 0,00**	R$ 0,00
DPT.13	209	**R$ 166,45**	R$ 34.788,05	**R$ 0,00**	R$ 0,00
DPT.14	87	**R$ 166,45**	R$ 14.481,15	**R$ 0,00**	R$ 0,00
DPT.15	33	**R$ 166,45**	R$ 5.492,85	**R$ 0,00**	R$ 0,00
DPT.16	153	**R$ 107,77**	R$ 16.488,81	**R$ 0,00**	R$ 0,00
DPT.17	36	**R$ 328,13**	R$ 11.812,68	**R$ 4,41**	R$ 158,76
DPT.18	5	**R$ 388,34**	R$ 1.941,70	**R$ 5,71**	R$ 28,55
DPT.19	24	**R$ 624,88**	R$ 14.997,12	**R$ 6,95**	R$ 166,80
DPT.20	3	**R$ 353,46**	R$ 1.060,38	**R$ 4,41**	R$ 13,23
DPT.21	3	**R$ 482,94**	R$ 1.448,82	**R$ 5,71**	R$ 17,13
DPT.22	1	**R$ 814,08**	R$ 814,08	**R$ 6,95**	R$ 6,95
DPT.23	57	**R$ 181,86**	R$ 10.366,02	**R$ 0,00**	R$ 0,00

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DPT.24	1	**R$ 147,26**	R$ 147,26		
DPT.25	740	**R$ 126,06**	R$ 93.284,40	**R$ 0,00**	R$ 0,00
DPT.26	103	**R$ 127,95**	R$ 13.178,85		
DPT.27	26	**R$ 297,48**	R$ 7.734,48	**R$ 22,00**	R$ 590,72
DPT.28	13	**R$ 138,66**	R$ 1.802,58	**R$ 23,54**	R$ 306,02
DPT.29	1	**R$ 688,20**	R$ 688,20	**R$ 150,00**	R$ 150,00
DPT.31	1	**R$ 260,51**	R$ 260,51		
DPT.32	7	**R$ 65,96**	R$ 461,70		
DPT.33	3	**R$ 699,67**	R$ 2.099,01	**R$ 150,00**	R$ 450,00
DPT.34	2	**R$ 254,27**	R$ 508,54		
TOTAL			**R$ 320.863,79**		**R$ 1.888,16**
TOTAL			**US$ 60,426.32**		**US$ 355.58**

Source: SODONCO/HGP/TO (2016) 01US$ (American Dollar) = 5,31 R$ (Brazilian Real)

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Covid-19 and the role of nursing in Maintenance of Mental Health

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Abstract— *This research presents itself as a bibliographic review about Covid-19 and the role of nursing in maintaining mental health. Aiming to analyse the mode of nursing assistance for maintaining the mental health of individuals in the midst of a global pandemic, emphasizing what the United Nations Organization (UNO) determines in its guiding guide for mental health care of several groups, since in the midst of the pandemic situation we are in, it is of paramount importance to prevent mental health problems, including anxiety and depression.*

Keywords— ***Covid-19, Nursing, Mental health.***

I. INTRODUCTION

According to the Ministry of Health (2020), COVID-19 is caused by the new coronavirus and is an asymptomatic and / or symptomatic infectious disease with respiratory infections. It can vary from a simple cold to a picture of severe acute respiratory syndrome.

Currently, in all areas, comments are made about the new Coronavirus, its symptoms, transmission mechanisms, possible diagnoses, tests and prevention. It would not be premature to say that we are experiencing a situation of public health calamity worldwide, since the disease has spread in gigantic proportions, changing everyone's habits and customs as mechanisms to prevent the physical and psychological health of individuals (BBC News, 2020).

However, in the midst of this pandemic it is of paramount importance to highlight mental health, since, in the midst of all this change in habits, routines, social isolation and especially, the feelings of panic, fear and concern that plague the world population , taking care of mental health is crucial for humanity to overcome this very complex phase in which it is living (UN News, 2020).

It is worth mentioning that an epidemic of this magnitude has as a consequence psychosocial disturbances that can overcome the affected population's ability to cope. Therefore, it is to be expected that the entire population will suffer anguish and tension. Thus, it is necessary to have a co-responsible construction between the individuals included in this process, that is, management, health authorities and the population (Silva et al., 2020).

In addition, strategies to experience this situation in the most flexible and healthy way possible should be established so that people can have a routine, a moment of self-knowledge and reflection, pauses when watching news that can cause insecurity, anguish and discomfort, the practice of work, relaxation and leisure activities, and the search for strengthening bonds with people that provide greater collective well-being, even if at a distance (Silva et al., 2020).

In this regard, it is worth mentioning that the most diverse sectors of society are working hard to overcome this pandemic with the least possible consequences.

Among these very important segments, health professionals, who are tirelessly working so that all those in need are served in the best possible way. These professionals constitute a risk group for Covid-19 due to the fact that they are vulnerable when they need to be exposed directly to infected patients, thus receiving a high viral load (millions of virus particles). In addition, they are subjected to exuberant stress when attending to these patients, many of whom are in a serious situation, in working conditions, sometimes inadequate (Teixeira et al., 2020).

Experiencing this totally unusual experience, in a totally atypical world, where there is no definition of status or specifications, it is worth highlighting the role of nursing professionals, as the most important in health care, since they do all care management, from people, materials, that is, they promote care in full for the people in need, taking care of these individuals in their physical, mental and social aspects. In this period in which we live in profound insecurities and uncertainties in all aspects of life, these professionals war against an invisible agent that threatens human life and holds everyone hostage. However, these professionals remain steadfast in the daily struggle for life. (Polakiewicz, 2020).

In addition, preliminary studies have shown the need to increase the number of mental and social health caregivers in order to meet the needs of community members, especially those who have greater risk factors with the possibility of developing some mental disorder. Such evidence suggests how important counseling and psychotherapy are, and in this period of necessary distance, specifically in the online service modality. (Duarte et al, 2020).

Based on these reflections, this research aims to analyze the systematization of nursing care to maintain the mental health of individuals in the midst of the COVID-19 pandemic.

II. METHOD

This is a study of bibliographic review with a qualitative approach, which for Volpato (2000), bibliographic

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research "is the search and collection of theoretical information on a given subject". Already Marconi and Lakatos (1996), clarify that, the qualitative approach is a research that has as premise, to analyze and interpret deeper aspects, describing the complexity of human behavior and still providing more detailed analyzes about the investigations, attitudes and trends of behavior.

This investigation was based on works by experts in the area covered and articles made available on reference sites for academic articles, such as; Virtual Health Library (VHL); Scientific Electronic Library Online (SCIELO), since, this is a virtual electronic library that covers a selected collection of Brazilian scientific journals, the bulletin of the BOCA magazine, which is an initiative of the Federal University of Roraima, where it has the purpose of publish essays, review articles, theoretical and empirical articles, reviews and videos related to public policy issues, the UN website, which made available in its collection a "booklet" so that groups of different professionals could obtain a base to work on the issue of mental health with your audience, among others.

Inclusion criteria were: complete articles, in Portuguese and English indexed in the last 5 years, based on the descriptors "mental health" and "covid-19". And as a form of exclusion were articles with different themes to the covid-19 and maintenance of mental health.

III. RESULTS AND DISCUSSION

As the Covid-19 pandemic is something recent, it became necessary to delimit the authors and articles that corroborate it according to the subject of this research. The boundaries will be presented through the following topics.

According to the data collected during the analysis of the theoretical framework, two main topics emerged: COVID-19 and the implications for mental health; Nursing in the struggle to advance psychosocial problems in the midst of a pandemic. However, there are publications of scientific studies that corroborate with the present theme, and these characteristics can be observed, in which the predominance are studies in Portuguese and English, such as Bibliographic reviews in original articles and indexed in the SCIELO, BIREME, MEDLINE, BVS databases , between the years 2015 to 2020.

The analysis of the literature found made it possible to elaborate two categories based on relevant points, namely: Category 1- COVID-19 and the implications for mental health; Category 2 - Nursing in the struggle to advance psychosocial problems in the midst of a pandemic.

84 complete articles were found in Portuguese and English, from a previous reading, only 21 remained according to the criteria previously established according to the theme.

3.1 Covid-19 and the implications for mental health

In December 2019, an entirely new virus called Coronaviridae appeared in the city of Wuhan in China, where it would later shake several nations, as well as the daily lives of everyone on a global scale. Since its discovery, many scientists from the most diverse countries have been in a single struggle, trying to find measures that can be used directly for the treatment of COVID-19.

In April, COVID-19 reached a major global impact in its spread, the disease was considered to be the most alarming viral respiratory syndrome since H1N1 influenza in 1918 (Ferguson et al., 2020). It is estimated that in the Spanish flu pandemic, "as the H1N1 pandemic became known", around 20 to 50 million people died worldwide at that time.

The symptoms of COVID-19, resemble those of a common flu, however, the respiratory crisis is the predominant symptom in this disease and, therein lies the danger, because due to the respiratory crisis the individual can reach death very quickly .

In January 2020, the World Health Organization (WHO) determined an international public health emergency, due to the alarming spread of COVID-19 an outbreak of this new disease was caused. Because of this, many protective measures have been taken, among which is social isolation. Fear of the unknown and the progress of the disease is present in a large part of the population, thus causing several psychosocial problems, among which the high level of stress and anxiety stood out.

Thus, the mental health of individuals around the world is also being discussed by the UN Health Agency's Department of Mental Health and Substance Use, where it has developed recommendations for the protection of mental health in the midst of the Coronavirus pandemic. About this:

"The sudden and almost constant flow of news about an outbreak can make anyone worried. Work with facts; not with rumors and misinformation". (World Health Organization, 2020)

The website and platforms of local health authorities can help to separate facts and speculations.

Call neighbors or community members who may need extra assistance.

Working justly as a community can help create solidarity in the approach to COVID-19. (UN, 2020)

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In Brazil, the Ministry of Health, through the Fiocruz Foundation, made material available for managers to face psychosocial problems in the midst of a pandemic. Considering the phases of the epidemic, strategies were created organized in "before", "during" and "after" the epidemic to help understand the demands and strategies for intervention. Based on the premises that:

An epidemic, such as COVID-19, implies a psychosocial disorder that can overcome the affected population's ability to cope. It can even be considered that the total population of the country suffers a psychosocial impact at different levels of intensity and severity. Although most psychosocial problems are considered normal reactions and symptoms for an abnormal situation, an increase in the incidence of psychological disorders (between one third and half of the population) is estimated according to the magnitude of the event, the degree of vulnerability psychosocial, time and quality of psychosocial actions in the first phase of the response to the epidemic. (BRAZIL, 2020)

It is worth mentioning that the material to aid mental health in the midst of the pandemic made available by the UN for the most diverse groups, as well as the chart made by the Fiocruz Foundation are on their respective websites.

3.2 Nursing in the struggle to advance psychosocial problems in the midst of a pandemic.

It is of utmost importance to emphasize that the nursing professional has a fundamental role in the prevention, recovery, promotion, and rehabilitation of health, based on ethical and legal precepts. That way, The guiding principle of Nursing is the responsibility to show solidarity with people, groups, families and communities, aiming at mutual cooperation between individuals in the conservation and maintenance of health. (MIRANDA, 1999)

Based on this assumption, it is relevant to highlight that, the paths already taken to achieve this principle of Nursing were and continue to be traced, over boulders, since, a lot of effort is required to live with the unfinished, with the ambiguities, with the differences , with the uncertainties and mainly with the multifinality. We have seen this more and more through the attitudes taken by nursing professionals in the midst of the COVID-19 pandemic. About this,

Health professionals working on the front lines, such as nurses and doctors, will be those who will predominantly listen to complaints and offer psychological support to people who seek health services or who are hospitalized

In this way, these professionals are exercising a multipurpose. In the midst of so much struggle to combat this epidemic, nursing, in addition to worrying about the physical health of patients and other individuals who need assistance, has gradually contributed to the mental health of all those in need. Because,

Assistance work with individuals cannot be a one-way action, in which they only receive ready instructions on how they should act to solve or alleviate their problems. Nursing discovers that the individual is not a passive recipient of professional care, but an agent, subject to his own process of living. (MACEDO and MONTEIRO, 2004)

Thus, in the midst of so many difficulties that we are facing due to the pandemic, the emotional shock was more than obvious, thus causing psychosocial problems, such as anxiety and depression. However, nurses are standing out in the midst of this fight, because in this difficult period these professionals represent the possibility of expanding our humanity and our own world with their examples of appeal to humanism.

IV. CONCLUSION

When reevaluating the practice of Nursing in the midst of the pandemic of COVID-19, it should be carried out within a reflective, creative and mainly humanistic perspective, as it is the central category of this profession in the midst of conflicts that we are taking care of, encompassing dynamism, mutability and innovation as a process.

Thus, during the disease process, the multifunctional nurse became necessary, since they corroborate significantly for the maintenance of health, both physical and mental, as they have drastically changed the perception of the patient to be human and citizen. It is worth mentioning that these attitudes are relevant ways of helping to preserve mental health, as it prevents and assists the risks of individualsdevelop anxiety attacks, due to the fear and insecurity that surround us due to this pandemic.

Thus, with positive attitudes of many nurses through humanization in times of perplexity and anguish during the act of acting in the health-disease process, it will be possible to transform at this moment of growing conflicts. This is undoubtedly one of the great challenges that these professionals are subject to, however, this is undoubtedly nursing.

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The benefits' program of electronic invoice as a tool to tackle tax evasion

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Abstract**—** *The tax burden in Brazil known as notably high and complex, misappropriation of taxes collected, and several scandals involving embezzlement of public money are the most frequent Brazilian citizens´ complains to avoid or not collaborate with the Government´s programs purposely to inspection and tax collection. The Government, aware of the need to identify new and effective ways to interact with its public, as well as implement a social control, put in place their sights on developing initiatives in order to encourage the Tax Citizenship in the country through offering benefits to the citizens. As an example of one of these initiatives, the Government implemented the Tax Invoice Citizenship Program which provides several benefits to taxpayers who request the issuance of tax documents at the time they´re conducting business operations. Thus, this article aims to investigate the programs already implemented in Brazil, evaluate how the Government is managing and applying the tax benefits generated from these programs, as well as, verify whether those programs are considered by Brazilian citizens as the most effective tool to monitor and fight against tax evasion in the country.*

Keywords**— Invoice Citizenship Program, Tax Evasion, Electronic Invoice.**

I. INTRODUCTION

In 2019, a research performed by IBGE[1]showed that Brazilian population reached about 210 million citizens this year. Whether we consider that, out of this total, 50% of the population are active consumers of consumer products, the Government may be count on thousands of citizens acting as tax agents and helping the country to monitor and fight against tax evasion.

The Government motivated by the promising scenario, in which citizens may act as tax agents, they developed initiatives to encourage the Tax Citizenship through offering benefits to the citizens. In 2007, as an example of one of these initiatives, the Government implemented the Benefits' Program of Electronic Invoice. The program was started in the State of São Paulo, and later, it was also spread to other states, reaching up 16 of the 27 federative units.

The program has as main principle reward the consumers of consumer products who collaborate with the program. For this happen, the consumers should request an issuance of the invoice, adding on this document their ID number- CPF[2]-in which it will allow the Government monitors the occurrence of the taxable event.

It is interesting to note that, the implementation of this program goes beyond the increase of the Government´s tax collection generated from a business transaction. It may create a huge opportunity to the Government raises social awareness about tax evasion in the country. Since each Brazilian citizen becomes a tax agent, and they are rewarded every time they request an invoice in connection with a business transaction.

This new supervisory role of the citizens would not be restricted to the requirement of the tax document,

[1]The Brazilian Institute of Geography and Statistics (IBGE) is a public institute of the Brazilian federal administration created in 1934 and its duties are linked to geosciences and social, demographic and economic statistics, which includes conducting censuses and organizing the information obtained from these censuses, to supply federal, state and municipal government agencies, and to other institutions and the general public.

[2]The Register of Individuals is the register maintained by the IRS in which any natural person, regardless of age or nationality, including deceased may apply. Each registrant is uniquely identified by an 11-decimal digit CPF registration number.

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but it also includes the possibility of verifying - by electronic means - the effective registration of tax documents in their credit´s program statements. Thus, whether it is identified by the consumers that the company has not issued the tax document accordingly, the consumer can denounce them to the regulatory government agency. An administrative proceeding will be initiated, and it may result in sanctions against the violators of Government´s laws.

The Benefits' Program of Electronic Invoice has allowed a change in the relationship between the State and the taxpayer. The common objective reunited them throughout the process of raising awareness about the social function of taxes, the duty to tax collection and the inspection process. All these steps of the process, initially under the responsibility of the State, it guarantees and promotes the fundamental rights as the citizens as the State.

Due to these facts, it´s important to emphasize how important is conducting research in regarding to these types of programs. The research will allow to obtain a depth knowledge about the applicability of the programs, as well as, it may take the relationship between the State and Brazilian citizens to the next level, balancing in a fair way the interest of both sides. Additionally, it highlights how important it is to combine a tax policy with exercise of citizenship.

In this context, this article aims to answer the following questions: **Which are the Electronic Invoice benefits program? Is the program an encouraging tool for the taxpayers request the tax document? And to help the Government to fight against tax evasion?**

Based on public information provided through Government´s official websites, the general purpose of this article is evaluating the current programs of each State and its benefits achieved since the implementation.

In addition, this article will present the results of the survey conducted with accounting students and accountants originally from different states of the country. The main purpose of the survey was trying to evaluate whether they are actively collaborating with the Government´s programs.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPED

2.1 Tax Evasion

Despite the social necessity, there is a common sense among Brazilians who claim that paying taxes in the country is unpleasant. Besides that, they affirm that evade is a protective measure for companies and themselves. Which they did not realize is that with this attitude, they are contributing to the legitimation of tax evasion.

Based on PIB´s information, the tax evasion in Brazil has been increasing year after year. In 2017,R$[3]571.5 billion were evaded. In 2016, the Sonegometro[4], considered as the panel of tax evasion in the country, recorded a loss of R$539 billion. The Brazilian law nº. 8.137/1990, later reformulated by the law nº 4.729/2015, stablish about the tax evasion. These laws together reinforce that tax evasion is considered as a crime in the country, as to the penalties provided by law.

Despite the relevance and pre-existence for years of evading, it was only with Becker's proposal (1968), that an approach to crime was initiated from the perspective of economic theory. This theory mentions that criminal decisions can be explained based on the rational behaviors of the individuals, it means that, when the individual decides to committee a crime, he weighs the benefits that will be obtained from their criminal action, as well as the risks involved, such as risk of being caught, convicted and fined.

Still regarding the individual´s perspective, Allingham and Sandmo's (1972) model, assumes that an individual considered rational always compares the estimate financial returns at the moment in which their incomes need to be reported with the possibility of being detained or punished by the authority. In the following years, Graetz, Reinganun and Wilde(1986), a significant progress on the theme. They presented a method in which the tax evasion could be measure through dynamic games in which all the stakeholders of the process (taxpayers, tax authorities and other) could be considered and influenced the Government agents' decisions. Thus, allowing for empirical analysis aimed at analyzing policy efficiency. This same model was used by Lipatov (2008), who to provide an important evidence which explains how the Government can increase its degree of trust in society and thereby reduce evasion.

In recent years, studies by Cowell and Gordon (1988) and Elster (1989) showed highlighted that the citizens have a key role in the probability that tax evasion occurs in a country. According to them, the reason is because it is important for them to gain as much as possible from the taxes paid to the Government. They affirmed that whether the citizens realize that paying tax

[3]The Brazilian currency symbol

[4]The Sonegometer created by the institution SINPROFAZ (Union of Prosecutors of Finance), provides an electronic scoreboard that reveals the billions evaded annually in Brazil through the site http://www.quantocustaobrasil.com.br

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will generate direct and/or indirect benefits for them, they will contribute and support this Government obligation. The citizens believe following tax laws is a social norm.

Thereby, we observed through the process to review the technical literature about the theme that the studies published focus on explaining and understanding the parameters related to the act of tax evasion, as well as the penalties apply in each case. Besides that, another important information is that these literatures contemplate other factors as well, such as the tax burden in the country, the benefits of tax collection to the society and the key citizen´s role to reinforce this process.

In this case, the new government´s programs that seek to fostering citizenship, it may be considered an important tool to tackle against tax evaders. These programs intend to promote tax regulations as moral standards when the citizens truly embraced this idea.

2.2 Tax Citizenship

The State has the duty to guarantee and promote the fundamental rights to all citizens. On the other hand, it is expecting that each citizen actively contributes to achieve the goals that there are common for all members of society Follini (2012).

Within this context, the term tax citizenship arises. It assumes that these terms should be conceived from the citizens who has as one of their duties, the collection of taxes that are considered as indispensable for the maintenance of the State. As mentioned by Nabis(2005)considered that the duty to pay taxes represents one of the main duties within a welfare State, so taxes constitute an undeniable duty of citizenship that each citizen must honor.

Following this line, the studies by Bobbio (2007)pointed out in one of his studies that the citizens' rights and duties has practical consequences in favor of public tax administration. For this reason, the State maintains an important role in the process of promoting and encouraging the tax citizenship programs within the population. These actions contribute to socializing the Government´s initiatives.

As stated by Mattos, Rocha and Toporcov (2013) tax citizenship programs can also bethe tax authorities´ response to the new perception of the taxpayers. They started to consider themselves as a client who need services. Instead of working on engaging the companies and individuals on which the tax burden falls. The Government decided to invest in educating the consumer and later turning them into a trustable partner. The reason behind the Government´ strategy was related to the fact that they believed that the consumers could help them to reinforce their programs, not only from the perspective of financial incentives, but also through awareness-raising campaigns which it highlighted how the program directly benefits the consumers, as well as it may increase tax collection and decrease tax evasion.

It is important to emphasize that this study is presented without pretending to exhaust the theme about tax citizenship. However, we believe that this type of programs may be an excellent tool to educate and engage the citizens about the tax citizenship programs. The tax citizenship program is considered a quite simple program because it does not require much to the consumers. The only mandatory requirement is related to the consumers´ request for an invoice should be issued every time they acquire any consumer products. Besides that, it is considered an effective way to help the Government to fight against tax evasion.

2.2 Invoice Citizenship Program

The Invoice Citizenship Program aims to protect the State as well as the tax payer in the process of acquiring consumer products from a company or individual. Based on the program´s rule the consumers should request the issuance of invoice every time they acquire any consumer products. With this simple action, the consumers ensure compliance with tax obligations. Pursuing this objective, the Government encourages the consumers to request the tax document, which is the triggering factor of business transaction event. Throughout this action, it is established a tax relationship between the Government, companies, and consumers. As shown below in the figure:

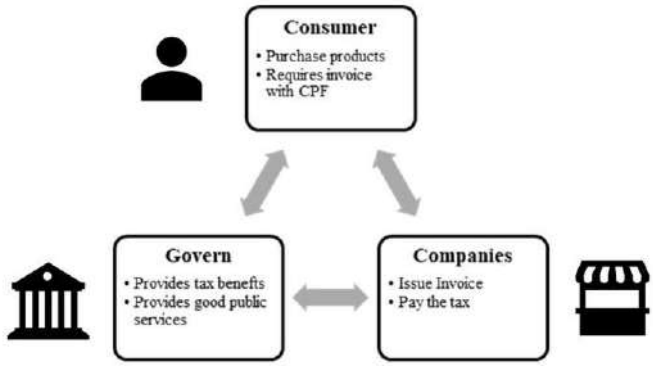

Fig.1: Consumer, Business and Government Relationship
Source: Made by the authors

It should be remembered that the benefit program was driven by the implementation of the new electronic document model named NF-e, which came into force since 2006 and replaced the previous tax document system based on the physical invoices issued in paper. This new model is guaranteed by the sender's digital signature, simplifying the taxpayer's ancillary obligations, and allowing, at the

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same time, real-time monitoring of commercial operations by the Tax Authorities - Portal NF-e (2019). In addition to the NF-e, other electronic documents have been developed, such as the Consumer Services Invoice - NFC-e, popularly known as the Tax Coupon, which allows to inform the CPF and are used in retail business operations.

During our technical literature review, we identify that the authors as Ramoset al (2015), showed the evaluated the incentives provided by the tax citizenship programs through the NF-e in different states of the country, during the period from2004 to 2012.Besides that, he verified the programs implemented by each state at the date when he conducted the research. As a conclusion of his study, he presented the programs implemented by each state and the types of benefits offered to the consumers, without the purpose of verifying specific impacts on the economy or population.

Hence, the research presented in this article has the purpose to deepen study the theme – Tax Citizenship Programs – adding the period the year of 2018. And it tries to identify its benefits offered and the target of the program, as well as to evaluate the improvements performed through the years, and what is the citizens' perceptions about the program.

III. METHOD

3.1 Research´s Characterization and Data Collection

The study presented hereby, it used a qualitative approach based on an exploratory nature with the purpose to help the readers to be more familiar with the main essence of the research, with the intention to show it more explicit, with improvement and insights based on intuition (Gil, 2002, p.41).

First of all, it was conducted search on the websites of the Secretary of Finance (Sefaz) of each Brazilian´s states and the Federal District, in order to identify which of federative units had implemented the programs to stimulate the issuance of the invoice. After identifying the federative units and the Internet addresses of the programs, a detailed study was conducted about the laws and decrees that allowed the program to be legal validity and its common objectives - to promote the issuance of the tax document. See on the table below, the following programs in force until December 2018:

Table 1: Programs by State and Information Available on the Websites

STATE	PROGRAM´S NAME	REGISTERED COSTUMERS	STATE	PROGRAM´S NAME	REGISTERED COSTUMERS
SP	Nota Fiscal da Paulista	20.413.577	**AM**	Nota Fiscal Amazonense	299.339
DF	Nota Legal	1.165.652	**PI**	Nota Piauí	226.419
AL	Nota Fiscal Alagoana	248.792	**PR**	Nota Paraná	2.561.225
SE	Nota da Gente	136.149	**MA**	Nota Legal	233.249
RO	Nota Fiscal Rondoniense	*	**TO**	Tö legal	*
PA	Nota Fiscal Cidadã	230.959	**RN**	Nota Fiscal Potiguar	*
CE	Sua Nota Vale Dinheiro	*	**RS**	Nota Fiscal Gaúcha	1.700.000**
GO	Nota Fiscal Goiana	*	**BA**	Nota Premiada Bahia – NPB	400.000**

* Information of the oficial sites

** SEFAZ press release information

Source: Made by the authors

Based on the results of our analyzes, we noted that the State of Ceará was the first state to implement the incentive program through the issuance of the tax document. However, it was only in December 2004, that the program´s participants were able to effectively register their coupons on the website of the Secretariat of Finance of Ceará. This action has the purpose of minimizing the

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time in which the consumers will be receive the benefit offered from supporting the Government´s program.

In August 2007, three years later that the Government launched the program, São Paulo state created the program named *"Nota Fiscal Paulista"*. More than 20 million registered users were identified until December 2018.In regarding to the number of tax documents issued in the state, more than 67 billion have been generated since 2008. From this total, 30% corresponds to the tax documents in which the CPF number is identified.

Comparing the information provided by SEFAZ´s website, it is possible to observe that the Government of São Paulo state is considered the pioneer in the process to implement with success the tax citizenship program through the issuance of the tax document. Through the website of the state, we observed that the Government maintains a detailed information about this program, such as registered users' evolution, credit receives per month and trading industry and industries segments, rewards provided to the citizens per month and its amount respectively.

In regarding to innovation, despite to the fact that huge improved of technology industry in recent years, the official websites of the programs presents limited data related to the number of taxpayers, and it does not specify the period of the information available nor the values of the rewards distributed.

The unavailability of data is a huge obstacle for those who conduct academic and/or economic research. The lack of disclosure of the data shows that the State does not consider fiscal transparency as an important part of the tax citizenship program. The SEFAZs that are providing detailed statistical information about the program are those from the Federal District and Paraná, but there is still much to evolve to allow statistical analysis of the benefits of these programs.

As mentioned earlier, each state has autonomy to decide how the best way to promote its tax citizenship. After analyzing the laws and decrees published by each state, that owns their program, we identified the following types of benefits offered to the citizens:

• Tax Return

From the total of 16 programs analyzed, we noted that seven allow the consumers -individuals or legal entities - to recover a percentage of 2% to 30% of ICMS collected by commercial establishments and service providers. It was observed that few programs have stipulated a threshold related to values offered as benefit to the consumers, as an example we can cited the "*Rondoniense* Invoice", which offers to the consumer a tax burden reduction up to 20% of the ICMS collected by the commercial establishment, being limited to 5% of the value of the tax document issued.

The benefit´s value offered to the consumers refers to the credits of the tax returned. The total amounts are credited in the bank account of the consumers that are identified through the CPF number informed on the tax document. It is important to mention that the credit cannot be transferred to another CPF number. Some states, as an example we can cited the São Paulo state, there are periods for "withdrawals" the benefits, as well as minimum value limit. The monetary threshold stablished by Sao Paulo state is aboveR$25.

- **Sweepstakes**

For each purchase made and registered through the electronic tax documents named NFC-e or NF-e in which CPF number was included, the consumers will be unableto compete for the prizes and special draws monthly. Most of the draws are made by following the federal lottery numbers.

- **Discounton IPVA**

The discount on IPVA means that atax will be offset against other fees and contributions. This definition is part of the propose to compensate the credit generated from ICMS tax, as well as premiums for discounts on the value of IPVA - Motor Vehicle Property Tax.

This was one of the benefits adopted by the Tocantins tax invoice program named *"Tô Legal*", which will enable the distribution of premiums and the granting of a 5% discount on the payment of IPVA to the final consumer.

- **Credits granted in Transportation Ticket or Cellular Telephony (Mobile)**

Several benefits considered as a differential have emerged in recent years. As an example, we can cite Maranhão state´s case denominated as "*Maranhão´s* legal invoice" that offered as benefit to the consumers a credit for each invoice. The amount ranges from $5 reais to R$25, per month.

- **Charitable Donations**

From the total of 16 programs researched, we observed that 12 of them allow the donation of the credits obtained from the program to support charitable institution previously registered in their official websites.

There are programs, such as *Potigar´s* Invoice, in which the taxpayer can "adopt" a non-profit organization. Thus, when the consumers are filling their register out in the Government´s Campaign form, the taxpayer can choose one of the non-profit organizations previously listed on it. Whether the taxpayer is drawn, the institution

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chosen by them will receive a prizein the amount equivalent to 50% of the consumer´s prize.

See below a table summarizing the programs and benefits collected in 2018 – **Table 2**. It is important to emphasize that that these benefits may be withdrawn or added of programs, according to criteria defined by the State´s management.

Table 2: State-Selected Programs and Benefits

	BENEFITS				
STATE	**Sweepstakes**	**Tax Return**	**Discounton IPVA**	**Credit Granted in Transportation Ticket or Cellular Telephony (Mobile Phone)**	**Charitable Organization**
CE	YES	*	*	*	YES
SP	YES	YES	YES	*	YES
DF	YES	YES	YES	*	YES
AL	YES	YES	*	*	YES
SE	YES	*	*	*	YES
RO	YES	YES	YES	*	YES
PA	YES	*	*	*	*
RS	YES	*	YES	*	*
GO	YES	*	YES	*	*
AM	YES	**	**	**	**
PR	YES	YES	*	*	YES
PI	YES	YES	*	*	YES
MA	YES	YES	YES	YES	YES
TO	YES	*	YES	*	*
RN	YES	*	YES	*	YES
BA	YES	*	*	*	YES

Source: Made by the authors

* Premium Incentives Not Applicable to Invoice

** There are no premium benefits yet, just a citizenship campaign with the issuance of invoice (under development)

Recently the programs from the states of São Paulo, Alagoas, Sergipe, Rio Grande do Sul, Paraná, Rio Grande do Norte, and the Federal District developed mobile phone apps(mobile applications). This new technology allows the taxpayers to follow closely the invoice registered in their systems, as well as the credits owned by each taxpayer.

3.1 Results and Discussion

To understand the factors that have influenced the consumers to request or not the invoice with their CPF number, an exploratory-descriptive study was performed. The criteria defined was the quantitative approach, with primary nature data.

Data collection was performed based on a non-probabilistic sampling chosen for convenience. The invitation was sent to students of the technical and undergraduate courses in Accounting and Graduate students throughout Brazil, which it allowed to analyze information from several states.

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The reason why we chose Accounting professionals is because the fact that Mussolini stated, in1994, that these professionals are qualified to use Accounting´s concepts, such as theoretical, technical and practical, as a means to leverage the economic development, through the appropriate use of Financial Accounting and Management tools. In addition, they must also be attentive to execute these functions in an ethical and socially responsible manner.

Faced with this role and holder of the knowledge of business information and processes, Accounting professionals must operate through their social contribution, ensuring that their work developed in a company is extremely relevant to the community to which they belong. Following this line, Nasi (1994) stressed that an Accountant must have an unquestionable ethical-professional behavior. Accountant must be aware of their social and professional responsibility.

The questionnaire was designed in a form of the Google Docs tool. It was restricted to the control and management of researchers and it was released by sharing in WhatsApp groups. These groups are related to academic courses in which the researchers acted as teachers and professionals. Initially, the estimated sample size was of 560 participants, in the period from January to February 2019. However, after 2 months of the survey´s execution, only 175 responses were collected, representing 31.2% of the initial sample.

The questionnaire´ structure was divided into three parts: the first part contains questions related to the survey respondents´ background, such as state of origin, age, education level, among others; in the second parts is the question whether the respondents usually request the issuance of the tax document and whether they add their CPF number on this document; the third part aim to identify the reason behind the respondents´ decision to request or not the invoice, as well as it includes their ID on it. The was of the questionnaire was structured allow the researchers to streamline and delimit the search by scenario.

The table below present the variables identified when it was reviewed the survey respondents´ background (State, age, and education), as shown below:

Table 3 - Sample distribution of respondents by Federation Units (State)

State	Number of respondents by State	Percentual of Respondents by State	State	Number of respondents by State	Percentual of Respondents by State
RS	33	19,0%	MG	8	4,57%
SP	28	16,0%	GO	8	4,57%
PE	25	14,1%	PR	6	3,42%
BA	19	10,85%	CE	5	2,85%
PI	15	8,57%	SC	4	2,28%
RJ	11	6,28%	ES	2	1,14%
TO	11	6,28%	MA	1	0,05%

Source: Made by the authors

Based on the data presented above, it is important to emphasize that despite of the fact that the states of Minas Gerais, Santa Catarina and Rio de Janeiro appeared in the results of the survey, these states do not have a tax citizenship program in place. Where as we did not receive any answers from the states of Rondônia, Sergipe, Alagoas and Distrito Federal.

In regarding to the level of education, we observed a predominance of respondents with Graduate course, which it represents 64.3%. Respondents who undergraduate are 33.7% and the remaining of 2.9% belongs to a technical course. These results showed to the researchers that most of the interviewers have a high level of education.

Table 4: Age range of the respondents and they add or not their CPF number on the Invoice

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Age range	Yes	%	No	%
18 a 25	11	52%	10	48%
25 a 40	60	67%	30	33%
40 a 60	31	53%	27	47%
60+	0	0%	3	100%

Source: Made by the authors

According to the table above, we observed the 60+ age group corresponds to a minority group in the survey respondents. However, it is important to note that this group represent the major group that does not support this kind of Government´s program, due none of them add their CPF number on the invoice.

Analyzing the results in connection with the request of issuance of invoice with consumer´s CPF number on it, we noted that from the 175 respondents, 105 affirmed that they requested it against 70 who did not request it. Based on the applicants, we highlighted that 32.2% of respondents who usually request to add their CPF number on the tax document, against 39.8% of respondents who sometimes require to include it, and, finally, 28% of respondents who only inform the CPF number when the seller asked them about their desire to do so.

In other words, these numbers demonstrated that the consumers are not actively requesting to include their CPF number on the invoice, even though in regarding to taxpayers who agree to inform it. In this case, it is becoming increasingly necessary to carry out awareness campaigns showing the importance of the tax citizenship program and the benefits of the programs to the society. See in the table below how the survey respondents informed to use benefits offered from the tax citizenship program:

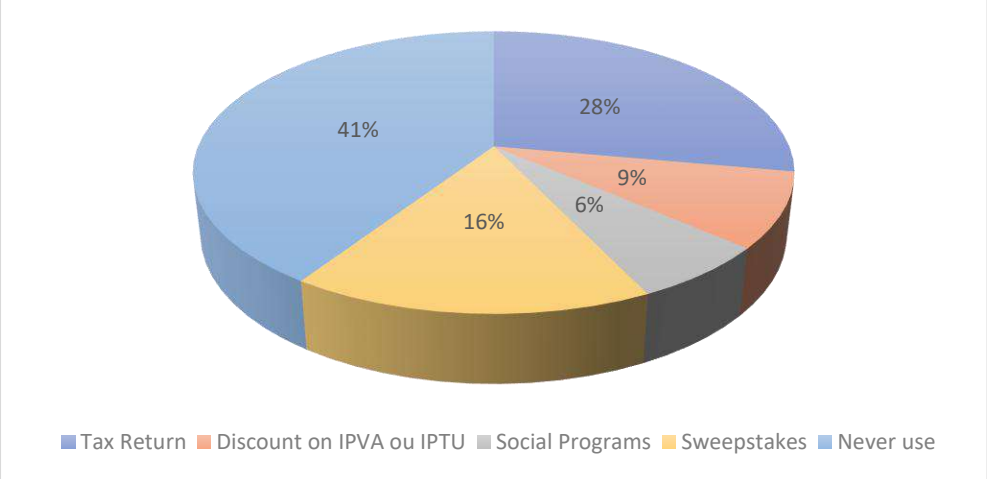

Fig.2: Benefits Used by Participants
Source: Made by the authors

Summarizing the table above, it is possible to observe that respondents prefer to use the benefits offered by the program to credit this value in their bank account. This benefit is offered from 7 programs of the 16 programs reviewed.

It should be noted that almost of 40% of respondents affirm to report their CPF number on the invoice, but they informed that not request the credits. This fact suggests two hypotheses: participants is not focus on owned benefits offered by the Government, butrather, taken part in exercising the tax citizenship, or they are not aware of the benefits and ways of redemptions.

Given the negative feedback to the respondents about the inclusion of CPF number on the invoice, it was questioned whether the reasons why they do not inform their CPF number on the invoice is the lack of benefits on their perspective. Thus, it is evident that Governments need to invest massively in outreach actions to educate its public to disseminate the knowledge about the benefits offered by these programs to the consumers who actively embrace it.

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Based on the results of the survey, approximately 13% of the respondents appear to be afraid that the Government´s controls through the data related to how much they consumed over a given period. This fact may indicate that their total income or part of that could not be declared accordingly.

The technical literature analyzes about tax evasion show us the existence of several studies mentioning that the tax evasion is directly related to the efficiency of the Government´s system to provide benefits to its citizens or the misuse of public resource. As examples of these studies, we can cite Allingham and Sandmo (1977), as well as Graetz, Reinganun and Wilde (1986).We observed this tendency on our research in which 20 respondents affirmed that in their point of view, those factors justify their absence to request the issuance of the invoice with their CPF number on the document.

The respondents also pointed out that process of adding their CPF number on the invoice it usually slows and take time to them because they need to wait the process be finalized by the seller. They believe the fact as important as misuse of public resources. Thus, the Governments need to consider ways to automate this process to ensure process agility which it may encourage the consumers to embrace the program

In the questionnaire was included specific question about which Government's initiative would be efficient in the process to become the CPF number a mandatory field on the tax document. The results show that 49.3% of respondents reported that whether the Government´s transparency to inform to the society the tax collected, they affirm that each consumer would start to support the program immediately. Thus, the Government must be attentive to divulgate its public policies in a transparent manner to the society.

It is important to mention that for 16% of the respondents the data security is an issued that need to be addressed by the Government. Basically, taxpayers do not trust in the security procedures stablished by the Government to protect their personal information.

In addition, the survey shows that 8% of respondents mention that they do not identify with this type of program or the benefits offered by them to the taxpayers. Thus, we observed that the Governments are still having a long path to be taken in process of convince the population to embrace the program.

IV. CONCLUSION

Based on the main purpose of this research, we focus on identifying the citizens´ point of view, as well as compare the different programs in place in order to verify the citizen´s perception about all of them, as well as highlight the adherence between them.

To compose this exploratory analysis and mitigate any misunderstand about the tax citizenship benefitprograms, it was considered relevant to highlight the fundamental list of benefits provided by each Government´s program. It should be noted that São Paulo state Invoice Program website is an exception whether compared to the other official program's websites. Those are unable to provide simple data to the citizens, such as number of consumers, evolution by month. The lack of information had a huge impact on our research because we weren´t able to generate statistical studies in which the results could measure the tax collected by each state.

It is important to note that each state is responsible for developing and implementing their programs following their own rules. Thus, the consumers who acquire consumers products from legal entities that are originally from different parts of the country, face on a daily basis a challenge to maintain their registers constantly updated, as well as monitor the website of each state to assure that they will be able to use the benefits offered by the programs. All these processes are considered by the taxpayers as complex and bureaucratic.

It is worth mentioning that the objective of the programs is to encourage the tax citizenship and reduce tax evasion. These both points still need to be studied, but for this, the Governments need to invest in technology, data protection and transparency. This effort may lead to increase the consumer participation.

The focus on this study was concentrated in the Accounting professionals´ perception. Therefore, we believe it would be important to conduct a more detailed research that cover taxpayers from different careers, region and age group in order to identify the applicability of these programs and whether the citizen participation is effective.

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Nursing teaching in emergency care in a mass event: Experience report

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Abstract— *Objective: to reflect on the knowledge, skills and abilities that should be fostered during academic nursing education for an effective professional performance in the face of a mass event, describing the experience of professors and students of the Nursing Undergraduate course in emergency teaching in this scenario. Methods: experience report, with participatory observation, experienced by teachers and students in nursing education in Urgent and Emergency care during mass events in partnership with the Brazilian Red Cross. The experience took place between September and October 2019, from the training process of the volunteers to the days of the event. Results: at the help stations, strategically dimensioned along the procession path, the students developed diversified actions, involving the management of the environment, planning and direct care. Such experience is a strategy that values the construction of knowledge in a participatory and questioning way, allowing direct contact with the user, providing a unique opportunity to apply the theoretical knowledge acquired in the academy, develop skills and dexterity in nursing actions, in addition to work as a team with the various actors in the state Urgency and Emergency network. Conclusion: the reflective study allowed us to glimpse several aspects regarding the thematic pillars peculiarities that involve nursing teaching in mass events, allowing to raise discussions about the competencies and skills essential to the performance of nurses and teaching strategies to promote teaching in this context.*

Keywords— ***Mass Casualty Incidents, Education, Nursing, Emergencies, Emergency Treatment, Emergency Nursing.***

I. INTRODUCTION

Mass events are defined as meetings of a large contingent of people, usually motivated by work, political, sporting, religious or recreational activities, which occur in a pre-programmed or not manner, and which, in general, has the potential to impact and cause consequences in several sectors of society, including Public Health[(1)]. Corroborating this definition, the Ministry of Health, Brazil, through the Resolution of the Collegiate Board no. 13, of March 28, 2014, article 5, item I, conceptualizes a mass event as: any collective activity of a cultural, sporting, commercial, religious, social or political nature,

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for a predetermined time, with an exceptional concentration or flow of people, of national or international origin, and who, according to the assessment of threats, vulnerabilities and risks to public health, require coordinated action by the health agencies of municipal, state and federal management[2].

According to the World Health Organization (WHO), a mass event is a gathering of people that is generally defined as "the congregation of a specific number of people (it may be just one thousand people; although most of the available literature, describe them as meetings that exceed 25,000 people) in a specific location for a specific purpose (a social function, a major public event, a sports competition) for a defined period of time", which can be planned or spontaneous and recurring or sporadic. Those planned may include sporting, social, cultural, religious and political events. Examples include music festivals, Olympic Games; spontaneous by their nature are more difficult to plan and may include events such as funerals of religious and political figures, meetings of displaced populations due to natural disasters, conflicts and wars[3].

One of the great mass events in Brazil takes place during the "Quadra Nazarena", in the city of Belém, State of Pará, Brazil, when religious events occur, such as novenas and translations in the "Círio de Nazaré"[4].

"Círio de Nazaré" is a cultural and religious event held in Belém since 1793, when the region was divided between the Province of Grão-Pará and Rio Negro (in the colonial and imperial periods). The territory was not yet configured geographically as we know it today. This was divided by the North and Northeast regions. In the meantime, the "Círio de Nazaré" has been gathering people from all over the world for more than two centuries; devotees, visitors and tourists, and each year, this number has been increasing and consolidating itself in the tourist and cultural aspect[4].

It is recognized that the concentration of people of national and international origin, of different habits and cultures, exposed to different risk factors to health, with possible illnesses, which can be enhanced and disseminated, constitutes a risk factor for health and damage environmental, requiring adequate planning and interaction of different sectors, public and private, in the prevention, response and recovery to possible emergencies and disasters[1].

Regarding the relevance of this theme to health, in addition to communicable diseases, participants in mass events are prone to food infections, increased consumption of legal and illegal drugs, accidents (such as fires, landslides, trampling and crushing), respiratory diseases (asthma), suicides, animal and insect bites, diseases related to temperature and humidity (dehydration, heat stroke, sunburn, respiratory conditions and hypothermia), injuries and traumas with lacerations and other degrees of injuries, cardiovascular diseases, among other conditions[1]. It should be noted that, in this study, the terminology adopted by the Trauma Committee of the American College of Surgeons is used in order to standardize the terms used in the care of trauma victims in a universal way, namely: Incidents with Multiple Victims for the events with more than five victims and Events with Mass Victims when there are natural or man-made disasters, involving 20 or more victims[5]. It is considered that in this context, the public and private sectors should be able to host large events satisfactorily and, for this, they should follow the recommendations of WHO, with regard to the strengthening of disaster risk management systems and their reduction in three levels of government management (municipal, state and national), as well as capacity development and increased resilience of health systems when dealing with multiple victims[1,3].

Various scenarios of society emerge as spaces for learning. In this context, in view of the essentiality of a generalist training of the nursing professional and, therefore, the building of a trained professional, in a comprehensive and specific way, to act in the various contexts and levels of complexity, especially in the scenarios involving urgencies and / or emergencies, including events with mass victims, this event emerges as a unique opportunity for teaching. We are convinced that the integral training of nurses must include the promotion of reflections about the knowledge, skills and competences required for an effective and resolutive performance, as an articulator and fundamental member of the multidisciplinary health team, in face of events of this nature[5].

A The Brazilian Red Cross branch, Belém, State of Pará, actively participates in the festivities by strengthening the Emergency Care Network in the metropolitan region of Belém, through service at strategically set up stations during the processions in partnership with health, public and private health services, fire brigade, civil defense, rescue groups and State Higher Education Institutions[6].

In this context, the research questions that we put on the agenda are: what knowledge, skills and abilities should be fostered during academic nursing education for an effective professional performance in face of a Mass Event? And, what teaching strategies are being implemented in the academy to consolidate these skills and competences? Aiming to train professional nurses aware of

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their role in a society that increasingly demands creative, critical and reflective work, the professors of the nursing course at the Metropolitan University Center of the Amazon and the State University of Pará have developed over 12 years activities that go beyond the walls of the academy.

In summary, this study aims to reflect on the knowledge, skills and abilities that should be fostered during academic nursing education for an effective professional performance in the face of a mass event, describing the experience of professors and students of the Undergraduate Nursing course in emergency teaching in this scenario.

II. METHOD

Experience report, with participatory observation, experienced by teachers and students in nursing education in Urgent and Emergency care during mass events in partnership with the Brazilian Red Cross. The experience took place in the period from September to October 2019, from the training process of the volunteers to the days of the event, allowing to know the work of the Brazilian Red Cross as an indispensable support in mass events, making it possible to experience the actions taking place and the main difficulties faced in assisting victims of the most varied clinical entities in the crowd during the "Círio de Nazaré" events.

III. RESULTS AND DISCUSSION

Círio festival is a sequence of rituals that make it, during the fifteen days that it takes place, a pole of attraction for devotees, visitors, tourists and pilgrims. Hosting mass events brings numerous challenges related to the crowding of people, demanding greater supply and organization of health services. The Círio festival impacts the entire State of Pará, mobilizing all forces around this event, constituting what Marcel Mauss called total social fact. Even when Círio de Nazaré is compared with some other social mobilization, and with other total social facts, it is nicknamed "Natal Paraense" and "Carnaval devoto"[(7)]. The nursing professional acts in front of events with mass victims supported by the Professional Nursing Practice Law n. 7498/86, which establishes as a private activity of the nurse the direct assistance to the critical patient and the execution of activities of greater technical complexity and which require knowledge with a scientific basis and the ability to make an immediate decision[(5)]. At the help stations, strategically dimensioned along the procession path, the students developed diversified actions, involving the management of the environment, planning and direct care. It is emphasized that such an experience constitutes a strategy that values the construction of knowledge in a participatory and questioning way, allowing direct contact with the user, providing a unique opportunity to apply the theoretical knowledge acquired in the academy, develop skills and dexterity in the actions of nursing, in addition to working as a team with the various actors in the state network of Urgency and Emergency, accompanied by teachers who develop the same work, enabling the exchange of knowledge and experiences in a realistic setting. Events of this magnitude are distinguished by climatic conditions, duration of the event, age and crowd behavior, specific dangers, use of alcohol and drugs, origin and number of participants, spatial distribution and attention to public services given to the event. Such variability leads to different scales of preparation of public health systems for the provision of health services[(1)].

Currently, the training of nursing professionals has been and is the focus of major changes in our historical process, being influenced by the representation that this profession had over time. In 2001, however, a major advance was consolidated, when, through Resolution National Council of Education / Higher Education Chamber n. 3, of November 7, 2001, the National Curricular Guidelines for the Undergraduate Nursing Course are instituted. In summary, the pedagogical principles elucidated by the National Curriculum Guidelines are: the pedagogy of competences; the principle of learning to learn; generalist, humanist, critical and reflective training; and student-centered training, with the teacher as a mediator / facilitator[(5)].

Different studies converge on the importance of participation and cooperation between different spheres of government, interdisciplinarity, intersectoriality in the planning and implementation of preventive actions and the reduction of health problems. They point out that joint work between different sectors of society is essential, with a view to better responding to situations with the potential to compromise and impact the lives and health of populations. In Brazil, one of the most recent norms, Ordinance Cabinet of the Ministry n. 1139/2013, highlights the need for coordinated action between the Public Health bodies of the three governmental spheres, as well as the provision of special health services according to the assessment of threats, vulnerabilities and risks to public health[(1)].

It is in this context that nursing stands out as a unique member of the attendance to this catastrophic event, having to act in a joint and synchronized way with the other professionals, uniting care actions and dialogical

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approaches with the victims and family members, providing the essential psychological support in its entirety. health care[5].

Risks to public health during the realization of major events must be considered in the planning and management stages of actions, especially with regard to emergency management, avoiding that the damaging events are of such magnitude that they become disasters[1].

In this perspective, we bring the academic training of the nursing professional as the foundation of this process, which is permeated by some fundamental subjective aspects that must be intentionally worked on, namely: the student, at that moment, experiences the inexperience and immaturity inherent in the phase of life in which they find themselves; most of them experience the traditional pedagogy model, which makes it difficult to understand the transforming function of the knowledge worked on; express communication difficulties during their first practical contacts with users, when they have to deal not only with their emotions, but also with those of the other; and as a complex result of these elements, they report signs of anxiety, fear and anguish[5].

The use of active methodologies and the role of co-responsible students for their education currently point to the revision of strategies that enable new and varied learning experiences[1].

A study revealed that the students want a form of teaching in which the teacher is stimulating the student, using practical classes, involving the participation of the student in their planning, with their considered experiences; that privileges the student's learning and not the teacher's teaching; that provides the student with reflection on learning and relating it to his life; in short, the students aim at teaching by discovery, which represents meaning to them[5,8].

In this way, the ideal teacher is defined as one who deeply knows the discipline he teaches, has clarity, demonstrates that there are different ways of teaching, does not discriminate between students, knows how to organize teaching and maintains a good relationship with learners[5,9].

Training of critical, reflective, creative nurses with technical and political skills for professional practice, in line with the National Curriculum Guidelines for the undergraduate Nursing course, necessarily involves the adoption of new teaching strategies, as well as the improvement existing ones, aiming at favoring different forms of content appropriation. The use of active methodologies and the role of co-responsible students for their training currently point to the revision of strategies that enable new and varied learning experiences[10].

It is based on this understanding, that the teaching experienced and reported in this experience emerges as a facilitating tool, from a “peculiar laboratory” to teach and learn. We believe that the role of nurses in urgent and emergency services requires a variety of knowledge, which is essential for the care of patients with complex needs. The present technologies, the permanent need for scientific improvement and the humanization of care configure particularities to nurses' actions[10].

In this conception, it is essential that the professionals involved in this assistance maintain tranquility and at the same time agility associated with making quick and safe decisions. For this, scientific knowledge and practical experience are required, in addition to training and implementation of protocols. Practical experience can be initiated during graduation, through simulations, considering that written tests are not able to fully guarantee the competence of the student, the quality of his assistance and the safety of critical patients. Simulations are important during the teaching process, because in addition to improving knowledge and psychomotor and cognitive skills, they encourage communication between the team involved in care in an environment very close to reality and allow the analysis of individual performance[11].

A study carried out in Saudi Arabia, describes that despite the central role of frontline nursing teams in emergency departments in response to disasters, little is known about the knowledge and skills required by this group of health professionals for effective performance in this area. scenario. There is a scarcity of studies that directly measure aspects of preparation for emergency nurses in the context of mass events[12].

Rescue authorities recognized several essential factors in preparing for mass meetings. These factors can be categorized in cooperation in the pre-planning phase, factors to be observed in the emergency plan and actions during the event. Mass meetings are part of society, requiring planning and management of the various segments of society, in order to ensure sufficient operational resources, such as the ability to deploy resources in advance on site, improving disaster preparedness, which also requires sufficient financial resources and cooperation[13].

In this understanding, it is suggested that the organizers of future events of this nature should consider the early and wide integration of public health and other segments of organized society, with a focus on disaster risk reduction for the management of these events[14].

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IV. CONCLUSION

The reflective study allowed us to glimpse several aspects related to the thematic pillars peculiarities that involve nursing education in mass events, allowing to raise discussions about the competencies and skills essential to the performance of nurses and teaching strategies to promote teaching in this context.

In the search for strategies for the training of professional nurses who meet the demands of the market, we emphasize that the academy should provide students with learning opportunities that enable development beyond the cognitive field, expanding critical-scientific reflection, capacity in decision-making in situations that are not always predictable, and insertion in the social context of these learning scenarios, not only performing specific actions to fulfill the tasks that are demanded, but showing interest in implementing relevant actions for the development of quality care regardless of the context of performance.

In this perspective, we argue that academic training is the foundation of this process. That said, based on the assumption that there are essential knowledge, skills and abilities inherent in the training of nurses to act in the face of a mass event, we believe that these experiences should be initially promoted and developed in the academic environment. We reiterate that under no circumstances do we advocate specific training with a focus on the nurse's specialty, but rather envision a comprehensive training that allows health professionals to refine their care excellence from a generalist perspective.

Thus, we hope to contribute to the development of new studies, which can demystify the role of nurses in mass events and cooperate with the affirmation of the educational process as the guiding axis of professional qualification, and, therefore, for the improvement of the process of health education and work.

In addition, we seek to apprehend the aspects that must permeate the academic education of nurses and, thus, contribute to the elucidation of teaching strategies that facilitate the teaching-learning process, through general training, of problematizing educational practices that promote knowledge, competencies and skills essential for professional performance.

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The importance of metrology for quality control in a metal stopper factory in the City of Manaus, AM

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Abstract*— *Companies that aim to participate in the current global market face several challenges, such as, agility, productivity, quality of their products or services, innovation and flexibility. However, in order to meet all these requirements, it is essential that these organizations invest in standardization, quality and define an efficient metrological base capable of obtaining accurate information and that assist in the decision making process based on calibrations, samples and tests. The present research has as general objective to evaluate the importance of the applicability of metrology in the quality control of a factory of metallic stoppers located in the City of Manaus. The applied methodology consists of a bibliographic research complemented by a case study in the focus company. The basis of any production process that aims for quality is rooted in metrology, without it is not possible to ensure that that product is within the specified. So in every company that seeks quality products, it is necessary to implement metrology management to show how quality can be achieved through this tool. The metal stopper factory has periodic calibration guidelines in the factory, it has instruments and measurement systems that certify the uncertainties inherent in metrological processes, ensuring the process of traceability of measurements, using corrections to reduce errors, generating improvements in the quality of results which consequently leads to increased confidence in the actions and decisions taken.

Keywords*— *Calibration, Measurement, Test, Sample.

I. INTRODUCTION

The implementation and knowledge of Metrology in Brazil is still recent, as it is only now being observed the importance in the country's development, in which Metrology has a strategic role in supporting the competitiveness of the national productive sector as well as in the health, environment, security and defense of Brazil [1].

From this point of view, Metrology is presented as a fundamental support for technological growth and innovation, promoting competitiveness and creating an environment favorable to industrial and scientific development throughout the country [2].

Metrology is the science of measurement, whose main foundation is to promote reliability, credibility, universality and quality in measurements. It is known that measurements are present, directly or indirectly, in practically all industrial production processes of decision making, making metrology immense and involving industry, commerce, health, safety and the environment. [1].

CONMETRO - National Council for Metrology, Standardization and Industrial Quality reported in the document of strategic guidelines for Brazilian metrology in 2012 that an estimated 4 to 6% of the national GDP of industrialized countries are the most dedicated to measurement processes, since it is a science that encompasses theoretical and practical aspects related to measurement, ensuring that quality control is present in all stages of manufacturing a product. Because through metrology it is possible to gain confidence from those who sell and those who buy the product, because its essence is to guarantee the accuracy of the production processes [3].

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It is notable that the Brazilian industry is currently growing consistently, addressing greater volume and higher quality of its products and services, so it is necessary that companies are increasingly prepared to deliver quality products to their customers. So, for the cork stopper it is no different, so for that it uses metrology as a way to benefit to reduce costs with jobs and rework and helps to maintain the quality of its products, thus adding credibility to its customers and partners.

This work has as general objective to clarify on the applicability of metrology in the quality control of a factory of metallic stoppers. With specific objectives to report on the importance of metrology for quality control and present the main advantages of metrology for the factory of metallic stoppers.

Due to globalization, in the last thirty years, standardization has become part of various aspects of human routines, facilitating the commercial and technical exchange that is sought to meet the needs of the current economic scenario to which the global industry finds itself [4].

The concepts of measurement and metrology have a similar relationship. However, the concept of measurement has been rooted in culture since the dawn of civilization. Being considered the connection between the universe of abstract concepts and the universe of empirical phenomena. For this reason, measurement consists of the fundamentals of knowledge through experimental results [5].

According to LIRA (2002, p. 3), metrology has its origin since the oldest trades, where instruments were used as exchange currencies:

In some ways, small changes have been made from those times to the present day, except that today's coins are rarely gold. In the past, as now, sellers and buyers should agree with the exchange units. But, unlike the old days, in which the fluctuation between exchange rates and unit of measurement values occurred entirely without any criteria or standardization, today there is agreement about a stable system of units of measurement that is recognized worldwide [6].

Historically, the first governmental action in the area of metrology was the adoption by Brazil, through a decree of D. Pedro II, of the decimal metric system created by the Metro Convention, signed in 1875. Another relevant record of government participation in the field of metrology, normalization and quality was the creation, in 1921, of the Experimental Fuel and Mineral Station in Rio de Janeiro. At that same time, in São Paulo, the Materials Testing Laboratory of the Polytechnic School of Engineering was created. It should be noted that the attention of both initiatives was focused on testing imported products [7].

Although ABNT was founded on the initiative of government agencies, the facts that culminated in its creation, and in its performance, are due more to the isolated actions of the scientists and technicians that made it up than to the deliberate action of the Brazilian State. Institutionally, the existing metrology framework at INT and standardization at ABNT was maintained until the formation of the National Institute of Weights and Measures (INPM), with Law No. 4048, of December 29, 1961, which regulated the creation of the Ministry of Industry and Trade (MIC). In this act, the Metrology Division and the Metrology Commission of INT, whose competences passed to INPM [8], were extinguished.

The National Institute of Weights and Measures (INPM) was founded in the mid-1960s with the responsibility to act in everything that involved the standardization of measurement systems, making its activities and competences extremely unique, and for the creation of a government organization involving broader skills. After Brazil went through its economic development, the institute was replaced and its activities passed to the National Institute of Metrology, Quality and Technology (INMETRO), which also became responsible for technical standardization and the standardization of industrial quality, INMETRO remains in this role today [8].

Companies that intend to participate in the globalized market must face many challenges, among them, product quality, agility, flexibility and capacity for innovation. In order for these requirements to be met, it is necessary to invest in standardization, quality and in the establishment of a metrological base capable of transforming samples, calibrations, and tests into reliable information for the decision-making process [9].

Its focus is to guarantee the credibility, reliability, quality of measurements and their universality. Because of this, it is possible to guarantee that metrology has a broader scope than expected, considering that directly or indirectly and in basically all decision-making processes involve this factor. According to the author, 4 to 6% of the national GDP of industrialized countries is directed to the measurement and calibration processes [10].

Decisions are exemplified by the release of a production batch after an approval test or trial; the outcome related to the causes of a problem with an impact on quality, after a study involving tests and measurements planned for evaluation according to statistical techniques;

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a failed batch after an inspection; a product approved in search of certification by an external body after an audit.

Among the procedures directly related to industrial metrology, there is quality control. Where all products need to absolutely comply with the parameters and specifications required for the project, in order to comply with the quality of the functions for which they were designed [1].

The result will not be complete and, consequently, the measurement will not have acceptable reliability, if it is not associated with the indications about the values that can certainly be measured, that is, associating the uncertainty with the measurement results. This uncertainty added to the result gives a qualitative idea for the measurement, since it is not possible to establish a true value of a measurement due to the absence of good conditions for measurement. Imperfections in instruments and measurement systems, conditions related to the environment (temperature, vibrations, noise, humidity, pressure, etc.) and errors caused by handling the instrument or method applied to achieve the measurement that impact the measurement result and that influence uncertainty, impacting the measurement reliability [1].

II. MATERIALS AND METHODS

The present research took place through bibliographic research where its base is developed using material already elaborated, as of books and scientific articles, referring to the theme and the research problem, through theoretical presentation referring to the themes related to the history and concept about the themes addressed [11].

To complement the work, a descriptive research was used, where according to Prodanov and De Freitas (2013), the researcher's role is to record and describe the facts observed without interfering with what is being observed [12]. This research model seeks to describe the characteristics of a given population or phenomena, or even to establish a relationship between variables, which can be carried out through questionnaires and systematic observations.

The analyzed data are considered qualitative because it is characterized in the qualification of collected data, during the identification of the problem. The research project will take place through a case study, defined as an empirical investigation focusing on the contemporary phenomenon, based on the early development of theories to conduct data collection and analysis [11].

The company chosen to carry out this project is Ambev - Brewery from the Amazon Metal Stoppers unit, located at Avenue Constantino Nery, 2575, Flores.

The foundation of AmBev - Company de Drinks of the Americas took place on July 1, 1999, after the merger of the two largest Brazilian companies in the sector: Company Antarctica Paulista and Company Brewery Brahma. The main objective was to create a global Brazilian company, strong enough to compete in the international market.

With activities in 18 countries on the American continent, the brewery remains a leader in the Latin American beer sector. Being created in 1999, with the union of the Brahma and Antarctica breweries, a member of the Anheuser-Busch InBev group (AB InBev). Its enterprise is based on the production and sale of beers, soft drinks and non-alcoholic and non-carbonated drinks. Its main Brazilian brands are Skol, Antarctica, Brahma, Original, Bohemia and Guarana Antarctica, and in other countries the main brands are Pilsen, Labatt Blue, Quilmes, President, Paceña, Alexander Keith's and Kokanee. The company is also a major independent bottler for PepsiCo. Responsible for the production, sale and distribution in Brazil and other Latin American countries, brands such as Pepsi, Lipton Ice Tea, H2OH!, and the isotonic Gatorade under license from PepsiCo (AMBEV, 2018).

III. RESULTS AND DISCUSSION

Metrology, when inserted in the context of the production process, is responsible for monitoring and controlling the variables and attributes of products, it has the function of stimulating production with quality, acting in the process, giving conditions for companies to be increasingly competitive in the business world, attributing to the products better added value and quality of consumption in the market.

Metrology adds benefits to production systems, as it is possible to reduce labor and rework costs and directly influence the quality of products and services, in addition to adding credibility to the companies that adopt them. In the metrology systems of companies specifically, it is very common to see the application of calibration and the evaluation of uncertainty, thus guaranteeing the quality of the instruments and standards of the production process [1].

Metrological reliability of measurement systems is the main motivation for carrying out calibrations, as it is possible to acquire benefits everywhere. For the final

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customer who consumes the product, for the one who produces and controls and, mainly, for the economy more generally. The lack of calibration can result in immeasurable losses in products, processes, services and in the image of the company, because without calibration the loss can occur both on the part of the supplier and on the part of the product buyer [12].

Metrology is the physical basis of quality control, as it is fundamental for the competitiveness of industries and technological development in the country, not being the work of chance that makes the most developed countries in the world invest in metrological operations, being the elements that impact the company's competitiveness, quality, metrology and productivity.

Thus, it is noted that metrology is exactly linked to quality, as it contributes to companies having a well-defined process, paying attention to quality standards, regardless of the area. In addition, metrology is linked to the practice of continuous improvement as it leads those involved to pay more attention to details and seek new ways to improve their process.

The company in question is fully committed to fully meet all the specifications of its products at each stage of production until the final product, and for that purpose it defines a process control system using statistical tools necessary for monitoring and checking process capabilities. For that, it has a data policy, in which it informs that the responsibility of all the members of the teams that produce, analyze and report data is responsible. Reliable and accurate documentation is critical and eliminates any possibility of erroneous data.

It was verified that the meters are classified as follows: a) Product - involved in direct or indirect measurement or evaluation of the product. Meters that measure weights, dimensions etc. or evaluate the visual aspects of the product would be classified as product meters. b) Process - involved in the measurement of the process associated with the production of the product used in the measurement checks. This can include pH meters, special pressure or temperature meters, etc. c) Others - offline meters not directly involved with the production or process. An example would be the tool room gauges.

When a meter control measurement exceeds the specified limits (control limits, specifications, etc.) it is a must to carry out a documented reaction plan to address the root cause of the problem. It is not acceptable to double check the meter, unless an exception is specifically granted for the quality of the zone - the plant must retain the exception. The root cause and corrective action must be documented electronically or via the system. In all cases, this information must be easily accessible. In the event that the meter is outside the acceptable measurement range, all products produced since the last acceptable measurement check will be considered suspect. Containment (blocking) of this product and appropriate disposal activities must take place.

All meters must have procedures that document the proper use, sample size and calibration / control frequency, as well as reaction plans and containment potential, if the meter is not working properly, called a service standard. All team members who use the meter must be formally trained in the use of the meter by plant policies associated with the training.

The new meters must have a formal study of measurement performance before using in production. Depending on the meter, it can be a potential, short or long term study, or a combination of these studies. The results of these studies will be published and retained in accordance with document management policies. Primary meters should be maintained / serviced / certified periodically, as appropriate. The frequency should be based on the supplier's recommendations as well as the risk assessment.

In this company it was observed that all areas have a secure, controlled and traceable data management system. Non-compliant results are recorded immediately upon identification. If the process is corrected, the results after corrective measures will also be recorded and they all impact on performance indicators (KPIs), non-compliant items must be justified by the operation and have provision by the Supervision, to discover the root cause of the problem.

The reliability of the data management system must be guaranteed, as it is the basis of any analysis to control the process. Reliable data cannot be repeated all the time (for example, data repeated within the specification limit) or have records at fixed times. The use of statistical tools requires valid data, depending on adherence to this policy. Make sure the data makes sense.

Calibration must be performed on all critical equipment according to the list of metrological plans (attached in this standard), which is updated periodically by the metrology specialist at ZBS.

The calibration points must be defined according to the equipment's process range. The process range must be acquired via PTP (inside the PTP there are the upper and lower process ranges specified by the types of products manufactured). If it is not possible via PTP, the equipment's process must be monitored, and its lower and

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upper range measured together with the equipment operator.

The calibration points must be created as follows: point 1: 20% below the lower limit of the process range; point 2: lower limit of the process range; point 3: middle of the process range; point 4: upper limit of the process range; point 5: 20% above the upper limit of the process range. When a device has only one point to be calibrated, the same calibration point must be entered 3 times. When an equipment has only 3 points to be calibrated, only points 1, 3 and 5 apply. The associated standard instrument must always be from the same unit of measurement as the equipment, for its correct calibration.

The calibration must be performed as follows: The instrumentalist receives the Maintenance Order, verifies which points should be calibrated, and already performs the LEP (Permissible Error Limit) calculation to assist him in the field calibration time. . In the field, you should check the physical condition of the equipment, request the area to perform the calibration. Remove the equipment and check if it is possible to perform the mesh calibration. It is necessary to check if the measurements of the points are within the LEP, if not, it is necessary to make an adjustment on the field instrument and, once the adjustment is made, make a calibration again and note the points.

The diffusion of scientific metrology occurs through RBC, consisting of a chair of approximately 500 laboratories registered and qualified by INMETRO. One of the ramifications of this area is Legal Metrology, responsible for meeting legal, administrative and technical requirements for measurement units, measuring instruments and material measures. It has a purpose in commercial transactions, where measurements are indispensable for the prospects of accuracy [1]

The author adds that the technical regulations and laws are enacted by the government that direct the activities of legal metrology, especially with regard to the metrological aspects of the instruments that involve these operations. The structuring of this regulation is based on the guidelines of the International Organization for Legal Metrology (OIML) and counts on the assistance of those responsible for the manufacture of instruments and consumers [1].

Metrology confidence encompasses numerous steps, such as: correct parameters of measuring instruments, statistical control, training and awareness of those involved in the activity, traceability of measurements and control of these instruments. Because of their importance, the organizations responsible for national and international standardization, such as: INMETRO, International Organization for Standardization - ISO, International Electrotechnical Commission - IEC, Brazilian Association of Technical Standards - ABNT, using specific standards (such as: NBR ISO 9001, ISO 17025, NBR ISO 10012 and NR-13) metrological quality management being a prerequisite for the recognition of the quality of processes and Certification of the Quality System [9].

In this way, the production systems benefit from metrological management systems, reducing costs with any necessary rework, in addition to the benefits with a direct impact on the quality of services provided and products, adding credibility to the process and image of the organization that adopt this tool . Specific points such as calibration and uncertainty assessment provide the quality of metrology applied to instruments and the production process [1]

Therefore, one must take into account the calibration history of the measurement medium, as well as the standard used in the last calibration of the same. Regarding the technical point of view, the result will be better in proportion to the reduction in the uncertainty of the calibration standard. However, when the standard's uncertainty decreases, the cost increases. A technical economic balance is then sought for the situation. The ideal is to seek a condition in which the standard has an uncertainty of one tenth of the uncertainty of the medium to be calibrated. It is necessary to highlight that this ideal point changes depending on the measurement system that will be calibrated. It is acceptable that in a calibration, this uncertainty is at least one third of the medium to be calibrated [14].

IV. CONCLUSION

Through metrology, the complete evaluation of new products is carried out before they are placed on the market. It is also important in the evaluation of processes and measuring instruments, in order to ensure that equipment makes the correct measurements of products. Thus, one of the great benefits is the standardization of measurement methods and the maintenance of the precision and accuracy of these methods. Metrology processes, when efficient and effective, lead to the minimization of inspection costs. They also contribute to reducing the cost of tailings and rework, using statistical quality control techniques.

Metrology is at the root of every production process that seeks quality, without it it is not possible to ensure that that product is within the specified. So in every company that seeks quality products, a metrological verification

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system is needed to show how quality can be achieved. Metrological proof or reliability of measurements is only achieved through Calibration and Traceability.

The metal stopper factory has periodic calibration guidelines at the factory, it has measurement instruments and systems that ensure the uncertainties required in metrological processes, ensuring the traceability of measurements, reducing errors through corrections, generating improvements in the quality of results, increasing the reliability of actions and decisions.

As the consumer market is more and more demanding, it was necessary for this factory in Manaus to adapt to what is required, because this way it can implement processes of proven quality to be qualified as a supplier to many other companies and also to enjoy the advantage of having processes quality and remain with a reliable and ethical image of your product in the market.

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Treatment of frenectomies with laser optimization

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Abstract**—** *Phrenectomy is the surgical procedure that aims to remove the labial, lingual and bridle curbs, allowing both orthodontic movement to close diastemas, as well as the proper movement of the tongue, necessary for functional activities. There are two techniques for frenectomy. One is the conventional technique with scalpels and periodontal knives, and the other using soft tissue laser. The aim of the study was to conduct a literature review of labial and lingual frenectomies using the laser. The methodology adopted was a literature review, with research of the articles being carried out in the Scielo and LILACS databases, with the descriptors "frenectomy", "frenulotomy" and laser as well as their respective ones in English. From this review, it is possible to observe that laser technology has been considered an alternative to conventional techniques, presenting several advantages such as: shorter operative work time, cauterization and sterilization of tissues, hemostasis, less need for local anesthesia and fewer post-operative complications (pain, edema and infection).*

Keywords**— Laser. Frenectomy, Lip curl, Frenulotomy.**

I. INTRODUCTION

Ankyloglossia is a congenital condition in which a newborn is born with an abnormally short, thickened or tight lingual frenulum that restricts the mobility of the tongue. Ankyloglossia may be associated with other craniofacial abnormalities, but it is also often an isolated anomaly (FERREIRA et al., 2018; GARROCHO-RANGEL et al., 2019).

It variably causes reduced anterior tongue mobility and has been associated with functional limitations in breastfeeding, swallowing, articulation, orthodontic problems, including malocclusion, open bite and separation of lower incisors, mechanical problems related to oral clearance and psychological stress (OLIVEIRA et al ., 2019; SOUZA et al., 2015).

Reported rates of ankyloglossia range from 0.1 to 10.7 percent, but definitive incidence and prevalence statistics are difficult to obtain because there are standard or clinically practical diagnostic criteria. An increased prevalence has been reported in newborns with a history of maternal cocaine abuse (SILVA et al., 2018).

Different diagnostic classifications based on anatomy and functional criteria have been proposed for the condition, but none have been universally accepted. The management of ankyloglossia in children is generally multidisciplinary, involving the participation of specialists in pediatric dentistry, periodontics, oral surgery, otolaryngology, and speech therapy, among others (OLIVEIRA et al., 2019).

It has been accepted worldwide that lingual frenectomy (frenulectomy, frenotomy, frenuloplasty) is the best approach to resolve the associated inconveniences of ankyloglossia. The procedure consists of the surgical release of the abnormal frenulum to release the movements of the tongue (COTA et al., 2019).

Various surgical techniques have been proposed, such as simple cutting with slides in newborns (also known as frenotomy), z-frenuloplasty, electrocauterization (argon plasma, monopolar bipolar diathermy), cryosurgery and lasers.

Laser is defined as electromagnetic and monochromatic radiation propagated at various

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wavelengths. Lasers provide an energy concentration in the form of an intense beam of light, in the infrared (IR) and ultraviolet (UV) spectral bands that can be used in oral soft tissue surgery. They can be classified as low or high intensity lasers (CARDOSO et al., 2016).

Since the first studies in the 1960s and 1970s, fractional Co2 or Erbium laser, neodymium and diode have been widely used for excision of soft tissues in pediatric maxillofacial lesions due to their reliability, versatility, practicality and simple configuration. In addition, this treatment option has demonstrated several therapeutic properties, including anti-inflammatories, biostimulants and satisfactory post-operative regenerative effects, improving and accelerating wound healing (PINHEIRO et al., 2018; RIBEIRO; SILVA, 2019).

With children, laser surgery offers additional advantages, including reduced operating time, minimal amounts of anesthesia, improved hemostasis, without the need for sutures and less post-operative medication prescription; therefore, a faster treatment option can decrease the psychological distress of pediatric patients associated with conventional surgery (PINHEIRO et al., 2018).

Thus, the objective of the study is to carry out a literature review of labial and lingual frenectomies using the laser, its advantages and disadvantages.

II. HELITERATURE REVIEW

2.1 THE ORIGIN OF THE LINGUAL AND LABIAL BRAKE AND ITS CHARACTERISTICS

A frenulum is a small fold of muscle tissue that prevents an organ in the body from moving too far. There are two main phrenia in the mouth: the lingual and labial frenulum (KOMORI et al., 2017).

Generally, frenums are assessed from when children are young. If a frenum is malformed (too short, too long or too rigid), it can cause developmental problems and movement restrictions as the child grows (COTA et al., 2019).

The lingual frenulum is the strip of tissue that connects the underside of the tongue to the floor of the mouth. It is designed to connect the tongue to the jaw, but if the frenulum is too tight or too short (attached too close to the tip of the tongue), it may restrict the movement of the tongue. This condition is commonly called ankyloglossia and can affect speech, swallowing, breastfeeding and eating. A tie in the tongue can also inhibit the correct development of the jaw, which can cause long-term orthodontic problems and / or lead to sleep apnea (SANTOS et al., 2018).

The aforementioned authors also mention that the labial frenum is the small strip of tissue that connects from the center of the upper lip between the upper front teeth. If the labial frenulum is too long, it can create a large gap between the two front teeth and / or cause gum recession as the frenum pulls the gums away from the teeth. In rarer cases, if the frenulum is too short / tight, it can create an open mouth position that inhibits the mouth from sealing properly. This can cause mouth breathing and inadequate development of the airways and jaw.

Ankyloglossia caused by abnormalities of the lingual frenulum is characterized mainly by fibrous adhesion of the tongue to the floor of the oral cavity. It is classified as complete or partial ankyloglossia, depending on the extent of adhesion. Cases of complete ankyloglossia are rare, with most cases exhibiting partial ankyloglossia, where the site of abnormal adhesion to the frenulum is the body of the tongue or the mandibular alveolar mucosa (KOMORI et al., 2017).

Ankyloglossia is usually detected at a young age due to dysphagia, masticatory difficulty, speech disorder or a regular examination. The upper labial frenulum is connected to the incisor papilla during the initial embryonic period. Subsequently, a gap develops gradually and the labial frenulum regresses with the development of the alveolar bone after birth and the eruption of the primary incisors. At around 10 years of age, after the end of the mixed dentition period and the eruption of the six teeth in the anterior region of the maxilla, the diastema naturally closes and stabilizes (OLIVEIRA; SANCHES; ANTONIO, 2019).

Consequently, according to Cota et al. (2019) it has been reported that, as long as no clear functional disorder is observed, it is better to continue with regular follow-up examinations of the upper lip frenulum until about 10 years of age (GARROCHO-RANGEL et al., 2019).

The clinical criteria used to diagnose ankyloglossia vary widely in the literature. Many authors use criteria based on the physical characteristics of the patient's oral anatomy. The most commonly used criterion is when the frenulum is abnormally short and thick, causing the tongue to be heart-shaped in its protrusion. The criterion also includes signs of functional impairment, such as the inability to project the tongue beyond the gingival margin and other indications that cause a reduction in tongue movement (OLIVEIRA et al., 2019).

A consensus on the diagnostic criteria is necessary to allow comparison of treatment studies. You should also

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remember the importance of interdisciplinary diagnosis, dental and speech evaluation, to know whether to choose surgical or conservative treatment. Choosing the latter, some exercises are indicated that allow obtaining the stretching of the lingual frenulum (GARROCHO-RANGEL et al., 2019; SOUZA et al., 2015).

2.2 FRENECTOMY AND FRENULOTOMY

The frenum can be treated by frenectomy or by frenotomy procedures. Phrenectomy is the complete removal of the frenulum, including its fixation to the underlying bone, while frenotomy is the incision and reallocation of the frenal fixation (COTA et al., 2019).

Frenectomy can be performed using the routine scalpel technique, electrosurgery or using lasers. The conventional technique involves excising the frenulum using a scalpel. However, it carries the routine risks of surgery, such as bleeding and patient compliance.

The classical technique was introduced by Archer (1961) and Kruger (1964). This approach was advocated in cases of midline diastema with an aberrant frenzy to ensure the removal of muscle fibers that were supposedly connecting the orbicularis oris with the palate. This technique is an excision-type frenectomy that includes the interdental tissues and the palatal papilla, together with the frenulum (PATHIL and BOIER, 2017).

Miller's technique was advocated in 1985. This technique was proposed for cases of post-orthodontic diastema. The ideal time to perform this surgery is after the completion of the orthodontic movement and about 6 weeks before the removal of the braces. This not only allows tissue healing and maturation, but also allows the surgeon to use orthodontic appliances as a way to retain a periodontal dressing (PATEL et al., 2015).

Z plasty is indicated when there is hypertrophy of the frenulum with low insertion, associated with an inter-incisor diastema, and when the lateral incisors appeared without the diastema disappearing and also in cases of short vestibule. VY plasty can be used to lengthen the localized area, such as the wide frenum in the premolar molar area.

Electrosurgery is recommended in patients with bleeding disorders, in which the conventional scalpel technique carries a greater risk, associated with problems in obtaining hemostasis and also in non-adherent patients (COTA et al., 2019; PATEL et al., 2015) .

However, despite the various modifications proposed for frenectomy, the widely followed procedure that remains is the classic technique. The classic technique leaves longitudinal surgical incision and scars, which can lead to periodontal problems and anesthetic appearance, requiring other changes (GARROCHO-RANGEL et al., 2019).

The use of electrosurgery and lasers has also been proposed for frenectomy. The researchers advocated the use of an electrocautery tube because of its effectiveness and the safety of the procedure, light bleeding and the absence of postoperative complications. However, it is associated with certain complications that include burns, risk of explosion if combustible gases are used, interference with pacemakers and production of surgical smoke (CARDOSO et al., 2016).

2.3 LASER ACTION MECHANISM AND ITS MAIN ADVANTAGES

The energy emitted by a CO2 laser at a wavelength of 10.6 μm is efficiently absorbed in tissues with a high moisture content, and this laser is commonly used for resection and vaporization of soft tissues in the oral cavity GARROCHO-RANGEL et al. , 2019).

When using a scalpel, sutures are required for intraoperative hemorrhage, while the electric scalpel offers strong hemostatic effects through thick layers of coagulation and deformation. However, the surrounding areas are affected by heat, and problems such as enlarged wounds, infection, delayed healing and postoperative pain are likely to occur, with many cases also requiring sutures (PATEL et al., 2015).

Meanwhile, although the laser has a shallow depth of resection, it causes relatively no opening of the wound surface due to the location of the effects of heat, and the coagulation / deformation layers are adequately thick, implying reliable hemostasis and early healing (PATHIL and BOIER, 2017).

In an investigation using the visual analogue scale, it was reported that postoperative pain and discomfort during chewing and speech were statistically and significantly less common with the laser than with the conventional scalpel. Thus, when compared to surgery with an electric or cold scalpel, the use of lasers can reduce treatment time and simplify the general surgical procedure, reducing the burden on patients and facilitating cooperation. Therefore, it appears to be highly useful in surgical procedures, such as frenectomy, commonly performed in pediatric patients. However, when using this laser to treat abnormalities of the upper lip frenulum, attention must be paid to the power during laser application. Unlike cases of lingual frenectomy, excessive power can lead to damage to the bone surface, and constant care must be taken to protect the eyes, because the laser is applied to the upper lip (RIBEIRO e SILVA, 2019).

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It has been reported that the erbium-doped aluminum and yttrium laser (Er: YAG), which, like the CO2 laser, is commonly used for oral soft tissue diseases, can be used without local anesthesia, performing irrigation at the site of application, enabling procedures such as frenectomy with surface anesthesia only. However, as the Er: YAG laser has weaker hemostatic effects directly after resection than the CO2 laser, many cases require the use of local anesthetics containing vasoconstrictors (PATEL et al., 2015).

III. METHODOLOGY

To carry out this systematic literature review, studies published between 2015 and 2020 were selected. The databases used for screening were LILACS, BBO and SCIELO using the combination of the keywords: Laser, Frenectomy, Lip brake, Frenulotomy (Laser , Frenectomy, Lip curl, Frenulotomy). This bibliographic search was completed in October 2020. During a first screening, only the combination of keywords was included. References to articles with no available abstract and those unrelated to the topic of specific interest were excluded.

IV. RESULTS AND DISCUSSION

In the first search performed, 273 articles were found that had some relation to the theme now proposed. Subsequently, we sought to perform a thorough reading of the titles of the articles, leaving only 98. Then, we opted for reading the abstracts, where only 53 studies were selected to be inserted in a more detailed analysis. At the end of these verification and analysis steps, 13 studies remained that met the inclusion criteria. It was found that the most significant portion of articles was found in the PUBMED database (6 articles), followed by SCIELO (4 articles) and LILACS (3 articles).

Of the 13 selected studies, five were published in a national journal and eight were published in American journals, shown in Chart 1.

This review consists of 13 articles published between 2015 and 2020, two published in 2015, two in 2016, one in 2017, three in 2018, four in 2019 and one in 2020. Of the selected sample, five were case studies, three comparative studies, two clinical studies, a cross-sectional retrospective study, a literature review and a retrospective clinical study, distributed, as shown in chart 1.

Table.1: References used in this review.

Authors	Title	Year	Periodical	Methodology
Cardoso et al.	Vantagens da Frenectomia Labial por laser diodo de alta intensidade	2016	INPerio	Case study
Cota et al	Frenectomia para restituição fono-motricial da língua	2019	REAS/EJCH	Clinical study
Garrocho-Rangel et al.	Treatment of ankyloglossia with dental laser in paediatric patients: Scoping review and a case report	2019	European Journal of Paediatric Dentistry	Bibliographic research
Komori et al.	Clinical Study of Laser Treatment for Frenectomy of Pediatric Patients	2017	Int J Clin Pediatr Dent	Clinical study
Martinelli et al.	Tongue position for lingual frenulum assessment	2020	Rev. CEFAC	Retrospective cross-sectional study
Medeiros Júnior et al.	Labial frenectomy with Nd:YAG laser and conventional surgery: a comparative study.	2015	Lasers Med Sci	Comparative study
Oliveira et al.	Tratamento de anquiloglossia parcial através de frenectomia: relato de caso	2019	Arch Health Invest	Case study
Olivi et al.	Laser labial frenectomy: a simplified and predictable technique.	2018	Eur J Paediatr Dent	Retrospective clinical study

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	Retrospective clinical study			
Patel et al	Comparison of labial frenectomy procedure with conventional surgical technique and diode laser	2015	Journal of Dental Lasers	Comparative study
Pinheiro et al	Duas propostas cirúrgicas para frenectomia labial – convencional e a laser de alta potência	2018	Rev port estomatol med dent cir maxilofac	Case study
Ribeiro e Silva	Frenectomia lingual com uso do laser de alta potência em odontopediatria: relato de caso.	2019	Rev Nav Odontol	Case study
Tomazini et al.	Aplicação de laser em cirurgia de frenotomia labial inferior – relato de caso.	2016	Full Dent Sci	Case study
Uraz et al	Patient perceptions and clinical efficacy of labial frenectomies using diode laser versus conventional techniques	2018	J Stomatol Oral Maxillofac Surg	Comparative study

In the presence of a frenulum, two procedures are proposed for its treatment: frenectomy and frenotomy. Phrenectomy involves the complete removal of the frenulum, including its adherence to the bone; while the frenotomy incision and repositioning of the frenulum adhesion (COTA et al., 2019; PATEL et al., 2015).

Frenectomy is the best option to resolve this condition, where the frenulum is correctly reinserted during its healing after the surgical procedure. The surgical technique can be performed in a conventional or laser way, differentiation in the execution, healing and postoperative. Conventional frenectomy is a simple procedure that consists of using scissors and scalpels to cut or section the lingual frenulum and posterior suture for healing the first intention. The use of high-power laser is indicated in frenectomy due to its exclusive interaction with the exposed tissue due to its wavelength and specific active medium, in addition to its secondary therapeutic effects that provide a more effective healing and a better postoperative to the patient. (SANTOS et al., 2018; MARTINELLI et al., 2020).

The frenectomy technique with the use of scalpels was proposed as a conventional and classic technique for removing an aberrant device; however, this technique has the disadvantage of causing more bleeding and a greater possibility of postoperative complications. On the contrary, the techniques that use the laser reduce the risk of bleeding and complications, but can cause burns, risk of explosion in the use of gases, risk of interfering with pacemakers and production of surgical smoke (MEDEIROS JÚNIOR et al., 2015 ; SEIFI and MATINI, 2017; TOMAZINI et al., 2016).

The association of the surgical procedure performed with the high power laser and the application of the low power laser in the infrared wavelength has its scientifically proven effectiveness. The low-power laser has biomodulatory effects, acting directly on cellular mitochondria, accelerating cellular metabolism and, consequently, generating benefits to the requirements. The low-power laser used in adjustment parameters helps in the healing process and the onset of pain or edema (KOMORI et al., 2017; MARTINELLI et al., 2020).

The clinical advantages and disadvantages of each laser have been reported mainly in the form of clinical reports, with few studies comparing the postoperative results between the different techniques. According to the clinical trials found, comparisons can be made between conventional techniques with a scalpel and the techniques that use the Nd: YAG laser and the CO 2 laser, with the main variables being the time of surgical intervention, the postoperative pain at talking and chewing and postoperative complications (PATHIL and BOIER, 2017; RIBEIRO and SILVA, 2019; ROZO et al., 2015; URAZ et al., 2018).

Laser techniques do not require anesthesia, generate less pain, provide better visibility during the operation, do not require periodontal dressings, offer better healing and less scarring. The laser allows the area to be sterilized and

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its use does not require the use of sutures. Of the studies, one reported post-surgical complications related to the level of bone exposure of the inserted gingiva after one week of intervention (MEDEIROS JÚNIOR et al., 2015; OLIVI et al., 2018). The authors state that the operator's inattention when using the laser and generating greater thermal energy could explain these complications.

The Nd: YAG and CO 2 laser showed better results in relation to pain and discomfort after speech and chewing. The CO 2 laser has been used for lingual frenectomies, with the advantages of being simple, fast, causing little pain, absence of infections, absence of paresthesia, in addition to leaving little or no scar (SEIFI and MATINI, 2017). The study by Haytac et al. (2016) compared the degree of postoperative pain when performing frenectomies with a scalpel and with a CO2 laser, the laser group showed less pain and functional complications (speech and edema) ($p < 0.001$), in addition to requiring less analgesics ($p < 0.001$). They conclude that the CO2 laser offers a safe, effective and acceptable alternative for performing frenectomies.

It is also noteworthy that oral tissues (mainly covering fabrics) have more than 90% water in their composition and, considering the affinity of the diode for wet tissues, the diode laser is highly indicated for oral surgery (RIBEIRO and SILVA , 2019).

The findings of studies by Garrocho-Rangel et al. (2019) show that early diagnosis and treatment of ankyloglossia are fundamental for the adequate functional oral development of pediatric patients. Laser surgery for lingual frenulectomy provides a more efficient and comfortable treatment for the child and the pediatric dentist compared to traditional scalpel / blade methods.

Cardoso et al. (2016) demonstrated the advantages of a high-intensity surgical laser (Nd: YAG; 808 nm; 1.2 W; 20 pps; 126 J) from a clinical case report of frenectomy performed on a female patient, with 34 years old, who has persistent labial brake associated with superior interincisal diastema. The surgical procedure with high-intensity soft tissue laser has some advantages, such as the reduction in surgical time, with a reduction in postoperative morbidity and symptoms.

Twenty articles were reviewed to prepare this Literature review, from different areas, to obtain an enriched work. It was found, however, that the laser is a more practical and less invasive medium used than the conventional method.

V. CONCLUSION

From this review, it is possible to observe that laser technology has been considered an alternative to conventional techniques, presenting several advantages such as: shorter operative work time, cauterization and sterilization of tissues, hemostasis, less need for local anesthesia and less post-operative complications (pain, edema and infection). The laser also facilitates access and visualization due to the lack of interposed instruments and bleeding in the operative field. In addition, the need for suture is eliminated and the uniform depth of the surgical site is maintained, reducing unnecessary damage to the tongue muscle. For all these resources, the laser is well tolerated by all patients in different age groups.

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Technological Innovations in Organic Fertilization

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Abstract**—** *This work is based on the reuse of the disposal of organic matter from fish found in street markets, supermarkets and restaurants. The discarded organic matter becomes an excellent product for organic fertilization, supplementing the soil in various types of applications. It acts on the soil providing better conditions for plant development, avoiding impacts resulting from water erosion. During the composting process, the compost will go through the monitoring and control of its production. This development process lasts until the compost acquires the ideal characteristics so that its beneficial action for the installed culture can be enhanced. The objective of this research was to demonstrate that organic fertilization helps sustainability with local resources. The research method is deductive from research already carried out.*

Keywords**— Organic fertilization, Fertilization, Technological innovation, sustainability.**

I. INTRODUCTION

The organic fertilizer from fish waste is intended to increase crop productivity, preserving the principle of environmental sustainability, since its use reduces the consumption of mineral fertilizers, as well as decreases the unrestrained consumption of natural resources, helping to preserve the sustainable cycle for future generations [1].

According to Dias; Fernandes (2006), organic fertilizer is a product of fundamentally organic nature, obtained by physical, chemical, physical-chemical or biochemical process, natural or controlled, based on raw materials of industrial, urban or rural, vegetable or animal origin, enriched or not with mineral nutrients [2].

The Northern region of Brazil, known for its peninsular geographical position, offers immense hydrographic resources and these resources are demonstrated by the amount of fish taken daily from the waters of the Negro River, the Solimões River and, consequently, the Amazon River.

The Negro River, whose coloring results from the acids released in the decomposition processes of organic sediments released by the forest itself, is an example of natural organic fertilization, without human interference.

Over its 1,700 km, the Negro River naturally receives a large amount of organic matter from the rest of the leaves, shrubs and trunks that, in the riverbed, are dissolved and decomposed, releasing acids that make the color dark water [3].

The waters of the Solimões River are called clear waters because they have large amounts of calcium and magnesium, in addition to suspended solids. Its colors vary from yellow to ocher and have a muddy appearance. The meeting of these two rivers, with different waters, forms the largest river in the world in length and depth: the Amazon River [4].

The Amazon River is the largest river in the world, its waters are shared in the context of the Amazon Basin, and cross borders of sovereign states, from the Andes to the mouth of the Atlantic Ocean. Amazonian waters nourish the life of a diversity of ecosystems, which have vast animal and plant species, which depend on the integrity of the Amazon River to exist [5].

Tons of fish are taken from these large rivers every day, taken to distribution centers and then to consumers.

Fish are the main source of food for the population living in the northern region of Brazil [6], serving all social classes.

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In this sense, it is worth asking what is made of the remains of fish that are not used in human food? Where are they discarded and what are the consequences of this discard? How to use fish waste efficiently in the production of fertilizers? What are the advantages that the use of tailings can bring to society?

After fishing and distribution, the fish pass through the sales centers. In these places, they are cleaned, cut and separated according to the demands of the consumer market. The remains of this procedure are discarded, taken to open-air dumps, where they rot, causing the proliferation of disease vectors, bad odor, leachate, among others. [7].

The disposal of organic matter is a waste of reusable material, since it can be transformed into organic fertilizer and serve to improve many types of crops. In this perspective, possibilities are opened to contribute to a healthier and more sustainable reality, since the redirection of the organic mass, considered waste, becomes a resource for the production of organic fertilizers.

The contribution would cover some branches of services that include from the opening of companies for the collection, storage and processing of organic matter, to the sale and distribution of the final product.

In this way, applying already known and developed methods, it is possible to create new sources of work, using a type of local material, found in abundance that, when used, reduces the environmental impacts caused by consumption and disposal. In addition, the material that is discarded can also serve as a basis for the production of bioenergy.

This article aims to demonstrate the importance of technological innovations in organic fertilization, via organic compounds derived from the disposal of fish waste in natura, in which such compounds can be used in various types of soil, improving their conditions, making them suitable for the cultivation of more productive plantations.

II. METHODOLOGY

The research was conducted on the basis of deduction through scientific articles and works that encompass the initial process of analysis of sustainable technologies and the types of fertilization currently applied in societies, from the initial process of collecting organic matter and soil to its process end of production [8].

This research is justified by the need to characterize the need to create new technologies in organic fertilization from fish waste, an abundant material found in the city of Manaus, located in the State of Amazonas, which belongs to the borders of Brazil [9].

III. RESULTS AND DISCUSSION

Fish waste, when used, can serve as organic matter for the production of organic fertilizers and also for the production of electricity. The simple fact that the tailings are not thrown into dumps or open places, inhibits the creation of bacteria and mosquitoes that can cause damage to human health, as well as avoid putrefaction that causes a bad smell.

The use of organic fertilizers dates back to antiquity. Where the first one, derived from nature itself is humus. Humus is the organic matter resulting from the decomposition of dead animals and plants, deposited in the soil [10].

This process develops other by-products produced by earthworms. It was from this wealth offered by nature that humanity was able to feed itself more and better.

Humification is the process of humus formation, in which it is considered a natural process when it is spontaneously produced by bacteria and fungi, when there is human interference it induces the production of humus, adding chemicals and water to a soil, it is called artificial humification [11].

Both in the natural and artificial formation of the humus, there is a release of various agents. Naturally decomposing organic agents, which will serve as a basis for demonstrating this research.

The banks of the River Nile bear witness to the importance of humus. It was because of it that many foods were obtained, this because it provides nutrients for plants, regulates populations of microorganisms that make soil fertile and suitable for plantations [12].

This site is also a source of various chemicals elements such as carbon, nitrogen, iron, phosphorus, manganese, among others. These substances are essential for the healthy growth of plants in general.

The creation of domestic animals such as cattle, horses and chickens made it feasible to human eyes that the manure produced by them was fertilizer, since plants were born and grew more quickly and more vigorously than those that had no contact with animal waste. And so, for a long time, man managed to improve his productivity, using organic fertilizers from the feces of domestic animals.

History shows us, the intimate relationship of the soil with the emergence of civilizations and peoples throughout our journey on Earth. Let us start with Egypt, one of the

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first human groupings, the origin of the word of its nation, meaning people of the black earth, in allusion to the color of the soil, after the floods of the Nile River, which fertilized the land. At that same time, the peoples of Mesopotamia emerged, occupying a plateau, between the Tigris and Euphrates rivers, also known as the Fertile Crescent, for having the shape of a crescent moon and having a fertile soil. Millennia later, it relates to the origin of the USA to knowledge of the soil, as it was crucial in the British defeat at the Battle of Cowpen in 1781 [13].

Based on the knowledge about the soil, information about reverse logistics is complemented, which consists of the reuse, reuse and recycling of materials from the main activities to produce other materials [14], as an alternative condition for land use, including. Thus, it is necessary to apply the necessary condition to make the logistics reverse, as a condition for the correct process of the material to be transformed for fertilization, being still relevant a brief analysis on the step by step of how to treat waste, while the chain through which it goes through until it completes the process. In this sense, the storage and accommodation process are important items to be followed so that the collected material can be processed and transformed into organic matter, following the following steps:

1. Storage of Tailings

For an adequate storage of tailings, it is necessary, first, to create a project that is viable, obeying the criteria and laws that promote sustainability and receive approval from the City Hall, since it is the government agency that must take care of the tailings.

In Brazil, the National Solid Waste Policy (PNRS) was instituted by Law No. 12,305, of August 2, 2010, regulated by Decree No. 7,404 of December 23, 2010, with the objective of imposing on companies the need for use of reverse logistics processes, where it defines: "manufacturers, importers, distributors, traders, consumers and owners of public urban cleaning and solid waste management services are responsible for the life cycle of products", published in the Brundtland Report (Our Common Future, in 1987 [15].

The North Region, being very hot and humid, makes it difficult to store fish waste. Therefore, it is necessary to find adequate storage for this type of material. Since the remains of fish are moist, the tendency of loss of raw material is very great. It can rot in a short time and is no longer suitable for reuse. Therefore, the storage location must be appropriate to the needs of the type of organic matter you are going to store. However, it seems that, to date, there are no containers or drums suitable for the conservation of this type of product, which raises new research, investments and solutions for this specific type of storage.

2. Collection of tailings

Waste collection consists of an operation that involves several types of resources. In addition to human investment in the preparation of adequate labor, vehicles, collection and storage equipment, as well as the destination location, generate great costs not yet measured, not to mention that the E.P.I. used for the entire operation must be in accordance with the current standard [16].

Considering all the needs mentioned above, it appears that the investments required for collection represent high investments because they require a vehicle for transportation, trained people, a place prepared with machines and products necessary for the continuity of the process. Once again it is confirmed that only the union between society and the Public Power will be possible to collect the tailings.

The scientific literature shows us that there are collections of oil [17], foods and others that can indicate the paths that can help and support the execution of the use of the remains of fish.

3. Processing

The processing of the collected organic matter, another fundamental step in the reuse process, consists in the immediate forwarding of what was collected to the place where it will receive the necessary and appropriate treatment. In this location, organic waste will receive biodegradable enzymes that assist in the decomposition process.

Thus, the location that receives the organic matter also requires investments, since it must have the equipment and products suitable for the treatment and processing of waste. And again, at this stage, the question of significant investments is essential.

4. Destination

The main destination for organic fertilizers is farmers. The purpose of organic fertilizers results in improving the quality of the land, which generously responds by giving more nutrients to the plants they produce, more and better.

In addition, the use of waste need not be restricted to the production of fertilizers. There is a possibility that these residues can be used for energy generation, as in the case of biomass, that is, organic matter from animal or vegetable origin is used to produce fuels, electricity and heat [18].

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5. Distribution

The distribution of products resulting from the reuse of fish tailings can be done in the same way as other products are commercialized, and can be done in small, medium and large scale, depending on the investments you receive from the collection of tailings to the final consumer.

IV. CONCLUSION

With the concentration of people in the cities, consumption has become increasingly higher, with regard to the increased use of raw materials, which requires new technologies for their better use, especially with regard to tailings, as well as in the generation of fertilizers. that help increase food productivity without harming the environment or the health of consumers.

However, sustainable activities require investments greater than those inserted in the current market. In addition, nature has a time that does not meet the urgency of today's world. It comprises its own time and manner, different from what humanity requires. Searching for ways to integrate these times and needs of men of nature is the biggest challenge. Faced with so many possibilities, the use of fish tailings can be a viable alternative if the various social agents, commit themselves to viability.

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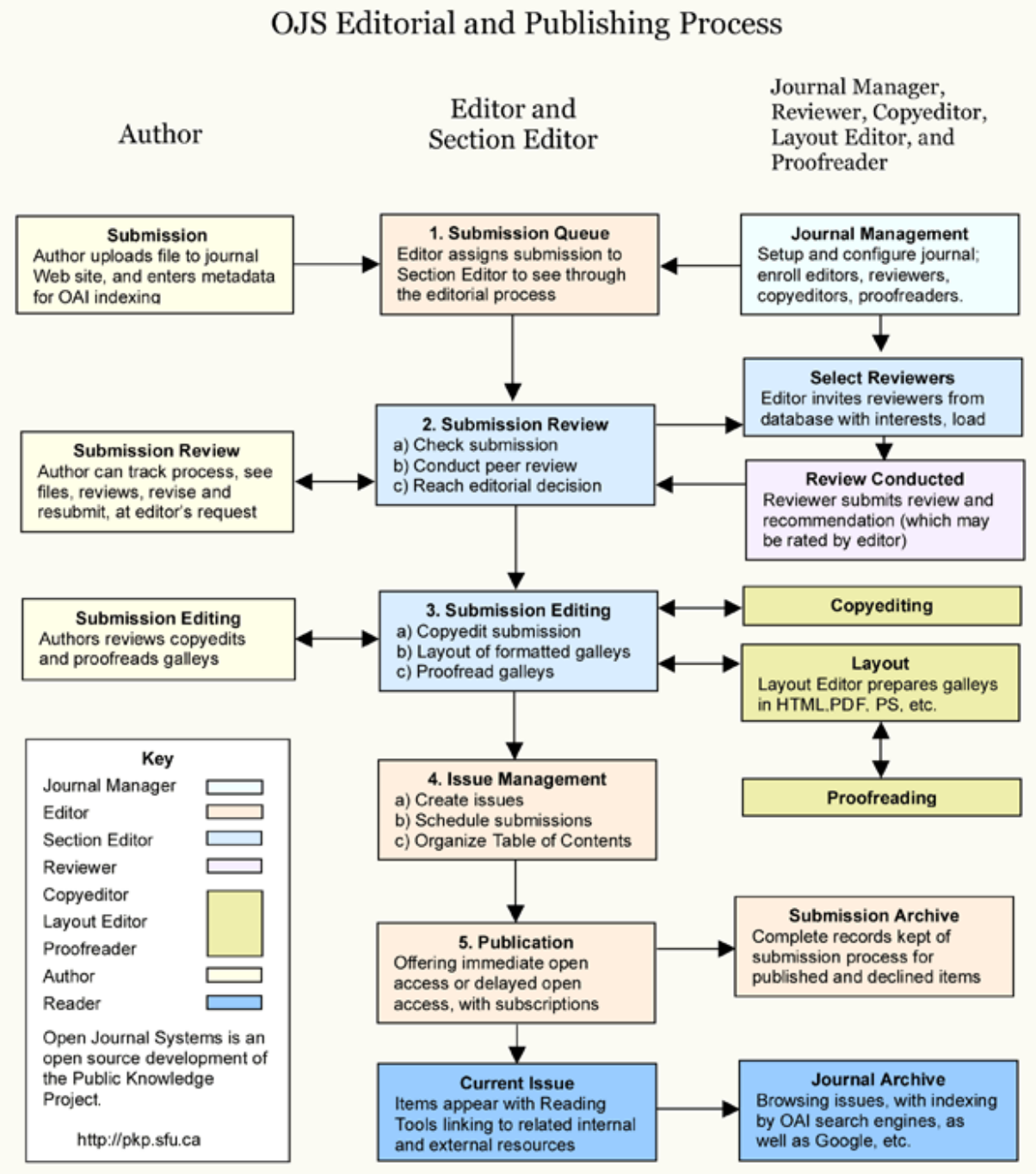

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